August 26, 2015
BAGG Job No.: BKFEN-29-00

Mr. Roland Haga
BKF Engineers
255 Shoreline Blvd, Suite 200
Redwood City, CA 94065

DRAFT Report
Geotechnical Engineering Investigation
Eastern Promenade Improvement Project
Coyote Point Recreation Area
San Mateo County, California

Dear Mr. Haga:

Transmitted herewith is our geotechnical engineering investigation report for the proposed Eastern Promenade Improvement Project located at the Coyote Point Recreation Area in San Mateo, 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 proposed construction on the subject property.

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

KO/JVZ
Distribution: 4 hard copies addressee,
1 electronic copy addressee

DRAFT REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
COYOTE POINT RECREATION AREA
SAN MATEO COUNTY, CALIFORNIA

For BKF Engineers

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▶www.baggengineers.com
▶phone: 650.852.9133 ▶fax: 650.852.9138 ▶info@baggengineers.com
847 West Maude Avenue, Sunnyvale, California 94085-2911

Attached Plates:

DRAFT REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
COYOTE POINT RECREATION AREA
SAN MATEO COUNTY, CALIFORNIA

For BKF Engineers

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering investigation performed for the proposed Eastern Promenade Improvement Project in San Mateo County, California. The attached Plate 1, Vicinity Map, shows the general location of the site, and Plate 2, Site Plan, shows the approximate location of the borings advanced at the site by BAGG as part of this investigation. This report was prepared in accordance with the scope of services outlined in our Proposal Number 15-238 dated April 29, 2015.

2.0 PROJECT AND SITE DESCRIPTION

The subject site is on the north side of Coyote Point and immediately east of a previous beach improvement project that included a rock revetment, with beach access for windsurfers frequenting the area, and a paved promenade pathway above and along the beach. The current project will create a new beach area, add sand dunes, and extend the promenade to connect to bluff trails to the east. The project will also reconfigure and relocate several parking spaces and construct a new restroom building. A new parking area will be added to the east of the current parking lot to replace the spaces lost to the beach re-configuration.

The western promenade area and a portion of this project area were previously investigated by Treadwell & Rollo (T&R) in 2009; however, their report did not include information in the vicinity of the proposed restroom building or the new parking lot area within the trees to the east of the current parking lot.

The T&R report suggests the onshore portion of this project is underlain by clayey fill materials placed over the beach sand deposits. Published geology maps of the area also indicate the tree-covered areas where the new parking lot will be located is underlain by shallow Franciscan bedrock covered with some thickness of colluvium and slope wash.

3.0 PURPOSE

The purpose of our services was to obtain geotechnical information regarding soil and groundwater conditions at the site as needed to develop recommendations for design and construction of the proposed restroom building and adjacent paving. The required information was obtained from one boring to approximately 15 feet in depth within the restroom building footprint and four shallow (3½ to 5 foot) borings within the two parking lot areas. Representative soil samples collected from the borings were then tested in our laboratory to evaluate their engineering characteristics. Information obtained from these tasks was used to develop conclusions, opinions, and recommendations regarding:

- seismicity of the site, including potential for future earthquake shaking, site class and structural design parameters per the 2013 California Building Code,
- specific soil and groundwater conditions discovered by our borings, such as loose, soft, saturated, expansive, or collapsible soils, that may require special mitigation or impose restrictions on the project, including depth to groundwater and the thickness and consistency of any fill soils encountered at the site,
- criteria for site grading, including placement of engineered fills and backfill in utility trenches, and preparation of subgrades for building slabs and pavements,
- foundation design criteria for the new restroom building, including lateral and vertical bearing pressures for dead, live, earthquake and wind loads; and minimum embedment depth,
- recommendations for AC pavement sections for use with various Traffic Indexes, including auto parking areas and driveway areas,
- general recommendations for surface and subsurface drainage at the site.

4.0 SCOPE OF SERVICES

Information required to fulfill the above purposes was obtained from one 15-foot boring drilled within the restroom building footprint and four shallow (3½ to 5 foot) borings located within the parking areas. Soil samples were obtained from the borings at roughly 3- to 5-foot intervals, and a laboratory testing program was performed on selected samples in order to evaluate the engineering characteristics of the soils at the site. Information obtained from these tasks was used to develop conclusions, opinions, and recommendations oriented toward the above-stated purpose of our services. Accordingly, 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 borings at the site at least 72 hours in advance of the drilling, and notified Underground Service Alert to mark utility lines on or entering the site.

3. Drilled, logged, and sampled one 15-foot boring and four shallow (3½ to 5 foot) exploratory borings with a truck-mounted drilling rig using continuous flight augers. The borings were drilled under the technical direction of one of our engineers or geologists, who also obtained disturbed bulk, Standard Penetration Test, and/or relatively undisturbed ring samples of the native soils for visual classification and laboratory testing. We then backfilled the borings with cement grout per standard protocol, and the drill cuttings were left on site.

4. Performed a laboratory testing program on the collected soil samples to evaluate the engineering characteristics of the subsurface soils. Tests included shear strength testing, Atterberg Limits tests, R-value tests, and moisture-density measurements.

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

6. Prepared four paper copies and one electronic pdf copy of a report summarizing our findings and included 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 the project.

5.0 FIELD EXPLORATION

Subsurface conditions at the site were explored by one 15-foot boring and four shallow (3½ to 5 foot) borings located within the parking areas at the approximate locations shown on the attached Plate 2,

Site Plan. The soil borings were drilled with a truck-mounted drilling rig using 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 borehole, 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 5, 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 Log 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.
- Plate 9 thru 13, 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 14, Atterberg Limits, summarizes and plots the results of the Atterberg Limits tests performed on selected samples, which were performed to classify the soils as well as obtain an indication of their expansive potential.

