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Draft Geotechnical Investigation Report
Sonoqui Wash Channelization
Gilbert and Queen Creek, Arizona

Draft Geotechnical Investigation Report
Sonoqui Wash Channelization
Gilbert and Queen Creek, Arizona

Submitted to:

Stanley Consultants, Inc.
Phoenix, Arizona

Submitted by:

AMEC Earth & Environmental, Inc.
Tempe, Arizona

16 July, 2004

AMEC Job No. 3-117-001097

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Scott Buchanan, P.E.
Stanley Consultants, Inc.
2929 East Camelback Road
Suite 130
Phoenix, Arizona 85016-4425

Dear Mr. Buchanan:

Re: Draft Geotechnical Investigation Report
Sonoqui Wash Channelization
Gilbert and Queen Creek, Arizona

Submitted herewith is the Draft Geotechnical Investigation Report prepared by AMEC Earth & Environmental, Inc. for the above referenced project. Included are the results of test drilling and laboratory analysis, and recommended criteria for excavation, embankment design, pavement design and temporary slopes.

Should you have any questions concerning the recommendations presented in this report, please do not hesitate in contacting us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Daniel N. Fréchette, Ph.D., P.E.
Geotechnical Engineer

Reviewed by:

Lawrence A. Hansen, Ph.D., P.E.
Senior Vice President

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c: Addressee (4)

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include soil boring location Maps. If you don't have one I can get a copy of it. Raj

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation performed by AMEC Earth & Environmental, Inc. (AMEC) of Sonoqui Wash in Gilbert and Queen Creek, Arizona. The purpose of this investigation was to examine the geotechnical profile beneath the site and to evaluate the engineering properties of the subsurface materials. This information was used to provide criteria for embankment design, pavement design and temporary slopes, and to prepare recommendations related to site grading, excavation and other aspects of the project where soil properties or behavior should be considered.

2.0 PROJECT DESCRIPTION

include Project location with Township and Range and Section #s,

Details of the project were provided to us by Scott Buchanan, P.E. of Stanley Consultants, Inc. It is understood that a multi-use conveyance channel capable of containing a 100-year storm event within the existing natural alignment of the Sonoqui Wash east of Higley Road for a length of approximately 3.5 miles. In addition, dip crossings across the channel are planned at several roadways.

include project Vicinity Map

3.0 INVESTIGATION

3.1 Subsurface Exploration

The subsurface investigation consisted of twenty-four borings to depths of ranging from 15 to 35 feet below existing site grades. Locations of the borings are shown on the site plan (Figure 1) presented in Appendix A of this report. The borings were completed utilizing a subcontracted CME-75 truck-mounted drill rig owned and operated by Geomechanics Southwest, Inc. (GSI) advancing 6 5/8-inch outside diameter (O.D.) hollow-stem auger. Standard penetration (split-spoon) testing and sampling were performed at selected intervals in the borings. Also, bulk samples of auger cuttings were obtained for laboratory testing.

Encountered soils were visually inspected and classified in the field and logged in accordance with ASTM D2487 (Unified Soil Classification System). Borehole logging and field supervision were performed by Shanda Wagner of AMEC. Logs of the test borings are presented in Appendix A of this report, along with a description of drilling and sampling procedures. All boring locations were staked in the field by AMEC using GPS and existing surface features. The majority of the field investigation was performed in March with some follow-up work in June 2004.

3.2 Laboratory Testing

The moisture content and dry density of selected samples recovered were determined and the results are shown on the test boring logs. Grain-size analysis, Atterberg limits (plasticity index)

and moisture-density relationship (standard Proctor) tests were performed on selected samples. In addition, pH, resistivity, and soluble sulfate tests were performed on selected samples. The results of these tests are presented in Appendix B.

3.3 Previous Investigations

Information from two previous investigations was reviewed and portions of them are included in the current report.

The first investigation was for a proposed bridge for Chandler Heights Road over Sonoqui Wash. The investigation was performed by AMEC at the beginning of this year for the Maricopa County Department of Transportation (MCDOT). The investigation consisted of four borings advanced to a depth of 80 feet below existing ground surface at the proposed bridge location. Grain-size analysis and Atterberg limit tests were performed on a surface sample (SM-1). The results of these tests were used characterize the subgrade material for use in pavement design for Chandler Heights Road dip crossing at Sonoqui Wash in case the construction of the bridge lags behind the construction of the current project. The boring logs for the four borings are provided in Appendix D.

The other investigation focused on the collection and testing of soil samples for sediment transport analysis. The investigation was performed by Hoque and Associates along sections of the Sonoqui Wash as part of the Queen Creek/ Sonoqui Wash Hydraulic Master Plan (HMP) and the information was provided to AMEC by Stanley Consultants. The results of the laboratory tests and a site plan showing the sample locations are presented in Appendix D.

4.0 SITE CONDITIONS AND GEOTECHNICAL PROFILE

4.1 Site Conditions

Sonoqui Wash is located within the towns of Gilbert and Queen Creek, and in unincorporated Maricopa County. The 3.5-mile wash parallels the Ocotillo Road alignment from Power Road to the confluence with Queen Creek Wash (located west of Higley Road). From Chandler Heights Road to Power Road the channel flows in a northwesterly direction. The project will start at the confluence of Queen Creek Wash and Sonoqui Wash at the Ocotillo Road alignment and will end near Chandler Heights Road.

Primarily agricultural fields bound the site between Higley Road to east of Power Road at Via del Jardin. Several private developments bound the eastern portion of the site from Via del Jardin to Chandler Heights Road. Vegetation along the existing wash alignment consists of occasional creosote bushes, native grasses and small shrubs.

4.2 Geotechnical Profile

The subsurface soils encountered at the site can be generalized into a two-strata system as follows:

- **Stratum A:** A surface layer of silt and sandy silt with lesser deposits of sandy clay extend from the surface to depths of 2 to 18 feet below existing site grades. The soils generally are nonplastic to low in plasticity, and are uncemented. In general, these soils are firm or medium dense near the surface stratum and become very firm to hard or dense to very dense with depth. Exceptions were noted in Borings B-7, B-13 and B-24. A silty sand deposit, with trace amounts of clay, was encountered from the surface to depths ranging from 5 to 8.5 feet in Borings B-24 and B-7, respectively. Silty sand was encountered from the surface to the full boring depth in Test Boring B-13.

- **Stratum B**: Sand and silty sand mixtures with trace amounts of gravel underlie Stratum A and extend the full depths of the borings. In general, these soils are uncemented, and are medium dense to dense. Exceptions were noted in Borings B-8, B-15, B-16, B-23 and B-24. In Boring B-8 a firm to very firm, low plasticity, sandy clay was encountered below about 8.5 feet to the full depth of investigation. In Test Borings B-16, B-23 and B-24 sandy silt zones were encountered at depths of 14 to 36 feet below existing grades. A sand and gravel mixture, with variable amounts of silt, was encountered in Borings B-6, B-19 and B-21 at depths of ranging from 11 to 26 feet below existing site grades. These soils were typically medium dense and uncemented.

4.3 Groundwater and Soil Moisture Conditions

No free groundwater was encountered to the depth of the investigation in any of the borings performed for this project or the previously mentioned projects. The moisture condition of the soils can be described as slightly moist to moist in zones.

5.0 DISCUSSION AND RECOMMENDATIONS

The channelization of Sonoqui Wash in the project area follows the existing wash alignment for the majority of the project. In these areas the wash is to be widened and deepened and have side slopes varying from 3H:1V to 6H:1V (horizontal to vertical). Sonoqui Wash near Power Road is to be re-aligned to the south requiring the construction of new channel and the backfilling of the existing channel. At the time of the geotechnical investigation and the writing of this report the type and location of structures (i.e., walls, drop structures, etc.) was unknown, and are not discussed herein.

Presented in the following sections are results of analyses of global slope stability of the proposed wash geometry, and pavement designs for the dip crossings. Recommendations are provided regarding site grading, earthwork factors, excavatibility, temporary and permanent slopes, and pipe corrosion potential. A discussion of subsidence and related hazards is also presented.

5.1 Stability Analysis

5.1.1 Methodology and Typical Cross Section

Static analysis of the proposed embankment cross section of interest was performed using the computer program PCSTABL (Bandini and Salgado, 1999)[1]. This program is based on a two-dimensional limiting equilibrium method. The factor of safety is calculated using a conventional method of slices approach with the modified Bishop method of analysis. The particular procedure employed generates circular-shaped slip surfaces between specified coordinate limits. The computed factor of safety (FOS) is conservative relative to solutions obtained by more accurate methods that more completely satisfy equilibrium.

The critical channel cross section after construction is anticipated to be 3H:1V on the upstream slope for an approximate length of 700 feet. The maximum height is approximately 12 feet with a minimum of 1-foot freeboard. The typical cross section assumed for the analysis is shown in Appendix C. The particular design conditions considered are listed in the following table:

Case	Design Condition	Slope
I	End of construction	Upstream
II	Sudden drawdown from maximum pool	Upstream

5.1.2 Soil Parameters

The geotechnical parameters required for slope stability analysis include the unit weights and shear strengths of the materials present in the cross section. The anticipated location of the 3H:1V sloped section was in the Rancho Jardines area near boring B-19, which was used to determine the geotechnical parameters for the analyses. The geotechnical parameters for the critical channel cross section are presented in Table 1. Due to the granular nature of the soils drained soil parameters with saturated unit weights were used for Case II – sudden drawdown.

[1] References are listed at the end of this report.

TABLE 1
GEOTECHNICAL PARAMETERS ASSUMED FOR STABILITY ANALYSIS

Depth (feet)	Description	ϕ (degrees)	c (psf)	γ (pcf)	γ_{sat} (pcf)
0-15	Silty Sand	34	100	100	110
15-25	Sand and Gravel	36	0	110	115

?

5.1.3 Stability Analysis Results

Calculated FOS values are listed in Table 2 and analysis results are included in Appendix C. The calculated FOS values are larger than the minimum required values for both cases analyzed.

TABLE 2
RESULTS OF STATIC STABILITY ANALYSES

Case	Condition	Slope	Calculated FOS	Minimum Required FOS
I	End of Construction	Upstream	3.3	1.4
II	Sudden Drawdown	Upstream	3.2	1.0

5.2 Site Grading

All vegetation and debris should be removed from areas designated for fill.

The soils should be compacted to at least 95 percent of maximum dry density in accordance with ASTM D698.

Where soils are too coarse to test by conventional methods, a minimum roller requirement should be used. The ground surface should be subjected to at least eight passes of a heavy vibratory roller having a static weight of at least 25,000 pounds. The weight of the vibratory portion (including the drum, shaft and internal machinery) should be at least 12,000 pounds. The frequency of vibration during operation should be between 1,100 and 1,500 cycles per minute and the dynamic force at the operating frequency should not be less than 40,000 pounds. The maximum roller speed during operation should be no greater than 1.5 miles per hour. The compaction equipment used should be subject to approval by the geotechnical engineer.

make it 4"

5.2.1 Structural Fill

All structural fill utilized on the project should be free of vegetation, debris and other deleterious material, and should contain no particles larger than six inches in diameter. All structural fill should be compacted to within the range of two percent below to two percent above the optimum moisture content and to a density of at least 95 percent of maximum dry density as determined by ASTM D698.

In general, structural fill should have no more than 75 percent by weight passing the no. 200 sieve and should have a plasticity index of no more than 10 when tested by ASTM D4318. It appears that the most on-site soils encountered during the investigation will meet the above criteria.

5.3 Earthwork Factors

It is anticipated that the existing channel is to be widened in some areas and filled in other areas as part of this project. The in-place density of soils within the proposed channel alignment were evaluated through sampling and testing. Twenty-one relatively undisturbed ring samples (depth of approximately 25 feet or shallower), including 16 in the upper 10 feet, were tested for density and moisture content. Sample locations and results of the tests are presented in Appendix B.

The mean in-place dry density of soils within the proposed channel alignment was found to be 94.9 pounds per cubic foot (pcf) and 97.6 pcf in the upper 5 and 10 feet, respectively. The mean standard Proctor maximum dry density was determined to be 105.3 pcf, based on laboratory tests. Utilizing a 95 percent of maximum dry density value of 100 pcf to represent the compacted fills, an estimated earthwork factor of 5 percent shrink is determined. If the compacted embankment fill dry density is assumed to be at 100 percent of maximum dry density (105.3 pcf), a shrink factor of 10 percent is determined.

An estimated earthwork factor of 10 percent shrink is recommended for use in design estimates for this project. This recommended factor is based on the above estimates and our understanding of prior construction experience in the Phoenix metropolitan area. Actual construction excavation, fill handling and placement, and compaction procedures, in particular the staging and phasing of the required excavations and the moisture content and degree of compaction of the fill, will determine the fill characteristics and final, in-place embankment fill densities, and therefore the earthwork factors.

5.4 Excavation

The soils encountered at the site are predominantly moderately firm in the upper five feet increasing to firm to very firm with depth, with occasional hard zones. Based on the predominantly firm to very firm nature of the soils, it appears that typical construction equipment will be able to excavate to the full depth required.

5.5 Slopes

5.5.1 Temporary Slopes

It is recommended that temporary cut slopes be no steeper than 1.5H:1V within the native granular soils. These recommended slopes are based on the uncemented materials encountered in the borings and OSHA requirements (OSHA, 1990). Steeper temporary excavations, including those to employ trench shoring, should be made only if based on stability analyses by a registered geotechnical engineer. The analysis should take into account the slope angles, trench geometries, and any surcharge loadings due to equipment and spoil piles.

5.5.2 Permanent Slopes

It is recommended that permanent cut or embankment slopes be no steeper than 3H:1V. These recommendations are based primarily on the aesthetics of the project and to minimize rilling and slope erosion.

5.6 Pavements

Pavement design analysis was performed for the proposed crossings of Sonoqui Wash at Higley Road, Power Road, Via del Jardin, Sossaman Road and Chandler Heights Road. For the purpose of the current project it is assumed that dip crossings are planned at these locations. The existing structural section at each location is unknown. An attempt was made to determine the existing structural section through as-built plans but the as-builts could not be located.

The structural section at the dip crossings was determined using the Town of Gilbert Pavement Design Charts (Design Charts). The input parameters required for use of the Design Charts are the plasticity index and the percent passing the No. 200 sieve of the subgrade, and the classification of the road. Samples adjacent to the proposed dip crossing locations were obtained during the field investigation and were tested to obtain the required information. The subgrade information and roadway classification at each dip crossing are presented in the following table:

Location	Boring Location	Subgrade Information		Roadway Classification
		Plasticity Index	Percent Passing No. 200 Sieve	
Higley Road	B-2	8	77	Major Arterial
Power Road	B-14	6	64	Major Arterial
Via del Jardin	B-18	NP	35	Major Collector
Sossaman Road	B-22	NP	34	Major Arterial
Chandler Heights Road	SM-1*	NP	34	Major Arterial

*Boring done as part of previous investigation for proposed Chandler Heights Bridge.
NP = nonplastic.

Using the information in the above table and the Design Charts the following conventional asphaltic concrete over granular base pavement structures were determined.

Location	Asphaltic Concrete (inches)	Granular Base Course (Inches)
Higley Road	4	12
Power Road	4	12
Via del Jardin	2	9
Sossaman Road	4	12
Chandler Heights Road	4	12

5.6.1 Materials Quality and Construction Requirements

The materials quality and construction requirements should conform to the following sections of the current "Uniform Standard Specifications for Public Works Construction" sponsored and prepared by the Maricopa Association of Governments:

Item	Section(s)
Untreated Base	310 & 702.2
Bituminous Prime Coat	315
Asphaltic Concrete	321 & 710

The type of seal coat should be determined based on construction performance.

5.6.2 Asphaltic Concrete

A type C19 mineral aggregate or approved alternate should be utilized. The job mix formula should be established using the Marshall method of mix design (ASTM D1559), with design parameters determined by MAG Section 710. The following criteria should be used in the mix design:

Oil Type – PG70-10
Number of blows, each end of specimen – 75
Stability, pounds – 1,800 minimum
Percent air voids – 3 to 5
Percent voids in mineral aggregate – 14 minimum
Index of retained strength, % - 60 minimum

The stripping potential of the job mix formulation should be determined in accordance with MAG Section 710. The type and quantity of anti-strip additive, if required, should be assessed to meet local agency specification requirements.

5.7 Pipe Corrosion Potential

The corrosion potential of five selected soil samples recovered in the vicinity of the dip crossings was estimated. The locations were characterized for the use of prospective corrugated metal pipe (CMP) utilizing laboratory pH and electrical resistivity testing, performed in accordance with Arizona Test Method 236. The locations were also characterized for the prospective use of concrete pipes utilizing sulfate testing, performed in accordance with Arizona Test method 733. Results of the corrosion potential testing are presented in Appendix B.

The laboratory pH values ranged from 8.1 to 8.3 and the resistivity values ranged from 2,925 to 6,241 ohm-centimeters (ohm-cm). Figure 203.01-5 of the Preliminary Engineering and Design Manual (ADOT, 1989) indicates that there are no restrictions on the type of pipe that can be used.

include copy in Appendix

Total soluble sulfate values ranged from 14 to 29 parts per million (ppm). In the case of the sulfate tests, the test result is the water-leachable or "available" sulfate content. These results were compared to Table 4.3.1 (Requirements for Concrete Exposed to Sulfate-Containing Solutions), specifically the "Sulfate (SO_4) in water, ppm" column in the table in Section 4.3 of the American Concrete Institute (ACI) Manual of Concrete Practice (ACI 318/318R, 2001). All test results were found to be "negligible" in terms of sulfate exposure, indicating that Type I or Type II Portland cement would be adequate for concrete pipes in contact with these materials.

6.0 SUBSIDENCE AND RELATED HAZARDS

Ground subsidence due to groundwater withdrawal in alluvial basins in the Southwest is a process of compression and subsequent consolidation of the alluvial sediments. Prior to the 20th century, groundwater levels in the basin deposits were at or near the ground surface, or at relatively shallow depths. Consumption of the groundwater resources has changed these groundwater systems, and is continuing to cause water-table declines in many of the basins. In

addition, damming of rivers in mountainous portions of the surrounding watersheds has reduced available recharge. As is the case in the site area, agricultural, industrial and municipal groundwater pumping has significantly depleted the groundwater reserves in several Arizona basins.

6.1 Local Conditions

Only a small amount of relatively current information is available regarding the southern portion of the Chandler-Mesa subbasin of the East Salt River Valley. Much of the information is dated and regional in nature. According to ADWR (Tatlow, 2002), the only current information available in the area is contained in the National Geodetic Survey (NGS) data sheets (NGS, 2004).

Several NGS monitoring points of interest are located in the vicinity of the Santa Fe railroad, approximately 3 miles east of the eastern extent of the project. The elevation of monument P364 was measured at 1457.50 feet in November, 1993. The US Geological Survey (USGS) 7.5-Minute Quadrangle Map, constructed from survey data in 1956, depicts an elevation for the same point at 1461 feet. Although the datums for these measurements are different, the information does indicate that about 3.5 feet of subsidence has occurred in the approximate time span of 38 years. This translates to a yearly subsidence rate of about 0.09 ft/yr.

Another useful NGS monitoring point is designated as G68. The contrast in the quadrangle elevation and an adjusted NGS elevation obtained also in November of 1993 indicates about 3.1 feet of subsidence at this point over the same time span stated above.

In general agreement with the elevation data of the NGS network and older quadrangle mapping, Schumann (1974) estimated about 1 to 3 feet of subsidence in the area, with 3 to 5 feet near Queen Creek over the period from 1948 through 1967.

Laney et. al. (1978) and Laney and Hahn (1986) indicate that the amount of groundwater decline since 1923 varies significantly from the east end to the west end of the project, with the east end having a decline 150+ feet greater than the west end. Due to the difference in groundwater decline, it is very likely that the east end of the project has undergone more subsidence than the west end. Current water level data from wells in the historical database may not represent general water levels in the region. Operating wells have local cones of depression that may be reflected in the reported water level readings. Such detail cannot be ascertained from the historic record, and current groundwater conditions are not known.

Due to what is known about past water levels, it is likely that differential groundwater decline will occur in the future. Differential groundwater decline could result in differential subsidence within the project length. If future differential subsidence does occur, gradients within the channel will change and the risk for earth fissure occurrence increases.

How can we account for this in channel design? Do we need to make sure we don't reverse the flow direction in future?

6.2 Earth Fissures

Earth fissuring poses an erosional hazard, with normal surface drainage captured by fissures, resulting in the formation of fissure gullies. Earth fissures in areas of large groundwater decline in alluvial aquifers are likely associated with a process termed generalized differential compaction. Due to this process, fissures commonly develop along the perimeter of subsiding basins, often in apparent association with buried or protruding bedrock highs, suspected mountain-front faults, or distinct facies changes in the alluvial section.

Based on regional mapping (Laney et al, 1978; Schumann, 1974; Schumann and Genualdi, 1986; and Harris, 1994), no known earth fissures occur within the project area. However, earth fissures have been identified south of the project area. The closes earth fissure is located about 1 mile south-southwest of the southeastern extent of the project. Schumann and Genualdi (1986) map the southeastern portions of the study area as an earth fissure zone. The absence of earth fissures within the project area cannot be confirmed without a detailed study.

6.3 Synthetic Aperture Radar Interferometry

The future application of repeat-pass synthetic aperture radar (SAR) interferometry to characterize the distribution and rate of ground subsidence in the study area will be of profound significance in managing the risks associated with ground subsidence and earth fissuring. Interferometry has the capacity to detect and quantify minute changes in terrain elevation by comparing phase variances of satellite-based side-looking radar data between orbits of a similar trajectory.

Interferometry suffers from both atmospheric and terrain influences that affect the quality of the interferogram. The constraint of de-correlation due to rapid changes in the ground surface is a potential limitation in the usefulness of interferometry. This can be caused by plowing and crop changes in agricultural areas, or urban development. The currently available interferograms suffer from considerable de-correlation in the area of interest and are not useful. Future advances in the instrumentation and data processing as well as long-term stabilization of the terrain through urbanization will likely resolve these constraints as the technology evolves. SAR interferometry will likely provide the means for monitoring subsidence in the area interest in the future.

7.0 REFERENCES

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Schumann, H.H., 1974, Land Subsidence and Earth Fissures in Alluvial Deposits in the Phoenix Area, United States Geological Survey, Miscellaneous Investigations Series, MapI-845-H.

Schumann, H.H. and Genualdi, R.B., 1986, Land Subsidence, Earth Fissures and Water-Level Change in Southern Arizona, Arizona Bureau of Geology and Mineral Technology Map 23, Tucson, Arizona.

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APPENDIX A

FIELD INVESTIGATION

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Auger Boring Drilling through overburden soils is performed with 6 5/8-inch O.D., 3 1/4-inch I.D. hollow stem auger or 4 1/2-inch solid stem continuous flight auger. Carbide insert teeth are normally used on bits so they can penetrate soft rock or very strongly cemented soils. A CME-75 truck-mounted drill rig is used to advance the auger. The drill rigs are powered with six-cylinder Cummins diesel engines capable of delivering about 11.4 kN-m torque to the drill spindle. The spindle is advanced with twin hydraulic rams capable of exerting 90 kN (20,000 pounds) downward force.

Generally, refusal to penetration of the auger is adopted as top of the SGC or "river-run" material or harder bedrock, which require other techniques for penetration. Grab samples or auger cuttings may be taken as necessary. Standard penetration tests or 2.42-inch diameter ring samples are taken in conjunction with the auger borings as needed, with the sampling interval and type being indicated on the boring logs.

Hammer Drill Drilling with the Hammer drill is accomplished with a Drill Systems AP-1000 drill rig advancing a double-walled drive casing with a link-belt 180 diesel pile driving hammer, having a rated energy of 8,100 foot-pounds per blow. Where noted on the boring log, the hammer is equipped with a supercharger which can boost the energy to approximately 12,000 foot-pounds per blow. The supercharger is used only in portions of the boring where blow counts are relatively high. Cuttings are removed with compressed air by a reverse circulation process, and are collected in a cyclone from which grab samples are obtained. The drive casing is either 9-inch O.D. by 6-inch I.D. or 6 5/8-inch O.D. by 4-inch I.D. and employs an expendable bit of slightly larger diameter than the O.D. of the casing. Hammer blows required to advance the drive casing are recorded in 1-foot increments, as noted on the boring logs. Standard penetration tests or 2.42-inch diameter ring samples taken are noted on the boring logs.

Core Boring Rock core samples are retrieved using a CME-75 drill rig, SAITECH GH 3 rig or Burley 2500, 4500 or 4000. The GH 3 is a portable hydraulic core drill. The GH 3 is powered by a Kohler two-cylinder 25-horsepower engine. The hydraulics motor which feeds a two-speed transmission and powers the BW spindle. This unit has a 3-foot stroke and is hand-fed with a 2,000 pound push-pull capability. The GH 3 has the capability of drilling with either B- or N-size core steel using standard or wireline systems. N-size core is the preferred size and it has a nominal O.D. of about 2 inches. The Burley 2500 and 4500 series are portable hydraulic core drills. The 4500 series is capable of a track-mounted or skid-type chassis. The Burley 2500 and 4500 series are powered by 44 and 75 HP power units, respectively, provide up to 2,000 foot-pounds (ft.-lbs.) of torque and in excess of 1,000 revolutions per minute (RPM) of spindle speed. Both rigs are capable of retrieving either N- or H-sized core using wireline systems. The N-size core has a nominal O.D. of about 2 inches and the H-size of about 2.4 inches. The Burley 4000 is a track-mounted core drill.

The CME-75 utilizes a wireline core drilling system that takes N-size cores. Using the NQ wireline system, core is recovered quickly by retrieving the core-laden inner tube through the drill string.

TEST DRILLING EQUIPMENT & PROCEDURES (Cont.)

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In many cases, 2-inch O.D., 1 3/8-inch I.D. samples are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3-inch O.D. samples lined with 2.42-inch I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samples in 6-inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per 6 inches on the boring logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587), pitcher samplers, Denison samplers or continuous CME samplers. Where samples of rock are required, they are obtained by NQ diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Also, representative samples are obtained from the cuttings from the hammer and Schramm drill rig.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares the boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the boring logs.

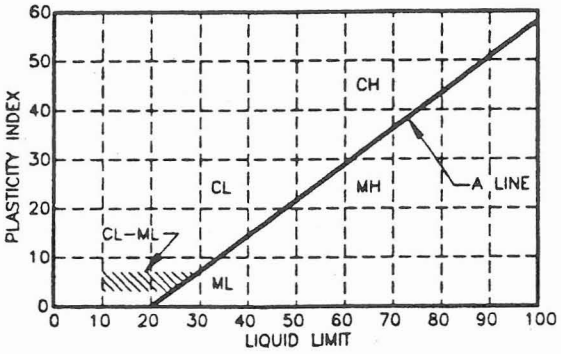
UNIFIED CLASSIFICATION SYSTEM FOR SOILS

Soils are visually classified by the Unified Soil Classification System on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" ASTM Designation: D2487.

MAJOR DIVISION				GRAPH SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures or sand-gravel-cobble mixtures.
					GP	poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS LIMITS PLOT BELOW "A" LINE & HATCH ZONE ON PLASTICITY CHART	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts of high plasticity, silty soils, elastic silts.
	CLAYS LIMITS PLOT ABOVE "A" LINE & HATCH ZONE ON PLASTICITY CHART	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, silty and sandy clays of high plasticity.

NOTE: Coarse-grained soils with between 5% & 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart to have dual symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 300mm (12in.)
Cobbles	300mm to 75mm (12in. to 3in.)
Gravel	75mm (3in.) to No. 4 sieve
Coarse gravel	75mm to 19mm (3in. to 3/4in.)
Fine gravel	19mm (3/4in.) to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

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TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

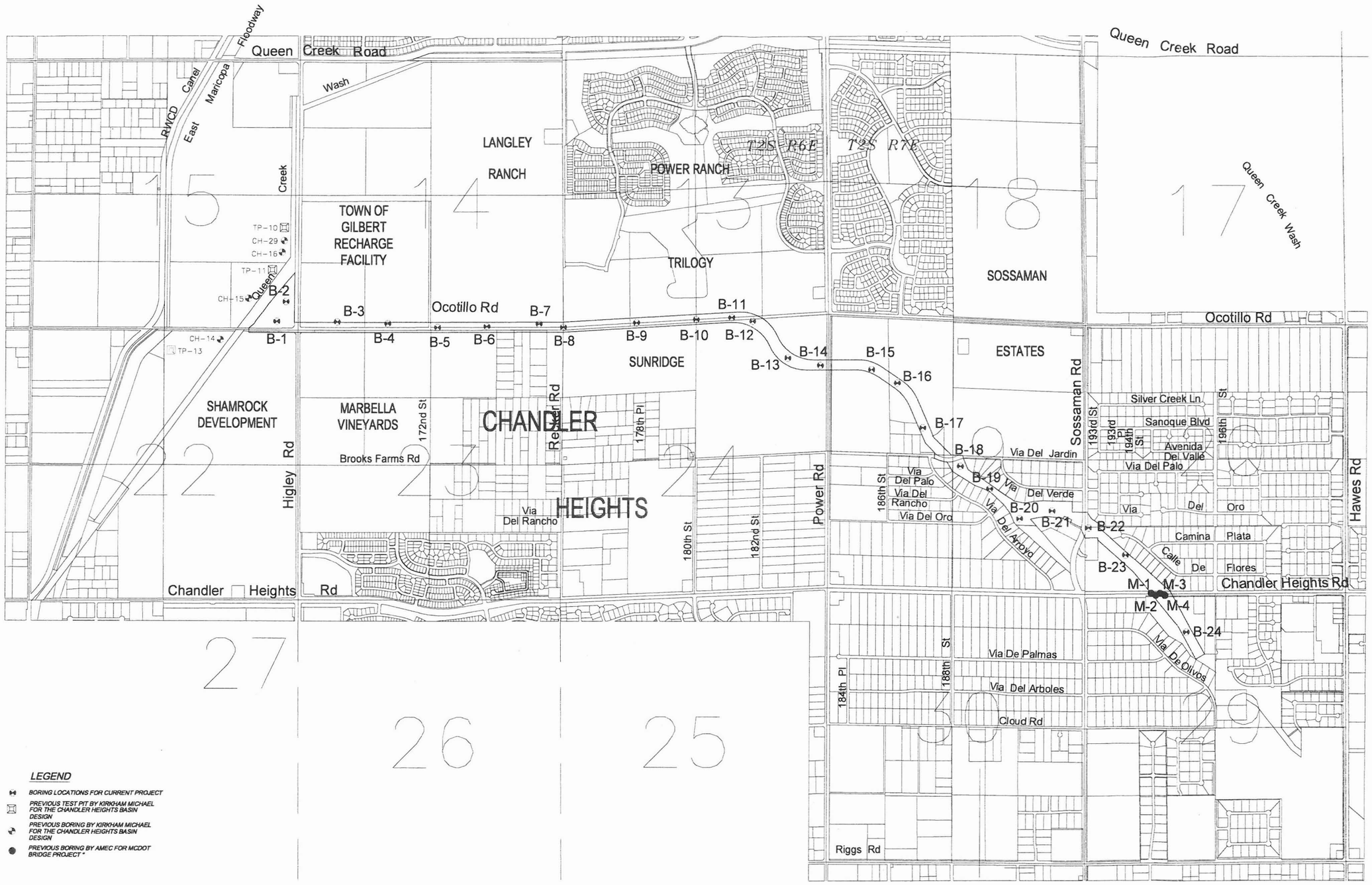
N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard