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. Atterberg Limits tests were performed on selected samples to aid in their classification. The results of our laboratory tests are summarized on the boring logs and plates described above.

6.0 GEOLOGY AND SEISMICITY

6.1 Regional Geology

A review of the "Geology of the Onshore Part of San Mateo County, California: A digital database" by E.E. Brabb and R.W. Graymer, D.L. Jones 1997, indicates that the tree covered area where the new parking lot will be located is underlain by "Greenstone" described as "Dark-green to red altered basaltic rocks, including flows, pillow lavas, breccias, tuff breccias, tuffs, and minor related intrusive rocks, in unknown proportions," and "Chert" described as "White, green, red, and orange chert, in places interbedded with reddish-brown shale."

The map also indicates that the lower, flat areas are underlain by artificial fill, which is typically placed over the soft bay mud soils when the areas are reclaimed from the Bay. However, Boring B-1 by Treadwell&Rollo, indicates the bay mud does not extend all the way to the base of the hill. It must be noted that our recent Borings B-1 and B-2 did not reach the base of the fill in the area, and therefore could not confirm or deny the presence of bay mud in those areas. Nevertheless, we have indicated a very rough approximation of the extent of the bay mud at the site. It appears that the lower, reconfigured parking lot is likely not underlain by soft mud.

A portion of the referenced map that includes the site area is presented herein as the Regional Geology Map, Plate 3.

6.2 Seismic Setting

The site, as is the entire San Francisco Bay area, is 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 Central Valley. The major fault in this system is the San Andreas fault located approximately 7 kilometers southwest of site. 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 San Gregorio fault is located approximately 17 kilometers southwest of the site, the Hayward fault is located approximately 23 kilometers northeast of site, and the Calaveras fault is located approximately 29

kilometers northeast of the site. Other faults are too distant, and/or judged incapable of generating ground accelerations large enough to be considered significant threats to this site. The distances to the major faults from the site, and their potential moment magnitudes are listed in the table below.

Table 1
Significant Earthquake Scenarios

Fault	Approximate Distance to Site (kilometers)	Probability[1] for $M_W \geq 6.7$ Within 30 years (%)
San Andreas	7	33
San Gregorio	17	5
Hayward	23	32
Calaveras	29	25

1. Working Group on California Earthquake Probabilities, 2014

6.3 CBC 2013 Seismic Design Parameters

Based on the soil information obtained from the exploratory boring at the proposed restroom site, the soil profile is classified as a Class "C", defined as a "very dense soil and soft rock" with an average shear wave velocity between 1,200 to 2,500 feet per second, average Standard Penetration Test (N) value greater than 50 blows per foot, and/or average undrained shear strength greater than 2,000 psf in the top 100 feet of the site.

Using the site coordinate of 37.5898 degrees North Latitude and 121.3246 degrees West Longitude, and the USGS Seismic Design maps (geohazards.usgs.gov/designmaps/us.application.php), the earthquake ground motion parameters were computed in accordance with 2013 California Building Code as listed in the following table.

Table 2
Parameters for Seismic Design

2010 CBC Site Parameter	Value
Site Latitude	37.5898° N
Site Longitude	121.3246° W
Site Class, Table 1613.5.2	Stiff Soil, Class C
Mapped Spectral Acceleration for Short Periods S_s	1.78g

Table 2
Parameters for Seismic Design

2010 CBC Site Parameter	Value
Mapped Spectral Acceleration for a 1-second Period S_1	0.82g
Site Coefficient F_a	1.0
Site Coefficient F_v	1.3
Site-Modified Spectral Acceleration for short Periods S_{Ms}	1.78g
Site-Modified Spectral Acceleration for a 1-second Period S_{M1}	1.07g
Design Spectral Acceleration for short Periods S_{Ds}	1.19g
Design Spectral Acceleration for short Periods S_{D1}	0.71g

7.0 SITE CONDITIONS

7.1 Subsurface Conditions

The borings advanced in the existing parking area for this investigation (B-1 and B-2) encountered fill soils to the depths explored. The fill soil consisted of medium dense coarse grained soil and medium stiff to hard clayey soils with varying sand and gravel contents.

The borings advanced in the proposed restroom building and upper parking lot areas encountered native soil consisting of 2 to 3 feet of dense to very dense silty sand. Underlying the silty sand, the site materials in the borings consisted of hard sandy clay to very dense clayey sand with varying sand contents.

7.2 Groundwater

Groundwater was not encountered in the borings drilled for the investigation. However, groundwater was encountered in the proposed new beach area from 6½ to 8 feet bgs in the borings and CPT's advanced during the 2008 investigation by Treadwell & Rollo.

Groundwater levels would generally be subject to seasonal fluctuations and the amount of yearly rainfall.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 General

Based on the subsurface exploration conducted at the subject site and the results obtained from our laboratory testing program, it is our opinion that the proposed project is feasible 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.

The site 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 2013 California Building Code defines the minimum standards of good engineering practice.

8.2 Site Grading

A detailed grading plan was not available when this report was prepared, but site grading will likely consist of clearing and grubbing, reworking the upper portion of the on-site soils, and preparation of the subgrade to receive new foundations for the restroom building, as well as removal of the asphalt within the entire parking lot area and demolition of the northern portion of the parking lot adjacent to the beach to receive the proposed beach and dune areas.

As used in this report, the term “compact” and its derivatives mean that all on-site soils should be compacted to a minimum of 95 percent of the maximum dry density, at a moisture content that is slightly over optimum as determined by ASTM Test Method D1557.

The following grading procedures should be followed for preparation of the areas to receive fills and/or 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.

- Within old pavement areas, completely remove or pulverize the existing AC such that 100 percent is smaller than 2 inches in size and 90 percent is smaller than 1 inch in size.

- 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 slightly 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. 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.