JOB NO.	3-117-001097
DESIGN:	DNF
DRAWN:	GWH
DATE:	7/2004
SCALE:	1" = 1000'

SITE PLAN
SHOWING BORING LOCATIONS

SONOQUI WASH CHANNELIZATION
GILBERT AND QUEEN CREEK, ARIZONA

FIGURE
1

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PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1317'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	6-7-7			CL	slightly moist	**SANDY CLAY,** predominantly fine grained sand, low plasticity, light brown
									moderately firm to very firm	
				S	3-5-7					
5				U	14	85	7			
10				S	5-5-7					
15				S	13-15-22					note: weakly lime cemented at 15'
								SP	slightly moist	**SAND,** occasional to rare silt, predominantly fine to medium grained, subangular to subrounded, nonplastic, light brown to brown
20				S	9-11-15				medium dense	
										Stopped Auger at 19'6" Stopped Sampler at 21'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-1

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1318'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	6-7-8			CL	slightly moist	**SANDY CLAY,** predominantly fine grained sand, low plasticity, light brown
									soft to very firm	
				S	4-6-9					
5				S	4-3-5					
10				S	10-18-18					note: increase in sand content at 10'
										note: weakly lime cemented at 11'
								SP-SM	slightly moist	**SAND WITH SILT,** predominantly fine to medium grained, subangular to subrounded, nonplastic, light brown
									firm to hard	
15				U	29	103	2			
20				S	21-39-36					note: fine grained gravel below 20', occasional clay at 20', reddish-brown
										Stopped Auger at 19'6" Stopped Sampler at 21'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-2

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1319'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	4-4-6		7	CL-ML	slightly moist moderately firm to very firm	**SANDY CLAY TO SANDY SILT,** predominantly fine grained sand, low plasticity, light brown to brown
5				U	9	93	5			
										note: increase in plasticity color is a whitish-brown, weakly lime cementation from 9' to 12'
10				S	10-16-17		9			
										note: increase in silt below 12'
15				S	10-10-12		6			
										Stopped Auger at 15' Stopped Sampler at 16'6"
20										
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-3

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1322'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	2-2-3			ML	slightly moist to moist soft	**SANDY SILT,** predominantly fine grained sand, low plasticity, light brown note: color is brown, nonplastic to low plasticity below 3'
5				S	3-3-4		6			
10				U	11	101	7			
								SM	slightly moist to moist moderately firm	**SILTY SAND,** predominantly fine grained, low plasticity, light brown
15				S	5-5-7					note: sand is grading coarser below 15'
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-4

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1325'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	5-6-7			CL	slightly moist moderately firm	**SILTY CLAY,** trace to some predominantly fine grained sand, medium plasticity, brown to light brown
5				U	12	104	4			
								CL	slightly moist to moist moderately firm	**SANDY CLAY,** predominantly fine grained sand, low plasticity, brown
10				S	6-6-7			ML	slightly moist to moist moderately firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown
15				S	16-21-20			SP	slightly moist to moist dense	**SAND,** trace of silt, predominantly fine grained, subangular to subrounded, nonplastic, brown to whitish-brown at depth note: gravel at depth
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-5

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1328'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	5-6-7			ML	slightly moist moderately firm	**SILT,** trace of fine grained sand, low plasticity, brown
								ML	slightly moist moderately firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown
5				S	5-6-7					
10				U	14	96	5			
								GP-GM	slightly moist dense to medium dense	**GRAVEL WITH SAND TO SILTY GRAVEL WITH SAND,** predominantly well graded sand, well graded, subrounded to subangular, nonplastic, light brown to whitish-brown
15				S	33-24-12					
20				S	18-14-11					note: grading into a silty sand to sandy silt below 21'
										Stopped Auger at 20' Stopped Sampler at 21'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-6

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1332'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	3-3-4			SC-SM	slightly moist soft	**SILTY SAND TO CLAYEY SAND,** predominantly fine grained, subrounded to subangular, low plasticity, brown to light brown
5				U	12	94	4			
								ML	slightly moist soft to moderately firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, light brown
10				S	3-3-4					
15				S	3-5-6					note: trace of coarse grained sand & fine grained gravel at 15'
								SP	slightly moist dense	**SAND & GRAVEL,** trace of silt, predominantly fine to medium grained sand, predominantly fine grained gravel, subangular to subrounded, nonplastic, light brown to whitish-brown
20				S	12-19-18					
										Stopped Auger at 20' Stopped Sampler at 21'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-7

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1335'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	6-9-7		5	ML	slightly moist firm	**SILT,** trace to some predominantly fine grained sand, nonplastic, light brown to brown
								ML	slightly moist moderately firm	**SANDY SILT,** predominantly fine to medium grained sand, low plasticity, light brown to brown
5				S	4-4-5		3			note: increase in sand at 7'
								CL	slightly moist to moist firm to very firm	**SANDY CLAY,** predominantly fine grained sand, low plasticity, brown
10				U	13	95	17			note: occasional predominantly fine grained sand layers from 8'6" to 10'6"
15				S	8-13-25		8			note: trace of fine grained gravel at 14'
										Stopped Auger at 15' Stopped Sampler at 16'6"
20										
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-8

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1336'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-3-2			ML	slightly moist to moist	**SANDY SILT,** nonplastic to low plasticity, brown
								SP	soft	
									slightly moist to moist	**SAND,** predominantly fine to medium grained, subangular to subrounded, uncemented, nonplastic, brown
5				U	11	97	4		firm	
10				S	6-7-10					note: trace of coarse grained sand & fine grained gravel below 10'; subangular to subrounded
										note: possible cobbles at 11'
										note: grading to a predominantly medium grained sand below 15' with coarse grained sand & fine grained gravel
15				S	13-20-20					note: trace of silt at 15'
										Stopped Auger at 15' Stopped Sampler at 16'6"
20										
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-9

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1345'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	2-2-2			ML	slightly moist to moist very soft	**CLAYEY SILT,** trace of predominantly fine grained sand, low plasticity, brown to dark brown note: possible organic material
5				S	1-1-1			ML	slightly moist to moist very soft	**SANDY SILT,** predominantly fine grained, subangular to subrounded sand, low plasticity to nonplastic, brown
10				U	5	105	18			
15				S	3-5-9			SM/ML	moist moderately firm	**SILTY SAND TO SANDY SILT,** trace of subangular to subrounded, fine grained gravel, predominantly fine grained sand, low plasticity, brown
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-10

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1334'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	5-5-4		8	CL	slightly moist	**CLAY WITH SAND,** predominantly fine grained sand, low plasticity, light brown
				A					moderately firm to firm	
5				U	10					
										note: grading to clayey sand to sandy clay at depth
10				S	10-13-17					
										note: some gravel at 13'
15				S	23-16-13					
										Stopped Auger at 15' Stopped Sampler at 16'6"
20										
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-11

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1347'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-3-2		8	ML	slightly moist to very moist soft to very soft	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown note: disturbed soil upper portion to 1'
5				S	0-0-1		30			
10				U	8	99	18			
								SM	slightly moist to moist firm	**SILTY SAND,** predominantly fine grained, subangular to subrounded, low plasticity, light brown
15				S	12-13-15		23			
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-12

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1349'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-3-3			CL-ML	slightly moist soft	**SANDY CLAY TO SANDY SILT,** predominantly fine grained sand, low plasticity, brown
				S	3-3-5					
								CL	slightly moist to moist very soft	**CLAY WITH SAND,** predominantly fine grained sand, medium plasticity, brown to reddish-brown
5				S	1-1-2					
								SM	moist soft to moderately firm with hard zones	**SILTY SAND,** predominantly fine grained, subangular to subrounded, nonplastic, brown to reddish-brown
10				U	10	101	20			
15				S	27-50/4"					note: weakly lime cemented at 15'
20				S	6-7-8					note: increase in plasticity at 20'
								SP-SM	slightly moist to moist, very firm	**SAND WITH SILT**
25				S	16-21-19					

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-1

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1349'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X					SP-SM		**SAND WITH SILT,** trace to some fine grained gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic, light brown
										Stopped Auger at 24'6" Stopped Sampler at 26'
30										
35										
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-13

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1351'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-4-5			CL-ML	slightly moist to moist	**SANDY CLAY TO SANDY SILT,** predominantly fine grained sand, low plasticity, light brown to brown
				A					soft	
				S	3-2-4					
				U	5	88	23			
5								CL	moist	**CLAY WITH SAND,** predominantly fine grained sand, medium plasticity, reddish-brown to brown
									very soft to moderately firm	
10				S	4-6-5					
								SM	moist	**SILTY SAND,** predominantly fine grained, subangular to subrounded, nonplastic, reddish-brown to brown
15				S	11-50/5"				hard	note: weakly lime cemented, color is light brown at 15'
								SP-SM	slightly moist	**SAND WITH SILT,** trace of fine grained, subrounded to subangular gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic, brown to reddish-brown
20				S	4-6-8				moderately firm	
										Stopped Auger at 19'6" Stopped Sampler at 21'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-14

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1353'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	3-1-2			SM	slightly moist very soft to soft	**SILTY SAND,** predominantly fine grained, nonplastic to low plasticity, brown
5				S	4-5-4		6			
								SW	slightly moist loose	**SAND,** well graded, subangular to subrounded, nonplastic, light brown to brown
								SM	slightly moist to moist firm to very firm	**SILTY SAND,** trace of fine grained, subrounded to subangular gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
10				S	2-5-12					
										note: whitish-light brown below 13'
15				S	16-16-15					
										note: brown below 17'
20				U	24					
25				S	4-4-5					

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-15

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1353'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X					SM		**SILTY SAND,** continued
										Stopped Auger at 24'6" Stopped Sampler at 26'
30										
35										
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-15

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1356'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-5-5			ML	slightly moist moderately firm	**SANDY SILT,** predominantly fine grained sand, low to medium plasticity, light brown
				S A	6-24-31		7	CL	slightly moist hard to very firm	**SANDY CLAY,** predominantly fine grained sand, low plasticity, light brown to whitish-brown note: weakly lime cemented nodules at 5'6" note: increase in sand at 6'
5										
				S	13-22-17					
10										
				U	21	101	9	SM	slightly moist moderately firm	**SILTY SAND,** predominantly fine grained, subrounded to subangular, nonplastic, brown
15										
				S	10-10-7			ML	slightly moist firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, light brown
20										
				S	8-10-15			SP	slightly moist medium dense	**SAND,** trace of silt, trace of fine grained gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic, light brown
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-16

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1356'
DATUM Stanley Consultants, Inc. Survey Data

Depth In Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X					SP		**SAND,** continued
										Stopped Auger at 24'6" Stopped Sampler at 26'
30										
35										
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-16

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1357'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	5-5-5			ML	slightly moist to moist moderately firm to soft	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown
5				S	4-4-4		5			note: increase in silt content below 5'6"
10				S	2-2-4					
								SM	slightly moist to moist	**SILTY SAND,** predominantly fine grained, subrounded to subangular, low plasticity, brown to light brown
15				U	100/10"	104	3		firm to hard	
20				S	8-11-15					note: increase in silt below 22'
25				S	10-11-15					

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-17

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1357'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X					SM		**SILTY SAND,** continued
										Stopped Auger at 24'6" Stopped Sampler at 26'
30										
35										
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-17

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1353'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	2-3-4			SM	slightly moist soft	**SILTY SAND,** predominantly fine grained, subangular to subrounded, nonplastic, light brown to brown
								ML	slightly moist hard	**SANDY SILT,** predominantly fine grained sand, nonplastic to low plasticity, light brown to whitish brown
5				U	71	104	5			
10				S	19-30-21		9			
										note: increase in sand content below 14'
15				S	10-15-24					
								SP	slightly moist medium dense	**SAND,** trace of silt, predominantly fine to medium grained, subangular to subrounded, nonplastic, whitish-brown
								SM/ML	slightly moist firm	**SILTY SAND TO SANDY SILT,** predominantly fine grained sand, low plasticity, brown to light brown
20				S	10-10-10					
										Stopped Auger at 20' Stopped Sampler at 21'6"
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-18

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1357'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	6-6-6			ML	slightly moist moderately firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown to light brown
								SM	slightly moist firm	**SILTY SAND,** predominantly fine grained, low plasticity, light brown
5				S	6-12-10		6			
10				U	58	104	7			
15				S	12-9-7					
								SW	slightly moist medium dense	**SAND,** trace of silt, well graded, predominantly fine grained, subangular to subrounded, nonplastic, light brown note: gravel at 17'
20				S	14-19-11			GP-GM	slightly moist medium dense	**GRAVEL WITH SAND TO SILTY GRAVEL WITH SAND,** well graded sand, predominantly fine grained gravel, nonplastic, light brown to whitish-brown
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-19

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/18/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1357'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				S	34-36-31			GP-GM		**GRAVEL WITH SAND TO SILTY GRAVEL WITH SAND,** continued
										Stopped Auger at 25' Stopped Sampler at 26'6"
30										
35										
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-19

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1360'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	2-2-2			ML	slightly moist very soft	**SANDY SILT,** predominantly fine grained sand, low plasticity, brown note: decrease in sand content & light brown at 2'6"
5				S	4-5-4					note: increase in sand content at 5.5'
								SM/ML	slightly moist moderately firm	**SILTY SAND TO SANDY SILT,** predominantly fine grained, nonplastic, light brown
10				U	13	94	13			
15				S	5-7-6					note: silty lense grade back to silty sand below 15'
								SP	slightly moist dense	**SAND,** trace of silt, some fine grained gravel, predominantly medium to coarse grained, subangular to subrounded, nonplastic, light whitish-brown to gray
20				S	10-16-31					
										Stopped Auger at 19'6" Stopped Sampler at 21'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-20

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1361'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	1-1-3			SM	slightly moist very soft	**SILTY SAND,** predominantly fine grained, nonplastic, light brown to brown
								ML	slightly moist moderately firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, light brown
5				S	5-5-9		7			
10				U	13					
								GP	slightly moist to moist medium dense	**GRAVEL WITH SAND,** trace of silt, trace of predominantly medium to fine grained sand, predominantly fine grained, subangular to subrounded, nonplastic, dark brown to whitish brown
15				S	15-16-13		2			note: coarse grained gravel at 16'
								SM	slightly moist hard	**SILTY SAND,** predominantly fine grained, nonplastic, whitish-to grayish-brown
20				S	14-17-41					
										Stopped Auger at 19'6" Stopped Sampler at 21'
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-21

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 6/17/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1364'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	4-6-9			SM	slightly moist to moist	**SILTY SAND,** predominantly fine grained, subangular to subrounded, nonplastic, light brown
				S	13-15-13				moderately firm to firm	note: increase in sand content from 3' to 4'
5				S	5-6-6					
								ML	slightly moist to moist	**SANDY SILT,** predominantly fine grained sand, weakly lime cemented, nonplastic, light brown
10				U	16	84	6		moderately firm	
								SP-SM	slightly moist	**SAND WITH SILT,** predominantly fine to medium grained, subangular to subrounded, nonplastic, light brown
15				S	4-5-5				moderately firm	
										Stopped Auger at 14'6" Stopped Sampler at 16'
20										
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-22

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1365'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	6-7-5			CL	slightly moist moderately firm to soft	**SANDY CLAY,** predominantly fine grained sand, low plasticity, brown
5				S	3-2-3					note: increase in sand below 5'
10				S	4-5-6		5	SM/ML	slightly moist moderately firm	**SILTY SAND TO SANDY SILT,** predominantly fine grained, nonplastic, light brown note: alternating layers of silty sand & sandy silt throughout
15				S	9-43-50/ 4 1/2"			ML	slightly moist firm to hard	**SANDY SILT,** predominantly fine grained sand, low to medium plasticity, light brown
20				U	27	102	6			
25				S	18-18-19			SP	slightly moist dense	**SAND,** trace of silt, some fine grained gravel, predominantly medium to fine grained, subangular to subrounded, nonplastic, whitish-brown

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-23

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1365'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25								SP		**SAND,** continued
								SC	moist firm	**CLAYEY SAND,** predominantly fine grained, subrounded to subangular, medium to high plasticity, brown
30				S	13-14-13					
								CL	moist very firm	**SANDY CLAY,** predominantly fine to medium grained sand, low plasticity, light brown to brown note: increase in sand (fine to medium grained) at depth
35				S	17-22-28					
										Stopped Auger at 34'6" Stopped Sampler at 36'
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-23

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1368'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	1-2-2			SM	slightly moist very soft to moderately firm	**SANDY SILT,** predominantly fine grained sand, low to medium plasticity, light brown
5				S	4-6-8					
								CL	slightly moist moderately firm	**SANDY CLAY,** predominantly fine grained sand, low plasticity, light brown
10				S	10-5-7					note: increase in sand content at 11'
								SM	slightly moist moderately firm to firm	**SILTY SAND,** predominantly fine grained, subangular to subrounded, nonplastic, light brown
15				S	6-5-8		2			
				A						
20				U	26 NR					note: increasing grain size at depth
								SP	slightly moist medium dense to dense	**SAND,** some fine grained gravel, trace of silt, predominantly fine to medium grained, subangular to subrounded, nonplastc, light brown
25				U	45	117	1			

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-24

PROJECT Sonoqui Wash Channelization

JOB NO. 3-117-001097 **DATE** 3/19/04

LOCATION See Site Plan

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. ~1368'
DATUM Stanley Consultants, Inc. Survey Data

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				~				SP		**SAND,** continued
								ML	slightly moist very firm	**SANDY SILT,** predominantly fine grained sand, low plasticity, whitish-brown
30				S	10-16-15					
										note: increase in plasticity at 34'
35				S	15-20-25					
										Stopped Auger at 34'6" Stopped Sampler at 36'
40										
45										
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - 3" O.D. CME tube sample
NR - No Recovery

LOG OF TEST BORING NO. B-24

APPENDIX B

LABORATORY TEST RESULTS

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	3/23/04

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or	SAND								GRAVEL									COBBLES	
				Clay	Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	**USCS**	**LL**	**PI**	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**	**#8**	**#4**	**1/4"**	**3/8"**	**1/2"**	**3/4"**	**1"**	**1 1/4"**	**1 1/2"**	**2"**	**3"**	**6"**	**Lab #**

PERCENT PASSING BY WEIGHT

B-3 @ 0' TO 5'	CL-ML	23	6	69	92	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2
B-4 @ 9'6" TO 10'6"	ML	19	2	61	78	91	95	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	8
B-5 @ 0' TO 1'6"	CL	42	20	86	94	97	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	10
B-6 @ 15' TO 16'6"	GP-GM	NV	NP	11	14	18	21	24	31	37	40	50	54	61	67	75	93	100	100	100	100	100	18
B-7 @ 4'6" TO 5'6"	SC-SM	24	6	47	70	91	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	21
B-8 @ 9'6" TO 10'6"	CL	34	14	90	94	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	27
B-8 @ 0' TO 5'	ML	NV	NP	62	79	90	94	96	98	99	99	99	100	100	100	100	100	100	100	100	100	100	29
B-9 @ 4'6" TO 5'6"	SP	NV	NP	3.4	7	25	43	59	81	88	89	93	94	96	98	100	100	100	100	100	100	100	31
B-10 @ 10' TO 11'6"	ML	20	1	72	84	94	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	36
B-11 @ 0' TO 5'	CL	32	13	81	92	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	42

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AASHTO R18

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amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	3/23/04

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or	SAND								GRAVEL									COBBLES	
				Clay	Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	**USCS**	**LL**	**PI**	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**	**#8**	**#4**	**1/4"**	**3/8"**	**1/2"**	**3/4"**	**1"**	**1 1/4"**	**1 1/2"**	**2"**	**3"**	**6"**	**Lab #**

PERCENT PASSING BY WEIGHT

B-18 @ 0' TO 5'	SM	NV	NP	34	56	79	88	92	97	99	99	100	100	100	100	100	100	100	100	100	100	100	48
B-19 @ 20' TO 21'6"	GP-GM	NV	NP	10	13	20	23	26	31	37	39	50	56	70	77	82	93	100	100	100	100	100	53
B-12 @ 9'6" TO 10'6"	ML	21	2	69	77	92	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	57
B-15 @ 14'6" TO 16'	SM	NV	NP	42	52	63	68	72	77	83	85	92	94	96	99	100	100	100	100	100	100	100	62
B-16 @ 4'6" TO 6'	CL	26	8	59	74	88	93	96	98	99	99	100	100	100	100	100	100	100	100	100	100	100	66
B-17 @ 4'6" TO 6'	ML	20	1	51	75	92	96	98	99	99	99	100	100	100	100	100	100	100	100	100	100	100	73
B-20 @ 9'6" TO 10'6"	ML	NV	NP	51	68	84	89	92	96	98	99	100	100	100	100	100	100	100	100	100	100	100	80
B-21 @ 14'6" TO 16'	GP	NV	NP	4.9	7	10	13	16	23	29	31	41	46	57	73	84	84	100	100	100	100	100	86
B-23 @ 0' TO 1'6"	CL	32	11	71	87	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	89
B-24 @ 9'6" TO 11'	CL	35	12	80	90	96	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

AASHTO R18

REVIEWED BY

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	2
SAMPLE SOURCE:	SEE BELOW	**DATE ASSIGNED:**	6/18/04

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or	SAND								GRAVEL									COBBLES	
				Clay	Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	**USCS**	**LL**	**PI**	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**	**#8**	**#4**	**1/4"**	**3/8"**	**1/2"**	**3/4"**	**1"**	**1 1/4"**	**1 1/2"**	**2"**	**3"**	**6"**	**Lab #**

PERCENT PASSING BY WEIGHT

B-2 @ 0.0-5.0'	CL	30	8	77	93	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	113
B-14 @ 0.0-5.0'	CL-ML	27	6	64	87	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	127
B-22 @ 0.0-5.0'	SM	NV	NP	35	56	87	95	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	134

AASHTO R18

REVIEWED BY

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PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
MATERIAL:	SOIL	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	3/23/04

MOISTURE CONTENT OF SOIL (ASTM D2216)

LAB #	BORING	DEPTH	WET WT. (gram)	DRY WT. (gram)	MOISTURE CONTENT
1	B-3	0' TO 1'6"	332.8	310.3	7.3%
2	B-3	4'6" TO 5'6"	360.1	341.8	5.3%
3	B-3	10' TO 11'6"	361.7	333.5	8.5%
4	B-3	15' TO 16'6"	480.5	454.7	5.7%
7	B-4	5' TO 6'6"	505.6	475.1	6.4%
11	B-5	4'6" TO 5'6"	782.2	756.0	3.5%
25	B-8	0' TO 1'6"	532.2	505.1	5.4%
26	B-8	5' TO 6'6"	533.6	519.4	2.7%
27	B-8	9'6" TO 10'6"	450.5	385.2	16.9%
28	B-8	15' TO 16'6"	673.7	625.7	7.7%
42	B-11	0' TO 5'	582.6	540.8	7.7%
45	B-18	10' TO 11'6"	623.9	573.7	8.8%
50	B-19	5' TO 6'6"	563.6	530.6	6.2%
55	B-12	0' TO 1'6"	1044.0	970.9	7.5%
56	B-12	4'6" TO 6'	492.1	378.1	30.2%
57	B-12	9'6" TO 10'6"	389.9	331.9	17.5%
58	B-12	14'6" TO 16'	549.4	447.4	22.8%
60	B-15	4'6" TO 6'	706.1	665.8	6.1%
66	B-16	4'6" TO 6'	311.9	291.4	7.0%
73	B-17	4'6" TO 6'	304.9	291.3	4.7%
84	B-21	4'6" TO 6'	610.8	571.7	6.8%
86	B-21	14'6" TO 16'	223.5	219.3	1.9%
91	B-23	9'6" TO 11'	504.3	481.3	4.8%
101	B-24	14'6" TO 16'	556.5	543.9	2.3%

AAR AASHTO R18

REVIEWED BY CMG

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	2
MATERIAL:	SOIL	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	6/18/04

MOISTURE CONTENT OF SOIL (ASTM D2216)

LAB #	BORING	DEPTH	WET WT. (gram)	DRY WT. (gram)	MOISTURE CONTENT
109	B-1	4.5-5.5'	665.4	622.8	6.8%
118	B-2	14.5-15.5'	758.4	744.7	1.8%
123	B-13	9.5-10.5'	869.2	727.1	19.5%
130	B-14	4.5-5.5'	792.8	645.3	22.9%
138	B-22	9.5-10.5'	645.9	610.9	5.7%

AASHTO R18

REVIEWED BY Cy

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
MATERIAL:	SOIL	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BORING	**DATE SAMPLED:**	3/23/04

DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD(ASTM D2937)

LAB #	BORING	MOISTURE WET WT. (g)	MOISTURE DRY WT. (g)	MOISTURE MOISTURE CONTENT	NUMBER OF RINGS	WET WGT. + RINGS (g)	WEIGHT OF RINGS (g)	DRY DENSITY (pcf)
2	B-3 @ 4'6" TO 5'6"	360.1	341.8	5.3%	6.0	986.6	277.5	92.9
8	B-4 @ 9'6" TO 10'6"	409.1	381.5	7.2%	6.0	1,052.2	271.0	100.5
11	B-5 @ 4'6" TO 5'6"	782.2	756.0	3.5%	6.0	1,046.5	269.2	103.7
17	B-6 @ 9'6" TO 10'6"	728.1	693.7	5.0%	6.0	997.7	269.4	95.8
21	B-7 @ 4'6" TO 5'6"	343.5	330.9	3.8%	6.0	974.5	270.0	93.7
27	B-8 @ 9'6" TO 10'6"	450.5	385.2	16.9%	6.0	1,078.1	273.9	94.9
31	B-9 @ 4'6" TO 5'6"	400.2	385.8	3.7%	5.0	837.6	227.3	97.4
36	B-10 @ 9'6" TO 10'6"	491.0	416.6	17.9%	6.0	1,152.0	257.0	104.8
44	B-18 @ 4'6" TO 5'6"	799.9	759.7	5.3%	5.0	884.1	223.6	103.9
51	B-19 @ 9'6" TO 10'6"	670.0	627.2	6.8%	5.0	896.0	225.6	103.9
57	B-12 @ 9'6" TO 10'6"	389.9	331.9	17.5%	6.0	1,117.3	274.7	99.0
68	B-16 @ 14'6" TO 15'6"	799.1	732.6	9.1%	6.0	1,070.8	271.0	101.2
75	B-17 @ 14'6" TO 15'6"	388.0	375.6	3.3%	3.0	524.0	135.9	103.7
80	B-20 @ 9'6" TO 10'6"	394.1	349.0	12.9%	6.0	1,044.4	271.8	94.4
93	B-23 @ 19'6" TO 20'6"	779.1	737.6	5.6%	6.0	1,052.3	272.6	101.9
103	B-24 @ 24'6" TO 25'6"	856.9	848.0	1.0%	6.0	1,123.1	266.2	117.0

REVIEWED BY

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	2
MATERIAL:	SOIL	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BORING	**DATE SAMPLED:**	6/18/04

DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD(ASTM D2937)

LAB #	BORING	MOISTURE WET WT. (g)	MOISTURE DRY WT. (g)	MOISTURE MOISTURE CONTENT	NUMBER OF RINGS	WET WGT. + RINGS (g)	WEIGHT OF RINGS (g)	DRY DENSITY (pcf)
109	B-1 @ 4.5-5.5'	665.4	622.8	6.8%	6.0	929.3	275.3	84.5
118	B-2 @ 14.5-15.5'	758.4	744.7	1.8%	4.0	691.3	184.7	103.0
123	B-13 @ 9.5-10.5'	869.2	727.1	19.5%	5.0	951.3	222.6	100.9
130	B-14 @ 4.5-5.5'	792.8	645.3	22.9%	6.0	1,058.4	270.9	88.4
138	B-22 @ 9.5-10.5'	645.9	610.9	5.7%	5.0	760.6	223.2	84.2

REVIEWED BY

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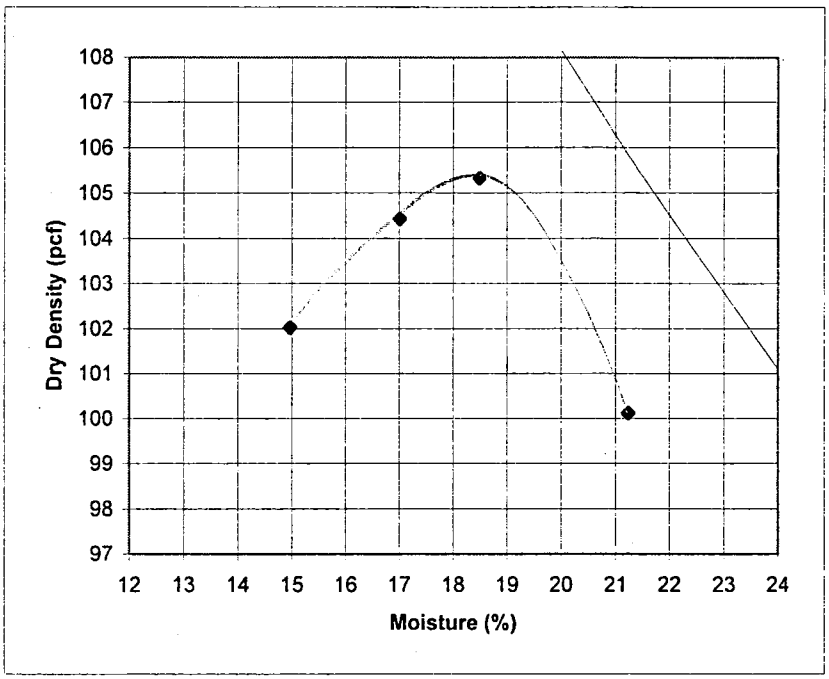
PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
MATERIAL:	SOIL	**LAB NO:**	42
SAMPLE SOURCE:	B-11 @ 0' TO 5'	**SAMPLE DATE:**	3/23/04

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)
SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MAXIMUM DRY DENSITY (pcf):	105.3
OPTIMUM MOISTURE (%):	18.5



SIEVE SIZE	PERCENT PASSING
6"	100
4"	100
3"	100
2"	100
1 1/2"	100
1 1/4"	100
1"	100
3/4"	100
1/2"	100
3/8"	100
1/4"	100
#4	100
#8	100
#10	100
#16	100
#30	99
#40	99
#50	97
#100	92
#200	81

ATTERBERG LIMITS

LL:	32
PL:	19
PI:	13
USCS:	CL

NOTE: THE ZERO AIR VOIDS CURVE REPRESENTS A SPECIFIC GRAVITY OF: 2.651 ASSUMED.