8.3 Foundations

The new restroom building may be satisfactorily supported upon conventional spread footing foundations. The footings should be established a minimum of 18 inches in depth with a minimum width of 12 inches. With these dimensions, footing may be designed using allowable bearing pressures of 2000 pounds per square foot (psf) for dead plus live loads, and 3,000 psf for total design loads including wind or seismic loads.

Lateral loads may be resisted by passive earth pressures against the foundation members which have been poured in neat excavations without the use of any forms, and by friction between the bottom of spread footings and soil. The allowable passive resistance may be taken as an equivalent fluid pressure of 350 pcf (triangular). The upper 12 inches of the passive resistance should be ignored unless the foundation is protected by a pavement or concrete slab. A coefficient of 0.35 may be used between the native soils and the bottom of concrete footings.

8.4 Slabs-on-Grade and Exterior Flatwork

The soil subgrade should be compacted as per the recommendations included in the "Site Grading" section of this report. In areas where moisture on the slab surface would be undesirable, 4 inches of approved, clean, free draining angular gravel should be placed beneath the concrete slab. The base course is intended to serve as a capillary break; however, moisture may accumulate in the base course zone. Therefore, a vapor barrier with a thickness of at least 15 mil (such as, Stegowrap or an approved equivalent) should be placed on the gravel base if moisture protection and a dry floor slab are desirable. The vapor barrier should be installed and sealed as per manufacturer's recommendations.

8.5 Drainage

Site drainage should be considered an integral part of the proposed project. The ground surface in unpaved areas adjacent to the building should slope at least 5 percent away from the structure for at least 5 feet to facilitate runoff drainage into catch basins or area drains. Any area where surface run-off becomes concentrated should be provided with a catch basin. The collected runoff from the catch basins should be discharged in a manner that will not cause erosion or saturation of soils in the vicinity of foundations or slopes.

8.6 Utility Trench Backfill

Vertical trenches deeper than 5 feet will likely require temporary shoring. 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 50 feet of the site 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 3 inches in greatest dimension. The on-site soils can be used for trench backfill, but not 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) should be compacted to 95% of maximum dry density. Jetting shall not be allowed.

8.7 On-Site Flexible Pavements

An R-value test was conducted on two composite bulk samples of the near-surface soils obtained from borings B-1 and B-2 and from borings B-4 and B-5. The test for the composite sample of Boring B-1 and B-2 resulted in an R-Value of 8 with an expansion pressure of 300 psf, while the test for the composite sample for Boring B-3 and B-4 resulted in an R-Value of 14 with an expansion pressure of 300 psf. An R-value of 8 and 14 were used for the soil subgrade in the lower existing parking lot area and in the upper new parking lot, respectively, to develop pavement section thickness recommendations for various traffic index values which are presented in the table below.

Table 3
Summary of Asphalt Pavement Sections

Pavement Component	Subgrade R-value =8						Subgrade R-value =14					
	TI=4.5		TI=5.0		TI=6.0		TI=4.5		TI=5.0		TI=6.0	
Asphaltic Concrete (AC) in Inches	3	3	3½	3½	4	4	3	3	3½	3½	4	4
Class II Aggregate Base (RMin=78) in Inches	7½	4	10	4	11	4	7	4	7	4	10	4
Class II Aggregate Subbase or Recycled AC/AB (R_{Min}=50)	--	6	--	6	--	8	--	6	--	6	--	7
Total Thickness in Inches	10½	13	13½	13½	15	16	10	13	10½	13½	14	15

The Traffic Index is a measure of the frequency and magnitude of traffic loading the flexible pavement is expected to experience during its life time. A Traffic Index (TI) of 4.5 is frequently used for areas subject to light automobile parking only. A TI of 6.0 is usually appropriate where the pavement will be subject to frequent use by vans or light delivery trucks with only occasional heavy truck traffic, such as from weekly garbage trucks. The calculated pavement section thicknesses for various traffic index values are listed in the table above.

The soil subgrade should be compacted as per the recommendations included in the "Site Grading" section of this report. All pavement components should conform to and be placed in accordance with the latest edition of CalTrans Standard Specifications, except that compaction should be measured by ASTM Test Method D1557.

8.8 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.

8.9 Observation and Testing

It is recommended that the Geotechnical Engineer (BAGG Engineers) 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. Changed or unanticipated soil conditions may warrant revised recommendations. For this reason, BAGG cannot accept responsibility or liability for the recommendations in this report if we are not given the opportunity to observe and test site grading.

9.0 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 widely scattered borings and a review of available geotechnical and geologic literature pertaining to the project site. 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, preparation of pavement subgrades and building pads, 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
Plate 2	Site Plan
Plate 3	Regional Geologic Map
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 thru 13	Boring Logs
Plate 14	Atterberg Limits
Plates 15 and 16	R-Values

ASFE document titled "Important Information About Your Geotechnical Engineering Report

10.0 REFERENCES

Brabb, E.E., R.W., Graymer, and Jones, D.L., *Geology of the Onshore Part of San Mateo County*, California Unite States Geological Survey, 1988

California Building Standard Commission, 2013 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2.

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California Department of Transporatation, 2011, *Trenching and Shoring Manual*, Issued by Office of Structure Construction, Revision 1, August 2011

Schlocker, J, 1970, *Generalized Geologic Map of the San Francisco Bay Region, California*: United State Geological Survey Open File Report.

U.S Geological Survey (USGS), 2013, *U.S. Seismic Design Maps*, USGS Earthquake Hazards Program

Working Group on California Earthquake Probabilities, 2008, *The Uniform California Earthquake Rupture Forecast*, Version 2 (UCERF2), U.S. Geological Survey Open File Report 2007-1437.

GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
COYOTE POINT
SAN MATEO, CALIFORNIA

VICINITY MAP

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BAGG ENGINEERS

LEGEND

- Eastern Promenade - New Route
- New Beach Area
- New Dunes
- Breakwater
- New Restroom Location (Tentative)
- Additional Parking Area (Tentative)
- High Water Line
- EasternPromenade - Existing Route
- Western Promenade
- Coyote Point Recreation Area
- **Approximate Location of Boring by BAGG Engineers, 2015**
- **Approximate Location of Boring by Treadwell & Rollo, Inc., 2008**
- **Approximate Location of Cone Penetration Test by Treadwell & Rollo, Inc., 2008**
- **Approximate Eastern Edge of Soft Bay Mud**

Source: Google Earth, Imagery

GEOTECHNICAL ENGINEERING INVESTIGATION
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COYOTE POINT RECREATION AREA
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BAGG ENGINEERS

SITE PLAN

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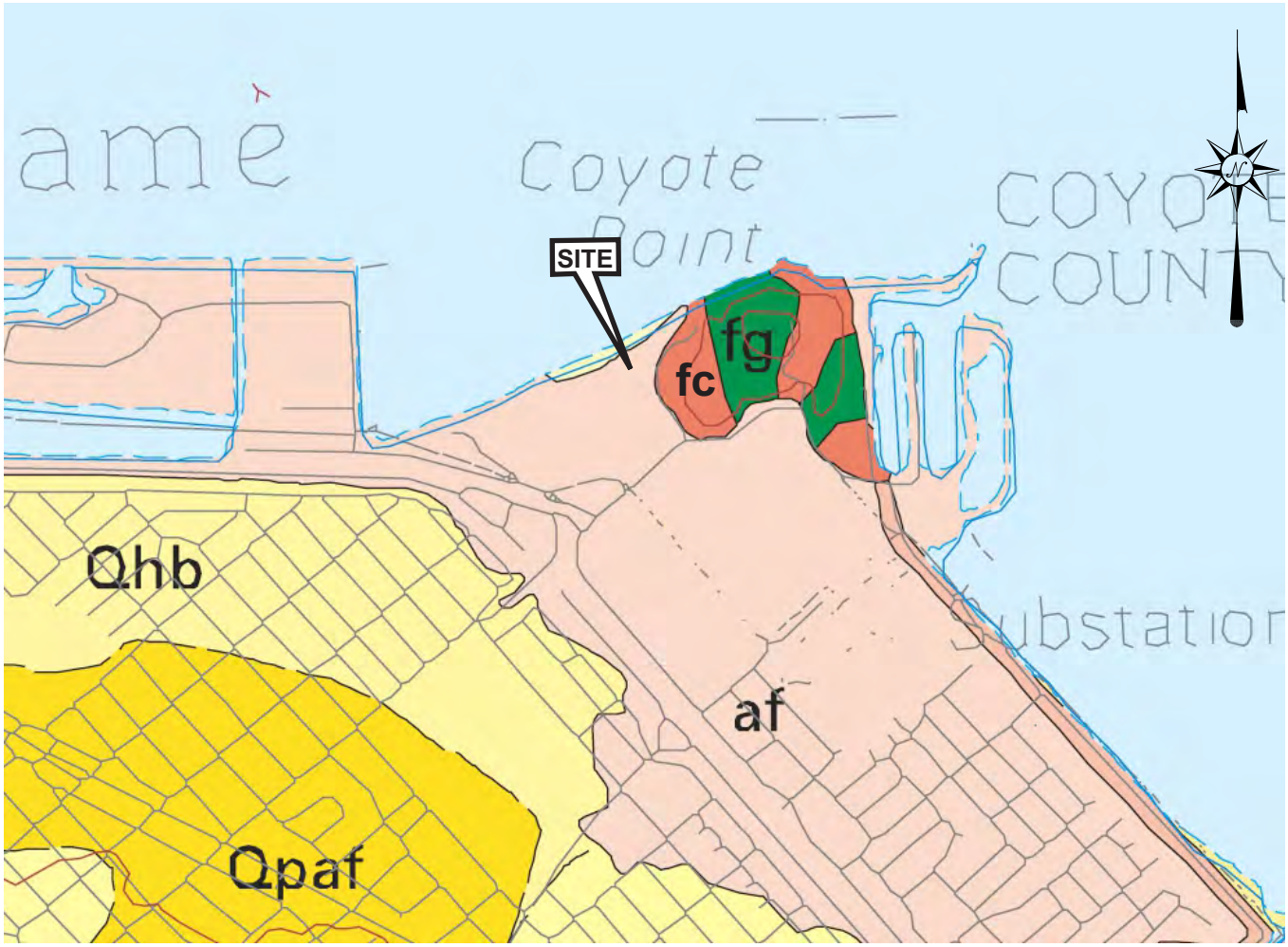

LEGEND

fg **Greenstone--** Dark-green to red altered basaltic rocks, including flows, pillow lavas, breccias, tuff breccias, tuffs, and minor related intrusive rocks, in unknown proportions.

fc **Chert--**White, green, red, and orange chert, in places interbedded with reddish-brown shale.

af **Artificial fill (Historic)--**Loose to very well consolidated gravel, sand, silt, clay, rock fragments, organic matter, and man-made debris in various combinations.

Qpaf **Alluvial Fans and Fluvial Deposists (Pleistocene)--** Brown dense gravel and clayey sand or clayey gravel that fines upward to sandy clay.

Qhb **Basin Deposits (Holocene)--** Very fine silty lay to clay deposists occupying flat-floored basins at the distal edge of alluvial fans adjacent to the bay mud.

Reference: Geology of the Onshore Part of San Mateo County, California United States Geological Survey, By E.E. Brabb, R.W. Graymer, and D.L. Jones, 1998.

GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
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SAN MATEO, CALIFORNIA

REGIONAL GEOLOGY MAP

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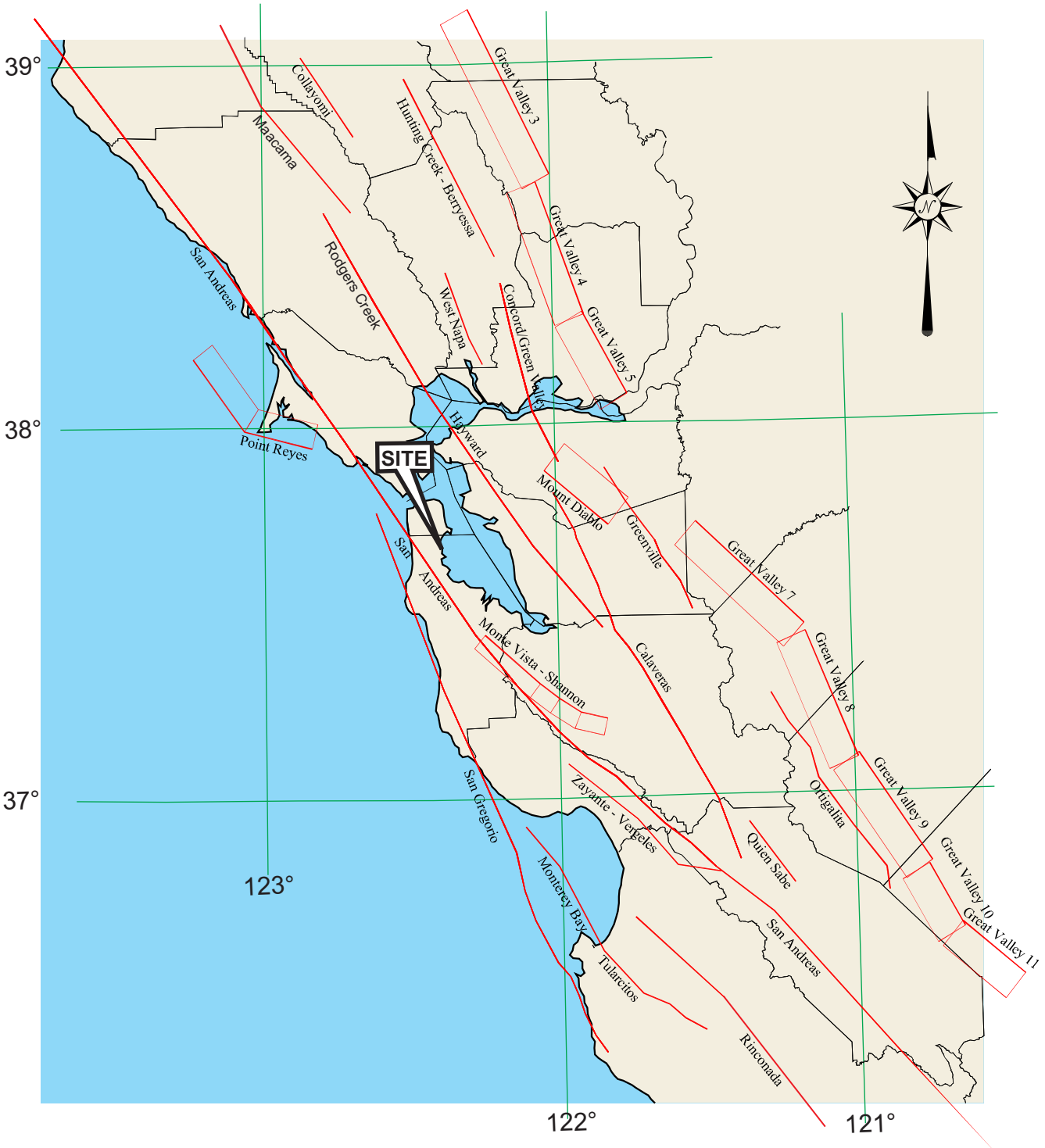
BvGG ENGINEERS



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

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EASTERN PROMENADE IMPROVEMENT PROJECT
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SAN MATEO, CALIFORNIA

REGIONAL FAULT MAP

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BAGG 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	

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: 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.)

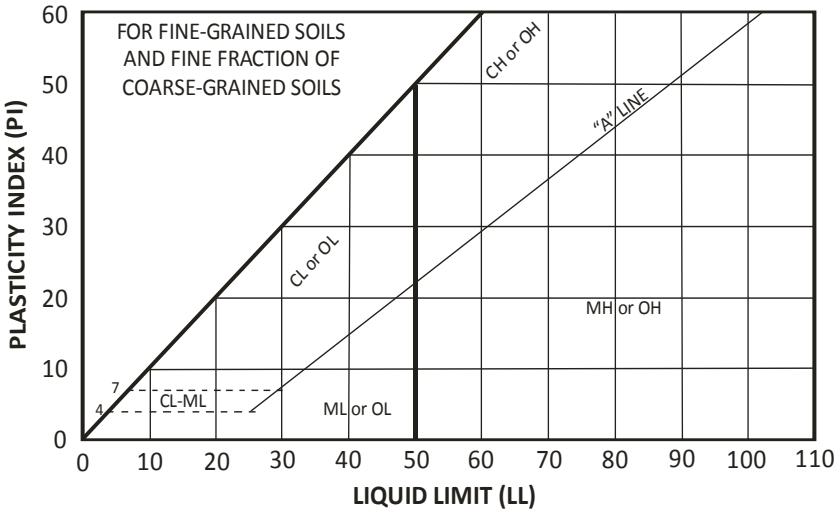
NOTE: Fine-grained soils receive dual symbols if their limits in the hatched zone on the Plasticity Chart(L-M)

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

BVGG ENGINEERS

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).

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Ref 1: ASTM Designation: D 2487-06, **Standard Classification of Soils for Engineering Purposes** (Unified Soil Classification System).