THIS IS A SUMMARIZED REPORT OF THE REFERENCED PROCEDURES AND DOES NOT INCLUDE ALL REPORTING REQUIREMENTS. ADDITIONAL DATA CAN BE PROVIDED AT CLIENT'S REQUEST.

REVIEWED BY _____

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	1
MATERIAL:	SEE BELOW	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	03/23/04

pH & RESISTIVITY (AZ 236)

LAB NO	SAMPLE SOURCE	MATERIAL	RESISTIVITY (Ohm-cm)	pH
29	B-8 @ 0' TO 5'	SOIL	2,925	8.2

REVIEWED BY

amec

PROJECT:	SONOQUI WASH CHANNELIZATION	**JOB NO:**	3-117-001097
LOCATION:	HIGLEY AND OCOTILLO ROAD	**WORK ORDER NO:**	2
MATERIAL:	SEE BELOW	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	06/18/04

pH & RESISTIVITY (AZ 236)

LAB NO	SAMPLE SOURCE	MATERIAL	RESISTIVITY (Ohm-cm)	pH
113	B-2 @ 0.0-5.0'	SOIL	5,321	8.1
127	B-14 @ 0.0-5.0'	SOIL	6,241	8.2
134	B-22 @ 0.0-5.0'	SOIL	5,436	8.3

REVIEWED BY

MOTZZ LABORATORY, INC.

Certificate of Analysis

AMEC
Mr. Cliff Metz
3232 W Virginia Ave
Phoenix AZ 85009-1502

Project: 3-00117-1097
Entered By: Vicki Normandin
Date Reported: 4/12/2004
Date Received: 4/5/2004
Date Complete:

Test	Method	Result	Units	Date	Initials
4030-001	**B 8 @0-5'**				
Sulfate-S (ARIZ 733)					
Sulfate-S, SO4-S	ARIZ 733	14	PPM	4/12/2004	

Approved By: _____

MOTZZ LABORATORY, INC.
2109 S. 48th Street, Suite 101
Tempe, AZ 85282

Soil Analysis Report

AMEC
Mr. Cliff Metz
1405 West Auto Drive
Tempe , AZ 85284-1016

Project: 3-117-001097
Sampler:
Date Received: 6/23/2004
Date Reported: 6/24/2004
PO Number: 3110-1679

Lab Number: 4225-01 **113 B2 @ 0.0-5.0'**

Sulfate-S (ARIZ 733)	Method	Result	Units
Sulfate-S, SO4-S	ARIZ 733	19	ppm

Lab Number: 4225-02 **127 B14 @ 0.0-5.0'**

Sulfate-S (ARIZ 733)	Method	Result	Units
Sulfate-S, SO4-S	ARIZ 733	29	ppm

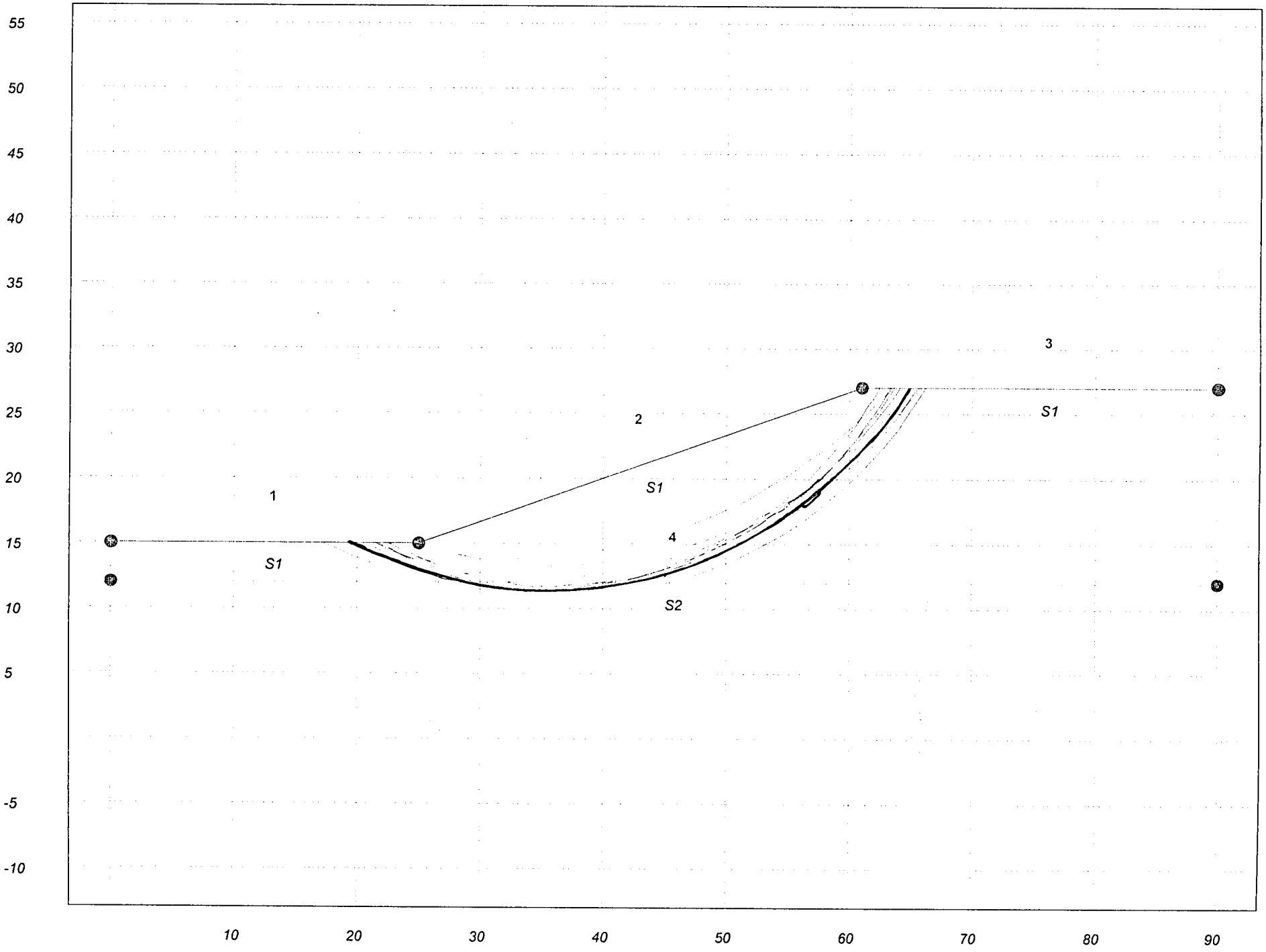
Lab Number: 4225-03 **134 B22 @ 0.0-5.0'**

Sulfate-S (ARIZ 733)	Method	Result	Units
Sulfate-S, SO4-S	ARIZ 733	15	ppm

APPENDIX C

SLOPE STABILITY RESULTS

Sonoqui Wash Case I - End of Construction Upstream - FS Min = 3.266



result.out
** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION Sonoqui Wash Case I - End of Constructio
n Upstream

BOUNDARY COORDINATES

3 Top Boundaries
4 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	15.00	25.00	15.00	1
2	25.00	15.00	61.00	27.00	1
3	61.00	27.00	90.00	27.00	1
4	0.00	12.00	90.00	12.00	2

1

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	110.0	100.0	34.0	0.00	0.0	0
2	110.0	115.0	0.0	36.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 10.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 61.00 ft.
and X = 70.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 5.00 ft.

1.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 53 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	19.47	15.00
2	20.38	14.57
3	21.29	14.17
4	22.22	13.80
5	23.16	13.45
6	24.10	13.12
7	25.06	12.83
8	26.02	12.56
9	26.99	12.31
10	27.97	12.09
11	28.95	11.91
12	29.94	11.74
13	30.93	11.61
14	31.92	11.50
15	32.92	11.42
16	33.92	11.37
17	34.92	11.35
18	35.92	11.35
19	36.92	11.38
20	37.91	11.44
21	38.91	11.53
22	39.90	11.64
23	40.89	11.79
24	41.88	11.96
25	42.86	12.15
26	43.83	12.38
27	44.80	12.63

28	45.76	12.91
29	46.72	13.21
30	47.66	13.54
31	48.59	13.90
32	49.52	14.28
33	50.43	14.69
34	51.33	15.12
35	52.22	15.58
36	53.09	16.07
37	53.96	16.57
38	54.80	17.10
39	55.64	17.66
40	56.45	18.24
41	57.25	18.83
42	58.04	19.46
43	58.80	20.10
44	59.55	20.76
45	60.28	21.45
46	60.99	22.15
47	61.68	22.88
48	62.35	23.62
49	63.00	24.38
50	63.62	25.16
51	64.23	25.96
52	64.81	26.77
53	64.97	27.00

Circle Center At X = 35.3 ; Y = 47.3 and Radius, 36.0

*** 3.266 ***

Individual data on the 56 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.9	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.9	57.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.9	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.9	129.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.9	162.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.9	180.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.1	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.0	239.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1.0	297.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1.0	353.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.5	197.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.5	210.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	1.0	461.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1.0	512.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1.0	559.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1.0	604.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1.0	646.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1.0	684.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	1.0	718.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	1.0	749.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	1.0	777.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

22	1.0	800.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1.0	820.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	1.0	836.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1.0	848.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.2	191.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.8	664.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	1.0	862.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	1.0	865.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1.0	863.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	1.0	859.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.9	851.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.9	839.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.9	824.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.9	806.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.9	785.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	0.9	761.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.9	735.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.9	705.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.8	674.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.8	640.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.8	604.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.8	566.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.8	527.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.8	487.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.7	445.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	0.7	403.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.7	360.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.7	303.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	0.7	251.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.6	194.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.6	139.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.6	87.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.6	37.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	20.53	15.00
2	21.43	14.58
3	22.35	14.18
4	23.28	13.81
5	24.22	13.47
6	25.17	13.16
7	26.13	12.88
8	27.10	12.62
9	28.07	12.40
10	29.05	12.20
11	30.04	12.03
12	31.03	11.89
13	32.02	11.78
14	33.02	11.70
15	34.02	11.65
16	35.02	11.63
17	36.02	11.63
18	37.02	11.67
19	38.01	11.74
20	39.01	11.84
21	40.00	11.96

22	40.99	12.12
23	41.97	12.30
24	42.95	12.52
25	43.92	12.76
26	44.88	13.03
27	45.84	13.33
28	46.78	13.66
29	47.71	14.01
30	48.64	14.39
31	49.55	14.80
32	50.45	15.24
33	51.34	15.70
34	52.21	16.19
35	53.07	16.71
36	53.91	17.25
37	54.73	17.81
38	55.54	18.40
39	56.33	19.02
40	57.10	19.65
41	57.86	20.31
42	58.59	20.99
43	59.30	21.69
44	59.99	22.41
45	60.66	23.16
46	61.31	23.92
47	61.93	24.70
48	62.54	25.50
49	63.11	26.32
50	63.57	27.00

Circle Center At X = 35.2 ; Y = 45.4 and Radius, 33.8

*** 3.266 ***

1

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.74	15.00
2	25.70	14.72
3	26.67	14.47
4	27.64	14.24
5	28.62	14.04
6	29.60	13.86
7	30.59	13.70
8	31.58	13.58
9	32.58	13.47
10	33.57	13.40
11	34.57	13.34
12	35.57	13.32
13	36.57	13.32
14	37.57	13.34
15	38.57	13.39
16	39.57	13.47
17	40.56	13.57
18	41.55	13.70

19	42.54	13.85
20	43.53	14.03
21	44.51	14.23
22	45.48	14.46
23	46.45	14.71
24	47.41	14.99
25	48.36	15.29
26	49.31	15.62
27	50.24	15.97
28	51.17	16.34
29	52.09	16.74
30	52.99	17.16
31	53.89	17.60
32	54.78	18.07
33	55.65	18.56
34	56.51	19.07
35	57.35	19.60
36	58.18	20.16
37	59.00	20.74
38	59.80	21.33
39	60.59	21.95
40	61.36	22.59
41	62.12	23.24
42	62.85	23.92
43	63.57	24.61
44	64.28	25.32
45	64.96	26.05
46	65.62	26.80
47	65.79	27.00

Circle Center At X = 36.1 ; Y = 52.4 and Radius, 39.1

*** 3.278 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	15.00
2	23.61	14.78
3	24.59	14.59
4	25.57	14.42
5	26.56	14.27
6	27.56	14.14
7	28.55	14.04
8	29.55	13.96
9	30.55	13.90
10	31.54	13.87
11	32.54	13.86
12	33.54	13.88
13	34.54	13.91
14	35.54	13.97
15	36.54	14.06
16	37.53	14.16
17	38.52	14.29
18	39.51	14.45
19	40.50	14.62

20	41.48	14.82
21	42.45	15.04
22	43.42	15.29
23	44.38	15.56
24	45.34	15.85
25	46.29	16.16
26	47.23	16.49
27	48.17	16.85
28	49.10	17.22
29	50.01	17.62
30	50.92	18.04
31	51.82	18.48
32	52.70	18.95
33	53.58	19.43
34	54.44	19.93
35	55.30	20.46
36	56.14	21.00
37	56.96	21.56
38	57.78	22.14
39	58.58	22.74
40	59.36	23.36
41	60.13	24.00
42	60.89	24.65
43	61.63	25.32
44	62.36	26.01
45	63.06	26.72
46	63.33	27.00

Circle Center At X = 32.4 ; Y = 56.7 and Radius, 42.9

*** 3.282 ***

1

Failure Surface Specified By 51 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.58	15.00
2	22.50	14.60
3	23.42	14.23
4	24.36	13.88
5	25.31	13.56
6	26.27	13.27
7	27.23	13.00
8	28.20	12.76
9	29.18	12.55
10	30.16	12.36
11	31.15	12.20
12	32.14	12.07
13	33.13	11.97
14	34.13	11.90
15	35.13	11.85
16	36.13	11.83
17	37.13	11.84
18	38.13	11.88
19	39.13	11.94
20	40.12	12.03

21	41.11	12.15
22	42.10	12.30
23	43.09	12.48
24	44.07	12.68
25	45.04	12.91
26	46.01	13.17
27	46.96	13.46
28	47.91	13.77
29	48.86	14.11
30	49.79	14.47
31	50.71	14.86
32	51.62	15.28
33	52.51	15.72
34	53.40	16.18
35	54.27	16.67
36	55.13	17.19
37	55.97	17.73
38	56.80	18.29
39	57.61	18.87
40	58.40	19.48
41	59.18	20.11
42	59.94	20.76
43	60.68	21.43
44	61.40	22.12
45	62.11	22.84
46	62.79	23.57
47	63.45	24.32
48	64.09	25.08
49	64.71	25.87
50	65.30	26.67
51	65.53	27.00