Ref 2: Terzaghi, Karl, and Peck, Ralph B., **Soil Mechanics in Engineering Practice,** John Wiley & Sons, New York, 2nd Ed., 1967, pp. 30, 341, and 347.

Ref 3: Sowers, George F., **Introductory Soil Mechanics and Foundations: Geotechnical Engineering,** Macmillan Publishing Company, New York, 4th Ed., 1979, pp. 80, 81, and 312.

Ref 4: Lowe, John III, and Zaccheo, Phillip F., **Subsurface Explorations and Sampling,** Chapter 1 in "Foundation Engineering Handbook," Hsai-Yang Fang, Editor, Van Nostrand Reinhold Company, New York, 2nd Ed, 1991, p. 39.

SOIL TERMINOLOGY

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 were drilled on July 28, 2015, with a truck mounted drilling rig with continuous flight augers. The borings were sealed with neat cement grout and capped with soil immediately after the last soil sample was collected.

2. The boring locations were approximately located by pacing from known points on the site, as shown on Plate 2, 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, with the blow counts given 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 this investigation to the depths explored as indicated on the boring logs.

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty gravel
	Description not given for: "O3"
	Paving
	Soft Lean Clay
	Well graded sand
	Lean clay with sand, stiff to very stiff
	Silty sand
	Clayey sand
Soil Samplers	
	Modified California Sampler: 2.375" ID by 3" OD, split-barrel sampler driven w/ 140-pound hammer falling 30 inches
Line Types	
_____	Denotes a sudden, or well identified strata change
_ _ _ _ _ _ _	Denotes a gradual, or poorly identified strata change
Laboratory Data	
DS	Direct shear test performed on a soil sample at natural or field moisture content (ASTM D2166).

Symbol	Description
DSX	Direct shear test performed after the sample was submerged in water until volume changes ceased (ASTM D2166).
PI	Plasticity Index established per ASTM D4318 Test Method.
LL	Liquid Limit established per ASTM D4318 Test Method.
AC	Asphaltic Concrete
AB	Aggregate Base

BORING LOG

Boring No. B-1

JOB NAME: Eastern Promenade Improvement Project
CLIENT: BKF Engineers
LOCATION: Coyote Point Recreation Area, San Mateo
DRILLER: West Coast Exploration, Inc.
DRILL METHOD: Continuous Flight Augers

JOB NO.: BKFEN-29-00
DATE DRILLED: 7/23/15
ELEVATION: 8'±
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		GM	SILTY GRAVEL: gray, medium dense, slightly moist to moist, gravel up to 1" in size	Fill
								CL	GRAVELLY LEAN CLAY with sand: reddish brown, moist, hard, some shale fragments	
				16.8	110	4	15 20 17 7 9 13		...some silt sand ...increase in shale content	
									Boring was terminated at 4.9' bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						8				
						12				
						16				
						20				
						24				

BORING LOG

Boring No. B-2

JOB NAME: Eastern Promenade Improvement Project
CLIENT: BKF Engineers
LOCATION: Coyote Point Recreation Area, San Mateo
DRILLER: West Coast Exploration, Inc.
DRILL METHOD: Continuous Flight Augers

JOB NO.: BKFEN-29-00
DATE DRILLED: 7/23/15
ELEVATION: 9'±
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	9 20 20		PAVEMENT: 1.5"AC, 4"AB	
								CL	GRAVELLY LEAN CLAY: dark gray, very stiff, moist, gravel up to 1" in size, some sand	Fill
								SW		
								CL		
				21.7	104	4	2 3 3		WELL-GRADED SAND: dark gray, medium dense, moist	
									SANDY LEAN CLAY: red brown, medium stiff, wet, some shale fragemnts	
						8			Boring was terminated at 4.9' bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						12				
						16				
						20				
						24				

BORING LOG

Boring No. B-3

JOB NAME: Eastern Promenade Improvement Project
CLIENT: BKF Engineers
LOCATION: Coyote Point Recreation Area, San Mateo
DRILLER: West Coast Exploration, Inc.
DRILL METHOD: Continuous Flight Augers

JOB NO.: BKFEN-29-00
DATE DRILLED: 7/23/15
ELEVATION: 14'±
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
				6.7	105	0	13 20 25	SM	SILTY SAND: yellow brown, dense, slightly moist, fine-grianed sand	Colluvium
DSX DSX	1500 500	18.5 20.4	1060 480	11.6 12.2	111 109	4	15 30 44	CL	SANDY LEAN CLAY: yellow brown, hard, moist, some oxidation staining, orangish yellow fine-grained sans ...red chert fragments	Franciscan LL=39, PI=25
DS DS	2100 1100	NAT NAT	2900 1800	15.9 15.3	111 114	8	22 50/5"		...some fine gravel	
				14.2	115	12	62/6"	SC	CLAYEY SAND: light yellow brown, moist, very dense, fine-grained sand, some oxidation staining	
						16			Boring was terminated at 14' bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						20				
						24				

BORING LOG

Boring No. B-4

JOB NAME: Eastern Promenade Improvement Project
CLIENT: BKF Engineers
LOCATION: Coyote Point Recreation Area, San Mateo
DRILLER: West Coast Exploration, Inc.
DRILL METHOD: Continuous Flight Augers

JOB NO.: BKFEN-29-00
DATE DRILLED: 7/23/15
ELEVATION: 38'±
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	60/6"	SM	SILTY SAND: brown, very dense, slightly moist, some fine-grained gravel, fine-grained sand, few gravel up to 1" in size	Colluvium
				16.4	104	4	53/6"	CL	SANDY LEAN CLAY: yellow brown, hard, moist, some fine-grained gravel, fine-grained sand	Franciscan
									Boring was terminated at 4' bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						8				
						12				
						16				
						20				
						24				