Circle Center At X = 36.3 ; Y = 47.6 and Radius, 35.8

*** 3.284 ***

Failure Surface Specified By 54 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	17.37	15.00
2	18.28	14.58
3	19.19	14.18
4	20.12	13.81
5	21.06	13.46
6	22.00	13.13
7	22.96	12.84
8	23.92	12.56
9	24.89	12.32
10	25.87	12.10
11	26.85	11.90
12	27.83	11.74
13	28.82	11.60
14	29.82	11.48
15	30.81	11.39
16	31.81	11.33
17	32.81	11.30

18	33.81	11.29
19	34.81	11.31
20	35.81	11.36
21	36.81	11.43
22	37.80	11.53
23	38.79	11.65
24	39.78	11.81
25	40.76	11.99
26	41.74	12.19
27	42.72	12.42
28	43.68	12.68
29	44.64	12.96
30	45.59	13.27
31	46.53	13.61
32	47.47	13.97
33	48.39	14.35
34	49.30	14.76
35	50.20	15.19
36	51.09	15.65
37	51.97	16.13
38	52.83	16.64
39	53.68	17.16
40	54.52	17.71
41	55.34	18.29
42	56.14	18.88
43	56.93	19.50
44	57.70	20.13
45	58.46	20.79
46	59.19	21.46
47	59.91	22.16
48	60.61	22.88
49	61.29	23.61
50	61.95	24.36
51	62.59	25.13
52	63.21	25.92
53	63.81	26.72
54	64.00	27.00

Circle Center At X = 33.6 ; Y = 48.6 and Radius, 37.3

*** 3.285 ***

1

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	15.00
2	23.53	14.56
3	24.44	14.15
4	25.37	13.77
5	26.31	13.43
6	27.25	13.11
7	28.21	12.82
8	29.18	12.57
9	30.15	12.34
10	31.14	12.15

11	32.12	11.99
12	33.11	11.86
13	34.11	11.76
14	35.11	11.70
15	36.11	11.67
16	37.11	11.67
17	38.11	11.70
18	39.10	11.77
19	40.10	11.87
20	41.09	12.00
21	42.08	12.16
22	43.06	12.35
23	44.03	12.58
24	45.00	12.84
25	45.96	13.13
26	46.90	13.45
27	47.84	13.80
28	48.76	14.18
29	49.68	14.59
30	50.58	15.03
31	51.46	15.49
32	52.33	15.99
33	53.18	16.52
34	54.01	17.07
35	54.83	17.65
36	55.62	18.25
37	56.40	18.88
38	57.15	19.54
39	57.89	20.22
40	58.60	20.92
41	59.29	21.65
42	59.95	22.40
43	60.59	23.16
44	61.20	23.95
45	61.79	24.76
46	62.35	25.59
47	62.89	26.43
48	63.22	27.00

Circle Center At X = 36.6 ; Y = 42.5 and Radius, 30.8

*** 3.288 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.58	15.00
2	22.48	14.57
3	23.40	14.17
4	24.32	13.79
5	25.26	13.45
6	26.21	13.14
7	27.17	12.86
8	28.14	12.60
9	29.12	12.38
10	30.10	12.19

11	31.09	12.04
12	32.08	11.91
13	33.07	11.82
14	34.07	11.76
15	35.07	11.73
16	36.07	11.73
17	37.07	11.76
18	38.07	11.83
19	39.06	11.92
20	40.06	12.05
21	41.04	12.21
22	42.02	12.41
23	43.00	12.63
24	43.97	12.89
25	44.92	13.17
26	45.87	13.49
27	46.81	13.83
28	47.74	14.21
29	48.65	14.62
30	49.55	15.05
31	50.44	15.51
32	51.31	16.01
33	52.16	16.52
34	53.00	17.07
35	53.82	17.64
36	54.62	18.24
37	55.40	18.87
38	56.17	19.51
39	56.91	20.19
40	57.62	20.88
41	58.32	21.60
42	58.99	22.34
43	59.64	23.10
44	60.26	23.88
45	60.86	24.69
46	61.43	25.51
47	61.98	26.34
48	62.38	27.00

Circle Center At X = 35.5 ; Y = 43.0 and Radius, 31.3

*** 3.289 ***

1

Failure Surface Specified By 52 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.58	15.00
2	22.47	14.55
3	23.37	14.12
4	24.29	13.72
5	25.22	13.35
6	26.16	13.00
7	27.11	12.68
8	28.06	12.39
9	29.03	12.13

10	30.00	11.90
11	30.98	11.69
12	31.96	11.52
13	32.95	11.37
14	33.95	11.26
15	34.94	11.17
16	35.94	11.11
17	36.94	11.08
18	37.94	11.08
19	38.94	11.11
20	39.94	11.17
21	40.93	11.26
22	41.93	11.38
23	42.92	11.53
24	43.90	11.71
25	44.88	11.91
26	45.85	12.15
27	46.82	12.41
28	47.77	12.70
29	48.72	13.02
30	49.66	13.37
31	50.58	13.75
32	51.50	14.15
33	52.40	14.58
34	53.29	15.03
35	54.17	15.51
36	55.03	16.02
37	55.88	16.55
38	56.71	17.11
39	57.52	17.69
40	58.32	18.30
41	59.10	18.93
42	59.85	19.58
43	60.59	20.25
44	61.31	20.94
45	62.01	21.66
46	62.69	22.40
47	63.34	23.15
48	63.98	23.93
49	64.59	24.72
50	65.17	25.53
51	65.73	26.36
52	66.14	27.00

Circle Center At X = 37.4 ; Y = 45.0 and Radius, 33.9

*** 3.307 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.58	15.00
2	22.51	14.64
3	23.46	14.31
4	24.41	14.01
5	25.37	13.73

6	26.34	13.48
7	27.31	13.25
8	28.29	13.05
9	29.28	12.88
10	30.27	12.73
11	31.26	12.61
12	32.25	12.52
13	33.25	12.45
14	34.25	12.41
15	35.25	12.40
16	36.25	12.41
17	37.25	12.45
18	38.25	12.52
19	39.24	12.61
20	40.24	12.73
21	41.23	12.88
22	42.21	13.06
23	43.19	13.26
24	44.16	13.48
25	45.13	13.74
26	46.09	14.02
27	47.04	14.32
28	47.99	14.65
29	48.92	15.01
30	49.85	15.39
31	50.76	15.79
32	51.66	16.22
33	52.56	16.68
34	53.43	17.15
35	54.30	17.66
36	55.15	18.18
37	55.99	18.73
38	56.81	19.30
39	57.62	19.89
40	58.41	20.50
41	59.18	21.14
42	59.94	21.79
43	60.67	22.46
44	61.39	23.16
45	62.09	23.87
46	62.78	24.60
47	63.44	25.35
48	64.08	26.12
49	64.70	26.91
50	64.77	27.00

Circle Center At X = 35.2 ; Y = 49.6 and Radius, 37.2

*** 3.307 ***

1

```
            Y            A      X      I      S            F      T

            0.00      11.25      22.50      33.75      45.00      56.25
X       0.00 +---------+*-*------+---------+---------+---------+
             -
             -
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                 -
                 -
                 -            .
       11.25 +              ..
                 -         ....
                 -        .....
                 -       .....6
                 -       .....1
                 -      .....61
A      22.50 +     .....612
                 -     .....11*
                 -    ......153.
                 -    .....6133..
                 -    .....123...
                 -    .....123...
X      33.75 +   ......153...
                 -   ......153....
                 -    .....1534...
                 -   ......1234....
                 -    .....1134....
                 -    .....91344....
I      45.00 +    ......1234....
                 -    ......91344...
                 -     ......1134....
                 -     ......91234....
                 -      ......91244...
                 -       ......91244...
S      56.25 +       .......91284..
                 -        .......91124..
                 -         .......911224..
                 -           .......91122*
                 -            ........3112
                 -              ........31
       67.50 +                 ........
                 -                    ....
                 -
                 -
                 -
                 -
F      78.75 +
                 -
                 -
                 -
                 -
                 -
T      90.00 +          *            *
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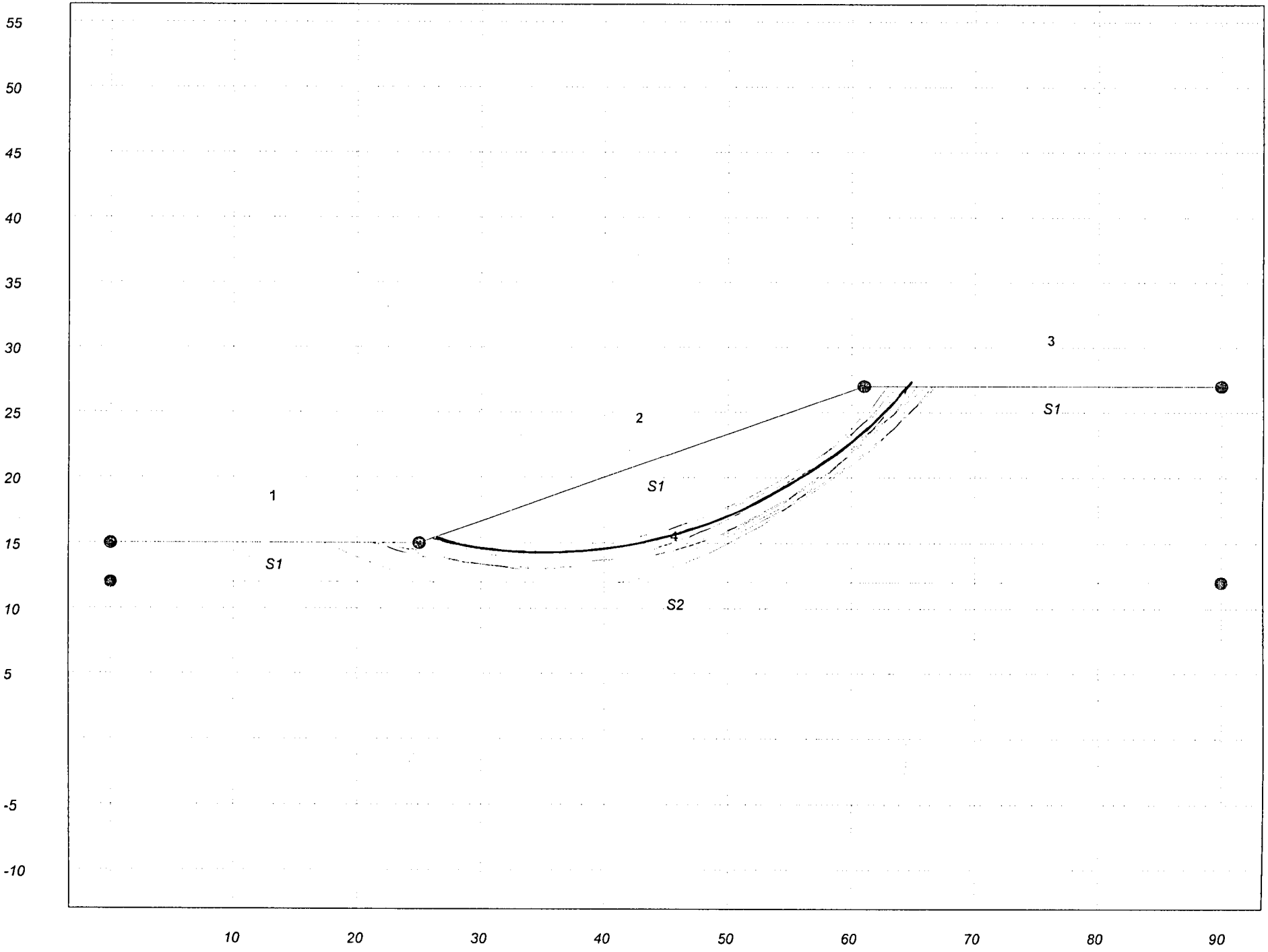
Sonoqui Wash Case II - Sudden Drawdown Upstream - FS Min = 3.195



result.out
** PCSTABL6 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: run.in
Output Filename: result.out
Unit: ENGLISH
Plotted Output Filename: result.plt

PROBLEM DESCRIPTION Sonoqui Wash Case II - Sudden Drawdown U pstream

BOUNDARY COORDINATES

3 Top Boundaries
4 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	15.00	25.00	15.00	1
2	25.00	15.00	61.00	27.00	1
3	61.00	27.00	90.00	27.00	1
4	0.00	12.00	90.00	12.00	2

1

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	100.0	34.0	0.00	0.0	0
2	115.0	115.0	0.0	36.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 15.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 61.00 ft.
and X = 70.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 5.00 ft.

1.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.05	15.35
2	27.03	15.14
3	28.01	14.95
4	29.00	14.79
5	29.99	14.65
6	30.98	14.53
7	31.98	14.44
8	32.98	14.37
9	33.98	14.33
10	34.98	14.32
11	35.97	14.32
12	36.97	14.36
13	37.97	14.41
14	38.97	14.50
15	39.96	14.60
16	40.95	14.74
17	41.94	14.89
18	42.93	15.07
19	43.91	15.28
20	44.88	15.50
21	45.85	15.76
22	46.81	16.03
23	47.76	16.33
24	48.71	16.66
25	49.65	17.00
26	50.57	17.37
27	51.49	17.77

28	52.40	18.18
29	53.30	18.62
30	54.19	19.08
31	55.07	19.56
32	55.93	20.07
33	56.78	20.59
34	57.62	21.13
35	58.45	21.70
36	59.26	22.29
37	60.05	22.89
38	60.83	23.52
39	61.60	24.16
40	62.34	24.83
41	63.08	25.51
42	63.79	26.21
43	64.49	26.92
44	64.56	27.00

Circle Center At X = 35.1 ; Y = 54.8 and Radius, 40.4

*** 3.195 ***

Individual data on the 44 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.0	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.0	86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.0	141.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.0	194.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.0	244.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1.0	293.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.0	338.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.0	381.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1.0	421.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1.0	458.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1.0	493.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	1.0	524.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	1.0	551.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1.0	576.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1.0	598.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1.0	616.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1.0	630.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1.0	642.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	1.0	650.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	1.0	655.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	1.0	656.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.0	655.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.9	650.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.9	642.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.9	631.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.9	617.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.9	601.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.9	581.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.9	559.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.9	535.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

31	0.9	508.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.9	480.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.8	449.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.8	416.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.8	382.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.8	346.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	0.8	309.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.2	62.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.6	202.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.7	206.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.7	147.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.7	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.90	15.00
2	23.85	14.70
3	24.81	14.42
4	25.78	14.17
5	26.75	13.94
6	27.73	13.74
7	28.71	13.56
8	29.70	13.41
9	30.69	13.28
10	31.69	13.18
11	32.69	13.10
12	33.68	13.05
13	34.68	13.02
14	35.68	13.02
15	36.68	13.05
16	37.68	13.10
17	38.68	13.17
18	39.67	13.27
19	40.67	13.40
20	41.65	13.55
21	42.64	13.73
22	43.62	13.93
23	44.59	14.16
24	45.56	14.41
25	46.52	14.69
26	47.48	14.99
27	48.42	15.31
28	49.36	15.66
29	50.29	16.03
30	51.20	16.43
31	52.11	16.85
32	53.01	17.29
33	53.89	17.76
34	54.77	18.24
35	55.63	18.75
36	56.47	19.29
37	57.31	19.84
38	58.13	20.41
39	58.93	21.01
40	59.72	21.62
41	60.49	22.26
42	61.25	22.91

43	61.99	23.58
44	62.71	24.28
45	63.41	24.99
46	64.10	25.71
47	64.77	26.46
48	65.23	27.00

Circle Center At X = 35.2 ; Y = 52.2 and Radius, 39.2

*** 3.204 ***

1

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.32	15.00
2	22.27	14.71
3	23.24	14.45
4	24.21	14.21
5	25.19	14.00
6	26.17	13.81
7	27.15	13.64
8	28.14	13.50
9	29.14	13.38
10	30.13	13.29
11	31.13	13.22
12	32.13	13.18
13	33.13	13.16
14	34.13	13.17
15	35.13	13.20
16	36.13	13.26
17	37.12	13.34
18	38.12	13.45
19	39.11	13.58
20	40.10	13.74
21	41.08	13.92
22	42.06	14.13
23	43.03	14.36
24	44.00	14.61
25	44.96	14.89
26	45.91	15.19
27	46.86	15.52
28	47.80	15.87
29	48.72	16.24
30	49.64	16.63
31	50.55	17.05
32	51.45	17.49
33	52.34	17.96
34	53.21	18.44
35	54.07	18.95
36	54.92	19.47
37	55.76	20.02
38	56.58	20.59
39	57.39	21.18
40	58.18	21.79
41	58.96	22.42

42	59.72	23.07
43	60.46	23.74
44	61.19	24.42
45	61.90	25.13
46	62.60	25.85
47	63.27	26.58
48	63.63	27.00

Circle Center At X = 33.3 ; Y = 53.3 and Radius, 40.1

*** 3.207 ***

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.47	15.00
2	25.46	14.86
3	26.46	14.74
4	27.45	14.64
5	28.45	14.56
6	29.45	14.50
7	30.45	14.46
8	31.45	14.44
9	32.45	14.43
10	33.45	14.45
11	34.45	14.49
12	35.44	14.54
13	36.44	14.61
14	37.44	14.71
15	38.43	14.82
16	39.42	14.95
17	40.41	15.10
18	41.40	15.27
19	42.38	15.46
20	43.36	15.66
21	44.33	15.89
22	45.30	16.13
23	46.27	16.40
24	47.23	16.68
25	48.18	16.98
26	49.13	17.30
27	50.07	17.63
28	51.00	17.99
29	51.93	18.36
30	52.85	18.75
31	53.76	19.16
32	54.67	19.59
33	55.57	20.03
34	56.45	20.49
35	57.33	20.97
36	58.20	21.46
37	59.06	21.97
38	59.91	22.50
39	60.75	23.04
40	61.58	23.60
41	62.40	24.18

42	63.20	24.77
43	64.00	25.37
44	64.78	26.00
45	65.55	26.63
46	65.98	27.00

Circle Center At X = 32.1 ; Y = 66.3 and Radius, 51.9

*** 3.215 ***

1

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.32	15.00
2	22.27	14.70
3	23.23	14.42
4	24.20	14.16
5	25.17	13.93
6	26.15	13.73
7	27.13	13.55
8	28.12	13.40
9	29.11	13.28
10	30.11	13.18
11	31.11	13.10
12	32.11	13.06
13	33.10	13.04
14	34.10	13.04
15	35.10	13.07
16	36.10	13.13
17	37.10	13.21
18	38.09	13.32
19	39.08	13.46
20	40.07	13.62
21	41.05	13.81
22	42.03	14.02
23	43.00	14.26
24	43.97	14.52
25	44.92	14.81
26	45.87	15.12
27	46.81	15.46
28	47.75	15.82
29	48.67	16.21
30	49.58	16.62
31	50.48	17.06
32	51.37	17.52
33	52.25	18.00
34	53.11	18.50
35	53.96	19.03
36	54.80	19.58
37	55.62	20.15
38	56.42	20.74
39	57.21	21.35
40	57.99	21.98
41	58.74	22.64
42	59.48	23.31

43	60.21	24.00
44	60.91	24.71
45	61.60	25.44
46	62.26	26.19
47	62.91	26.95
48	62.95	27.00

Circle Center At X = 33.4 ; Y = 51.2 and Radius, 38.2

*** 3.215 ***

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.05	15.35
2	27.01	15.05
3	27.97	14.77
4	28.94	14.53
5	29.91	14.31
6	30.89	14.12
7	31.88	13.95
8	32.87	13.82
9	33.87	13.71
10	34.86	13.63
11	35.86	13.59
12	36.86	13.56
13	37.86	13.57
14	38.86	13.61
15	39.86	13.68
16	40.85	13.77
17	41.85	13.89
18	42.84	14.04
19	43.82	14.22
20	44.80	14.43
21	45.77	14.67
22	46.73	14.93
23	47.69	15.22
24	48.64	15.54
25	49.58	15.88
26	50.51	16.25
27	51.42	16.65
28	52.33	17.08
29	53.22	17.53
30	54.10	18.00
31	54.97	18.50
32	55.82	19.03
33	56.65	19.58
34	57.47	20.15
35	58.28	20.75
36	59.06	21.36
37	59.83	22.01
38	60.58	22.67
39	61.31	23.35
40	62.02	24.06
41	62.70	24.78
42	63.37	25.53

43	64.02	26.29
44	64.59	27.00

Circle Center At X = 37.1 ; Y = 48.4 and Radius, 34.9

*** 3.226 ***

1

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.90	15.00
2	23.85	14.70
3	24.81	14.42
4	25.78	14.16
5	26.75	13.93
6	27.73	13.72
7	28.71	13.54
8	29.70	13.38
9	30.69	13.25
10	31.68	13.14
11	32.68	13.05
12	33.68	12.99
13	34.68	12.95
14	35.68	12.94
15	36.68	12.95
16	37.67	12.98
17	38.67	13.05
18	39.67	13.13
19	40.66	13.24
20	41.65	13.37
21	42.64	13.53
22	43.62	13.71
23	44.60	13.92
24	45.58	14.15
25	46.54	14.40
26	47.50	14.68
27	48.46	14.98
28	49.40	15.31
29	50.34	15.65
30	51.27	16.02
31	52.19	16.42
32	53.10	16.83
33	54.00	17.27
34	54.89	17.73
35	55.76	18.21
36	56.63	18.71
37	57.48	19.24
38	58.32	19.78
39	59.15	20.34
40	59.96	20.93
41	60.75	21.53
42	61.54	22.16
43	62.30	22.80
44	63.05	23.46
45	63.79	24.14

46	64.50	24.84
47	65.20	25.55
48	65.88	26.28
49	66.52	27.00

Circle Center At X = 35.7 ; Y = 53.7 and Radius, 40.8

*** 3.229 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.11	15.00
2	23.07	14.72
3	24.03	14.46
4	25.00	14.22
5	25.98	14.01
6	26.96	13.81
7	27.95	13.64
8	28.93	13.50
9	29.93	13.37
10	30.92	13.27
11	31.92	13.19
12	32.92	13.13
13	33.92	13.10
14	34.92	13.09
15	35.92	13.10
16	36.92	13.14
17	37.91	13.20
18	38.91	13.28
19	39.90	13.39
20	40.90	13.51
21	41.89	13.66
22	42.87	13.84
23	43.85	14.03
24	44.83	14.25
25	45.80	14.49
26	46.76	14.76
27	47.72	15.04
28	48.67	15.35
29	49.62	15.68
30	50.55	16.03
31	51.48	16.40
32	52.40	16.79
33	53.31	17.21
34	54.21	17.64
35	55.10	18.10
36	55.98	18.57
37	56.85	19.07
38	57.71	19.58
39	58.55	20.12
40	59.38	20.67
41	60.20	21.25
42	61.01	21.84
43	61.80	22.45
44	62.58	23.08

45	63.34	23.73
46	64.09	24.39
47	64.82	25.07
48	65.54	25.77
49	66.24	26.48
50	66.72	27.00

Circle Center At X = 34.8 ; Y = 56.6 and Radius, 43.5

*** 3.229 ***

1

Failure Surface Specified By 54 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	17.37	15.00
2	18.27	14.57
3	19.19	14.17
4	20.12	13.80
5	21.05	13.44
6	22.00	13.12
7	22.95	12.82
8	23.91	12.54
9	24.88	12.29
10	25.85	12.07
11	26.84	11.87
12	27.82	11.70
13	28.81	11.55
14	29.80	11.43
15	30.80	11.34
16	31.80	11.27
17	32.80	11.23
18	33.80	11.22
19	34.80	11.24
20	35.79	11.28
21	36.79	11.34
22	37.79	11.44
23	38.78	11.56
24	39.77	11.71
25	40.75	11.88
26	41.73	12.08
27	42.71	12.30
28	43.68	12.56
29	44.64	12.83
30	45.59	13.14
31	46.53	13.46
32	47.47	13.82
33	48.40	14.20
34	49.31	14.60
35	50.22	15.02
36	51.11	15.48
37	51.99	15.95
38	52.86	16.45
39	53.71	16.97
40	54.55	17.51
41	55.37	18.08

42	56.18	18.66
43	56.98	19.27
44	57.75	19.90
45	58.51	20.55
46	59.26	21.22
47	59.98	21.91
48	60.68	22.62
49	61.37	23.35
50	62.04	24.10
51	62.68	24.86
52	63.31	25.64
53	63.91	26.44
54	64.32	27.00

Circle Center At X = 33.8 ; Y = 48.7 and Radius, 37.5

*** 3.231 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.32	15.00
2	22.30	14.81
3	23.28	14.64
4	24.27	14.49
5	25.26	14.36
6	26.26	14.25
7	27.25	14.16
8	28.25	14.09
9	29.25	14.05
10	30.25	14.02
11	31.25	14.01
12	32.25	14.02
13	33.25	14.06
14	34.25	14.11
15	35.25	14.18
16	36.24	14.28
17	37.23	14.39
18	38.23	14.52
19	39.21	14.68
20	40.20	14.85
21	41.18	15.05
22	42.16	15.26
23	43.13	15.49
24	44.10	15.75
25	45.06	16.02
26	46.01	16.32
27	46.96	16.63
28	47.91	16.96
29	48.84	17.31
30	49.77	17.68
31	50.69	18.07
32	51.61	18.47
33	52.51	18.90
34	53.41	19.34
35	54.29	19.81

36	55.17	20.29
37	56.04	20.78
38	56.90	21.30
39	57.74	21.83
40	58.58	22.38
41	59.40	22.95
42	60.21	23.53
43	61.01	24.13
44	61.80	24.75
45	62.58	25.38
46	63.34	26.03
47	64.09	26.69
48	64.43	27.00

Circle Center At X = 31.1 ; Y = 63.2 and Radius, 49.2

*** 3.233 ***

1

```
              Y            A     X     I     S            F     T

              0.00      11.25     22.50     33.75     45.00     56.25
X       0.00 +---------+*-*------+---------+---------+---------+
             -
             -
             -
             -
             -
       11.25 +
             -
             -            .
             -           .9
             -         ...9
             -        ...93
A      22.50 +       ...992
             -      ....93*
             -      ....9211
             -     ....9.21.
             -    .....9.21..
             -    .....9.21..
X      33.75 +    .....9.21...
             -    .....9721...
             -    .....9.21...
             -    .....9.21....
             -    ......9214...
             -    ......9211....
I      45.00 +    ......9721....
             -    .......9211....
             -     .......721....
             -     .......9211....
             -      .......9211...
             -      ........7210...
S      56.25 +        .......7210...
             -        ........7213...
             -          .......72115..
             -           .......82113*
             -            ........7211
```