BORING LOG

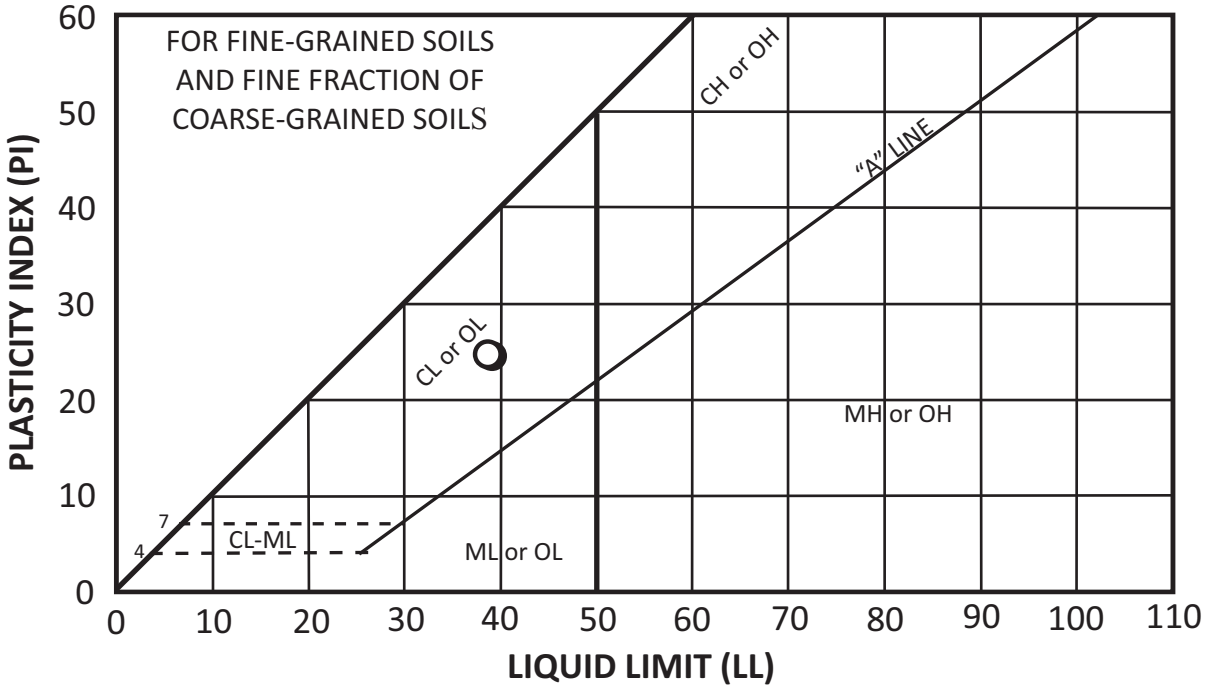
Boring No. B-5

JOB NAME: Eastern Promenade Improvement Project
CLIENT: BKF Engineers
LOCATION: Coyote Point Recreation Area, San Mateo
DRILLER: West Coast Exploration, Inc.
DRILL METHOD: Continuous Flight Augers

JOB NO.: BKFEN-29-00
DATE DRILLED: 7/23/15
ELEVATION: 40'±
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
				6.1	105	0	22 52		SILTY SAND: yellow brown, very dense, slightly moist, fine-grained sand	Colluvium
								CL	SANDY LEAN CLAY: yellow brown, hard, moist, some fine-grained gravel, fine-grained sand	Franciscan
						4			Boring was terminated at $3\frac{1}{2}$' bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						8				
						12				
						16				
						20				
						24				

PLASTICITY CHART



SYMBOL	SAMPLE SOURCE	DEPTH (FEET)	NATURAL WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL DESCRIPTION
O	Boring B-3	4.5	--	39	14	25	Yellow brown sandy lean clay (SC)

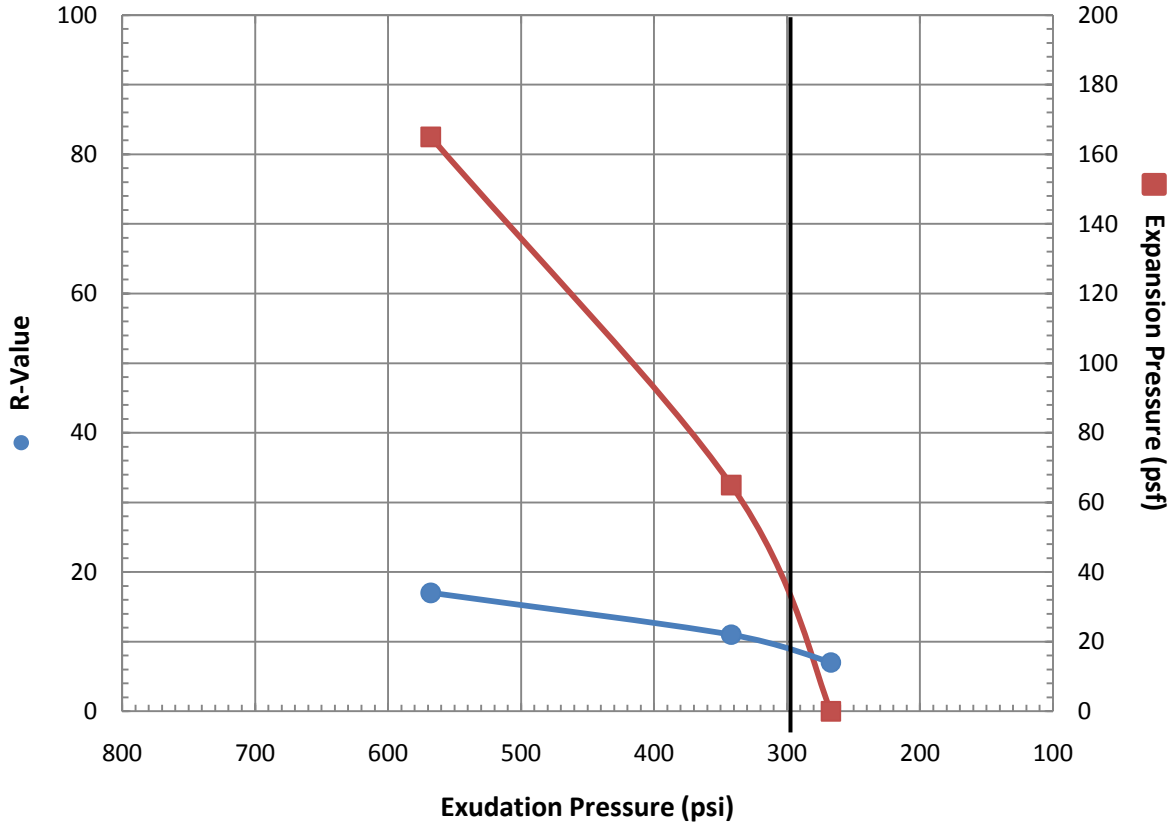
GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
COYOTE POINT RECREATION AREA
SAN MATEO, CALIFORNIA

ATTERBERG LIMITS

DATE:	JOB NUMBER:	PLATE
AUGUST 2015	BKFEN-29-00	14

BAGG ENGINEERS

Bulk B-1 & B-2



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. Psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	290	127.9	10.2	165	124	2.51	568	17	17
2	210	123.5	12.6	65	138	2.54	342	11	11
3	160	120.1	13.6	0	142	2.58	267	7	7

R-value at 300 psi exudation pressure = 8

Exp. Pressure at 300 psi exudation pressure = 32

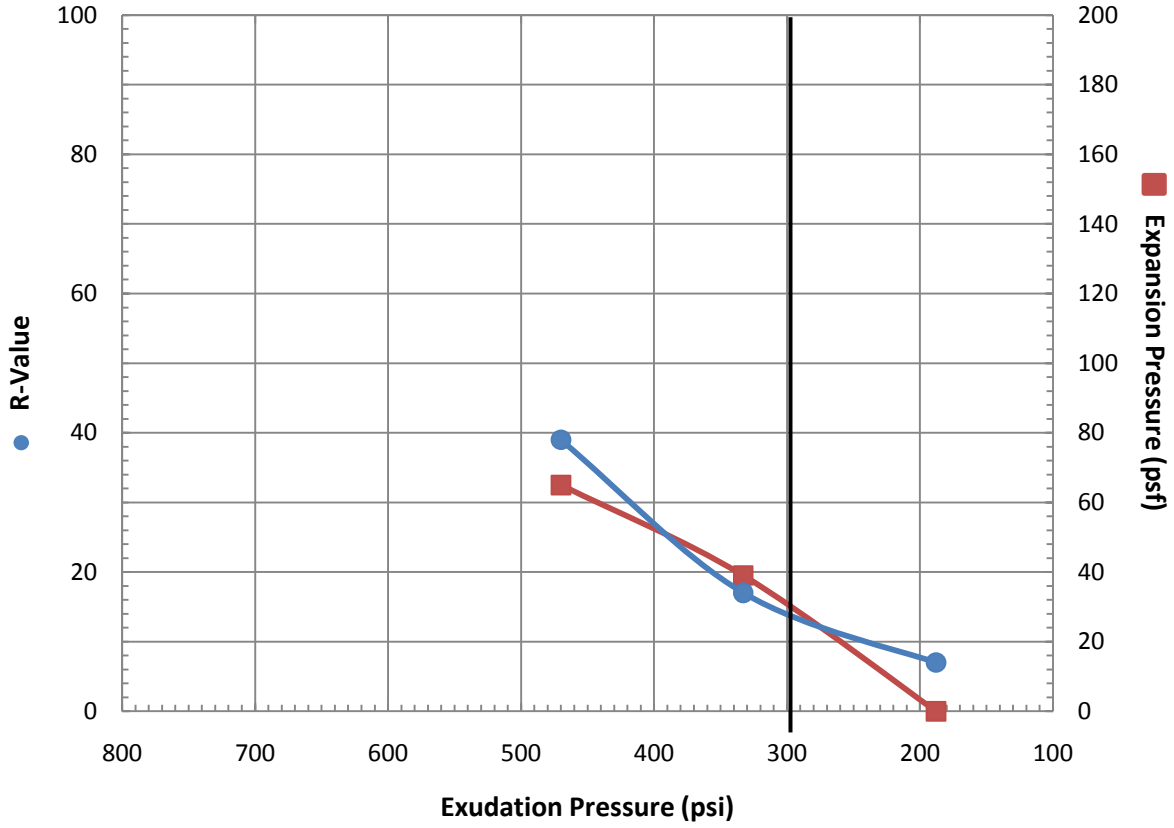
GEOTECHNICAL ENGINEERING INVESTIGATION
EASTERN PROMENADE IMPROVEMENT PROJECT
COYOTE POINT RECREATION AREA
SAN MATEO COUNTY, CALIFORNIA

R-VALUE TEST DATA

JOB NO:	DATE:	PLATE
BKFEN-29-00	August 2015	15

BvGG ENGINEERS

Bulk B-4 & B-5



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. Psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	123.6	12.3	65	83	2.50	470	39	39
2	295	120.5	13.0	39	123	2.60	333	17	18
3	195	117.2	14.0	0	141	2.58	188	7	7

R-value at 300 psi exudation pressure = 14

Exp. Pressure at 300 psi exudation pressure = 30

GEOTECHNICAL ENGINEERING INVESTIGATION **COYOTE POINT RECREATION AREA** **EASTERN PROMENADE IMPROVEMENT PROJECT** **SAN MATEO COUNTY, CALIFORNIA**	**R-VALUE TEST DATA**		
	JOB NO: BKFEN-29-00	DATE: August 2015	PLATE 16