```
                                  result.out
          -                       .......842
    67.50 +                         .......8
          -                             ....
          -
          -
          -
          -
F   78.75 +
          -
          -
          -
          -
          -
T   90.00 +          *                 *
```

APPENDIX D

BORING LOGS AND TEST DATA FROM PREVIOUS INVESTIGATIONS

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	7-6-4		3	SM	slightly moist medium dense	3" of Aggregate Base Course **SILTY SAND,** some fine grained gravel, nonplastic, brown
5				S	3-5-6		3			
10				S	7-7-9		4			
								SP	slightly moist medium dense to dense	**SAND,** predominantly medium to fine grained, nonplastic, brown
15				U	24		2			
20				S	9-19-25		3			note: fine grained sand from 20'6" to 23'
								SC	slightly moist very firm to hard	**CLAYEY SAND,** some fine grained gravel, poorly graded sand, weakly lime cemented, low to medium plasticity, light brown
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 1

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				U	33	96	7	SC	slightly moist	**CLAYEY SAND,** continued
									very firm to hard	note: thin layers of strong lime cementation throughout strata
30				S	25-50/3"		8			
35				U	50/5 1/2"		13			
40				S	27-31-50/5"		15			
45				S	23-36-50/6"		12			
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 1

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50			X	S	50/4"		6		slightly moist hard	
55			X	S	24-27-48		9			
60			X	S	38-50/5 1/2"		6			
								SP	slightly moist very dense	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic, light brown
65			X	S	16-31-40		4			
								SC/CL	slightly moist hard	**CLAYEY SAND TO SANDY CLAY,** predominantly medium to fine grained sand, weakly to moderately lime cemented, low to medium plasticity, light brown
70			X	S	50/3"		9			
75										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 1

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
75				S	50/5"				slightly moist hard	
								SP	slightly moist very dense	**GRAVELLY SAND,** fine grained gravel, poorly grained sand, nonplastic, light brown
80				S	28-39-40					
										Stopped Auger at 80' Stopped Sampler at 81'6"
85										
90										
95										
100										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 1

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.2'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	slightly moist medium dense	3" of Aggregate Base Course over **SILTY SAND,** predominantly medium to fine grained, nonplastic, brown
5				S A	4-5-7					
								CL-ML	slightly moist firm to very firm	**SILTY CLAY TO CLAYEY SILT,** some fine grained sand, low plasticity, brown note: weakly lime cemented below 15'
10				S	13-13-13					
15				S	14-15-22					
								SM	slightly moist medium dense	**SILTY SAND,** considerable fine grained gravel, poorly graded sand, nonplastic, brown
20				U	25	109	3			
								SC	slightly moist firm to hard	**CLAYEY SAND,** predominantly medium to fine grained, weakly to moderately lime cemented, low plasticity, brown to light brown
25										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 2

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.2'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				S	10-10-12			SC	slightly moist firm to hard	**CLAYEY SAND,** continued
30				U	50/2" NR					
35				S	50/6"					
40				U	50/ 4 1/2"					
45				S	21-32-50/6"					
								SM	slightly moist	**SILTY SAND,** considerable fine grained gravel, poorly graded sand, nonplastic, brown
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 2

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.2'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				U	54		5	SP	slightly moist very dense	**GRAVELLY SAND,** continued
								SC	slightly moist hard	**CLAYEY SAND,** some fine grained gravel, predominantly medium to fine grained, weakly lime cemented, low plasticity, brown
55				S	50/5"					
60				S	41-50/5"					
								SP	slightly moist very dense	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic, brown
65				S	23-26-50/4"					
								SC/CL	slightly moist hard	**CLAYEY SAND TO SANDY CLAY,** predominantly medium to fine grained sand, weakly to moderately lime cemented, low to medium plasticity, light brown to brown
70				S	17-29-50/6"					
75										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 2

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/9/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1373.2'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
75				S	22-45-50/4"			SC/CL		**CLAYEY SAND TO SANDY CLAY**continued
								SP	slightly moist very dense	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic, brown
80				S	38-46-50/6"					
										Stopped Auger at 80' Stopped Sampler at 81'6"
85										
90										
95										
100										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 2

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1372.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	6-11- 12			SC	slightly moist firm	Aggregate Base Course over **CLAYEY SAND,** fine to medium grained sand, low plasticity, brown
								SM	slightly moist medium dense	**SILTY SAND,** fine grained, nonplastic, brown
5				U	14					
10				S	10-15- 15			CL-ML	slightly moist firm to very firm	**CLAYEY SILT TO SILTY CLAY,** some fine grained sand, weakly lime cemented, low plasticity, brown
15				U	82					
								SP	slightly moist firm	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic
20				S	9-13- 14					
								CL	slightly moist	**SANDY CLAY,** trace of fine grained gravel, weakly lime cemented, low to medium plasticity, brown
25										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▼			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 3

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1372.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				U	32	109	11	CL	slightly moist firm to hard	**SANDY CLAY,** continued note: moderately lime cementation below 27'
30				S	50/6"					
35				S	38-50/6"					
								CH	slightly moist hard	**CLAY,** some fine grained sand, medium to high plasticity, weakly to moderately lime cemented, dark brown
40				U	38-50/5"					
								SC	slightly moist hard	**CLAYEY SAND,** poorly graded, weakly lime cemented, low plasticity, brown
45				S	19-21-42					
50										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 3

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1372.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				U	72			SP-SM	slightly moist very dense	**SAND,** some silt, predominantly fine grained, weakly lime cemented, nonplastic
								SC	slightly moist very hard	**CLAYEY SAND,** poorly graded, weakly lime cemented, low to medium plasticity, light brown
55				S	39-50/5"					
60				S	50/3"		9			
								SP	slightly moist very dense	**SAND,** some fine grained gravel, poorly graded sand, weakly lime cemented, nonplastic, brown
65				S	18-19-32					
70				U	47					
								CL	slightly moist very firm to hard	**SILTY CLAY,** some fine grained sand, weakly lime cemented, low to medium plasticity, brown
75										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 3

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1372.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
75				S	18-24-39			CL	slightly moist firm to hard	**SILTY CLAY,** continued
								SP	slightly moist very dense	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic, brown
80				S	50/5"					Stopped Auger at 80' Sampler refused at 80'5"
85										
90										
95										
100										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 3

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1369.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				A				SM	slightly moist medium dense to dense	3" of Aggregate Base Course **SILTY SAND,** predominantly fine grained, nonplastic, brown
5				S	12-14-22		5			
								SC	slightly moist hard to firm	**CLAYEY SAND,** predominantly medium to fine grained, weakly to moderately lime cemented, low plasticity, brown
10				U	38-50/5"		10			
15				S	9-11-12		13			
20				U	68		12			
25										

GROUNDWATER

DEPTH(ft)	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 4

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1369.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				S	12-23-50/2"		8	SC	slightly moist hard	**CLAYEY SAND,** continued
								CH	slightly moist firm to very firm	**SILTY CLAY,** some fine grained sand, medium to high plasticity, brown
30				S	15-16-21		18			
35				U	49		21			
40				S	12-24-25		18	SC	slightly moist very firm to hard	**CLAYEY SAND,** poorly graded, weakly lime cemented, low plasticity, light brown note: intermittent thin layers of fine grained gravel throughout
45				S	17-29-40		7			
50										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 4

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1369.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				U	47	103	15	SC	slightly moist very firm to hard	**CLAYEY SAND,** continued
55				S	17-29-38		10			
60				U	48		7	SP-SM	slightly moist hard	**SAND,** some to considerable silt, predominantly fine grained sand, nonplastic, brown
65				S	31-50/6"		11	SC-CL	slightly moist hard	**CLAYEY SAND TO SANDY CLAY,** predominantly medium to fine grained sand, weakly lime cemented, low to medium plasticity, light brown
70				S	8-10-11		16	ML	slightly moist to moist firm	**SANDY SILT,** low plasticity, brown
75								SP	slightly moist very dense to dense	**GRAVELLY SAND,** fine grained gravel, poorly graded sand, nonplastic, grayish-brown

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▼			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 4

PROJECT Chandler Heights Road Bridge over Sonoqui Wash

JOB NO. 3-117-001090 **DATE** 12/8/03

LOCATION

RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1369.4'
DATUM MCDOT - Point No. 1005 NEC Section 30 T2S R7E

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count Per 6-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
75			X	S	38-32-34			SP		**GRAVELLY SAND,** continued
80			X	S	15-18-17					
			X					SM	slightly moist	**SILTY SAND,** predominantly fine grained, nonplastic to low plasticity, brown
										Stopped Auger at 80' Stopped Sampler at 81'6"
85										
90										
95										
100										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽		none	
▼			
▼			
▼			

SAMPLE TYPE

A - Drill cuttings; NR - No Recovery
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
C - CME sample

LOG OF TEST BORING NO. 4

HOQUE
& ASSOCIATES
1225 North Stadem Drive
Tempe, Arizona 85281
Tel: 602-921-1368
Fax: 602-921-0194

May 6, 1999

Mr. Fred K. Duren, Jr., P.E.
Vice President, Huitt-Zollars
4742 North 24th Street, Suite 100
Phoenix, Arizona 85016

Subject: Laboratory Test Results for Sediment Samples Collected From Queen Creek / Sanokai Wash HMP at Maricopa County, Arizona

Dear Mr. Duren:

Hoque & Associates, Inc. has completed laboratory testing of sediment samples collected from Queen Creek and Sanokai Wash. Sample locations were designated by West Consultants. Attached to this letter are the results of the tests performed and a sample location map.

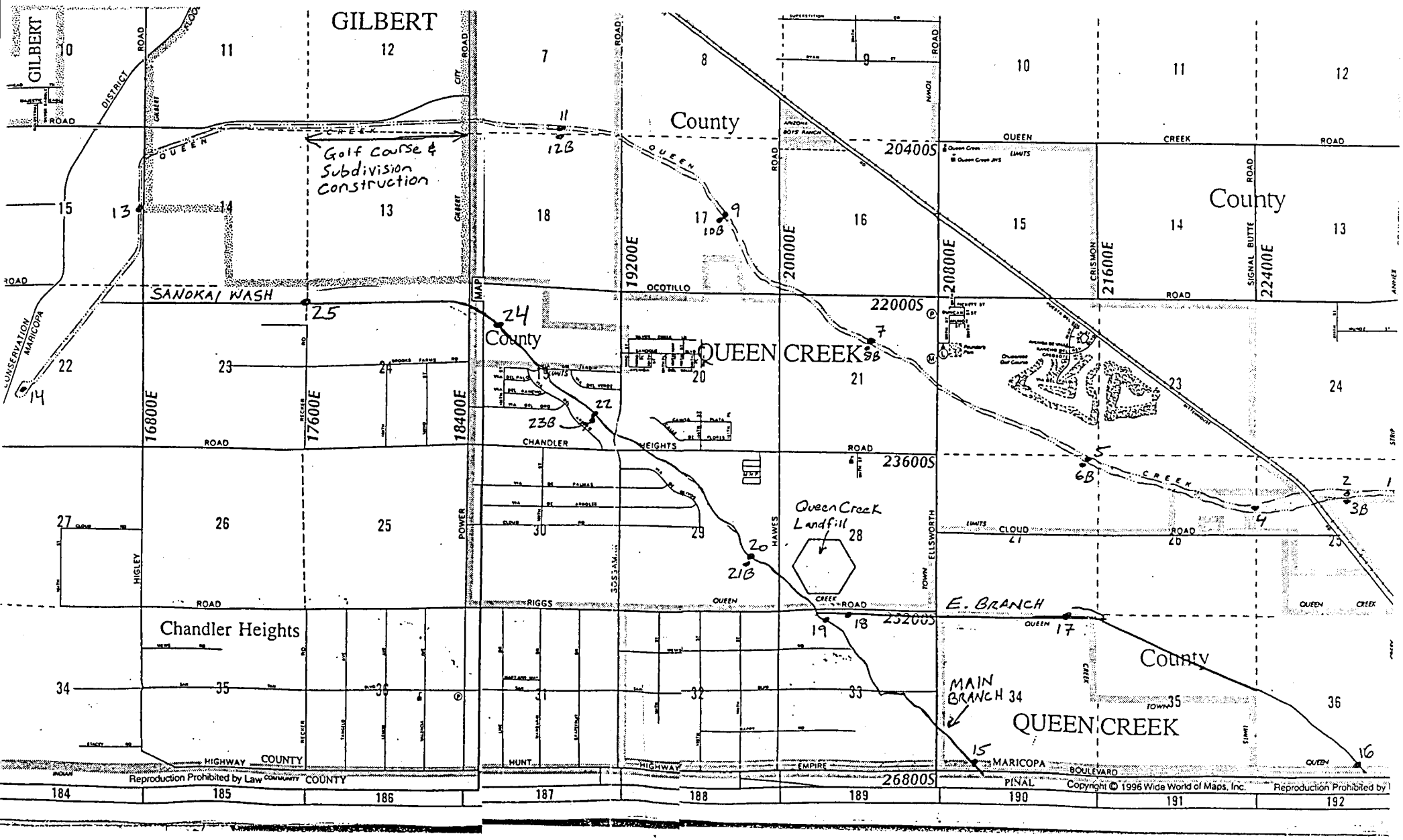
If you have any questions, please contact us at (480) 921-1368.

Sincerely,
Hoque & Associates, Inc.

Michael Wilson, E.I.T.
Project Engineer

Cc: Mr. Dennis L. Richards, P.E.

Enclosure


GILBERT
County
QUEEN CREEK
Chandler Heights
QUEEN CREEK
Golf Course & Subdivision Construction
SANOKAI WASH
Queen Creek Landfill
E. BRANCH
MAIN BRANCH
16800E
17600E
18400E
19200E
20000E
20800E
21600E
22400E
20400S
22000S
23600S
25200S
26800S
QUEEN CREEK ROAD
OCOTILLO ROAD
CHANDLER HEIGHTS ROAD
RIGGS ROAD
HUNT HIGHWAY
MARICOPA BOULEVARD
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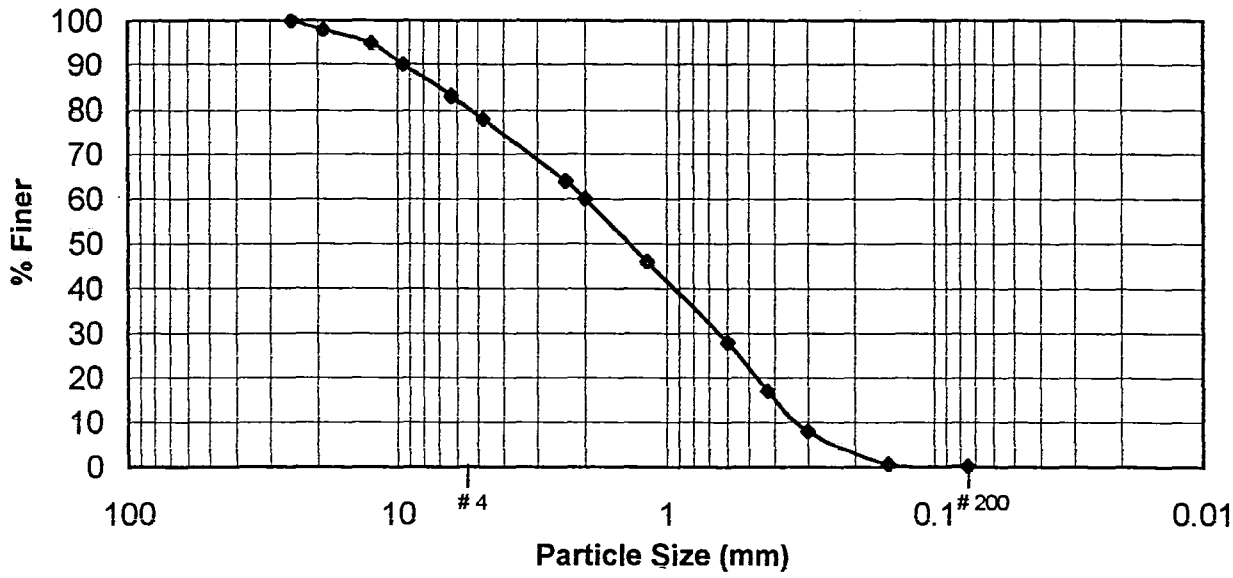
Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-1



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	100
3/4"	19	98
1/2"	12.5	95
3/8"	9.5	90
1/4"	6.3	83
#4	4.75	78
#8	2.36	64
#10	2	60
#16	1.18	46
#30	0.6	28
#40	0.425	17
#50	0.3	8
#100	0.15	0.7
#200	0.075	0.3

Gravel Content = 22%
Sand Content = 77.7%
Fines = 0.3%

$C_u = 6.3$

$C_c = 0.6$

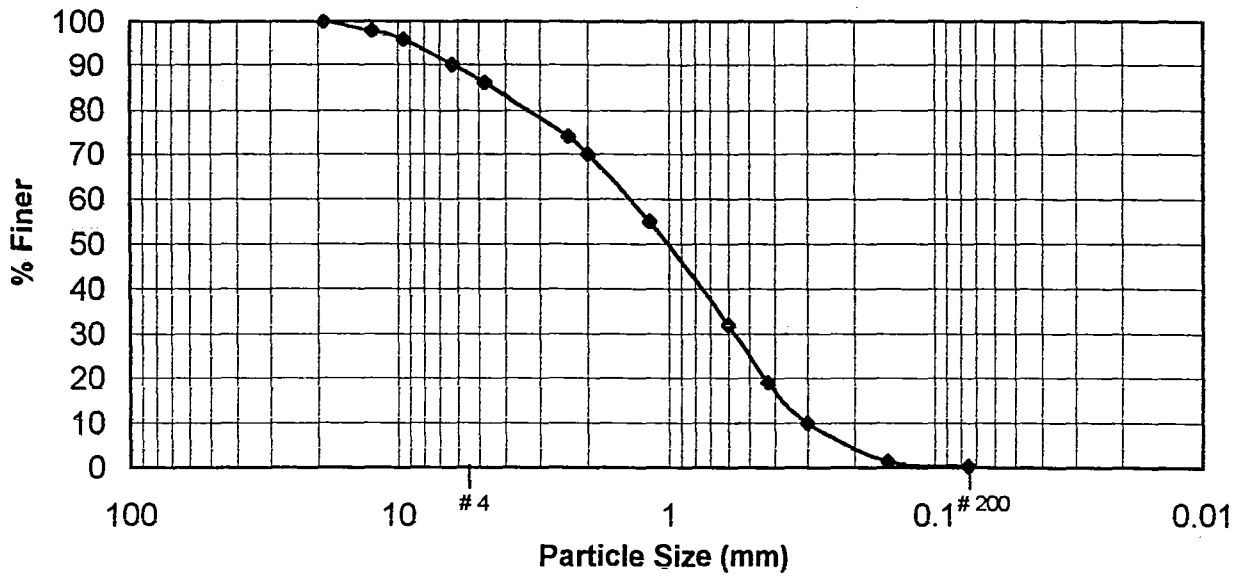
USCS Symbol = SP
USCS Name : Poorly graded Sand with gravel

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-2



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	100
1/2"	12.5	98
3/8"	9.5	96
1/4"	6.3	90
#4	4.75	86
#8	2.36	74
#10	2	70
#16	1.18	55
#30	0.6	32
#40	0.425	19
#50	0.3	10
#100	0.15	1.5
#200	0.075	0.5

Gravel Content = 14%
Sand Content = 85.5%
Fines = 0.5%

$C_u = 4.3$

$C_c = 0.8$

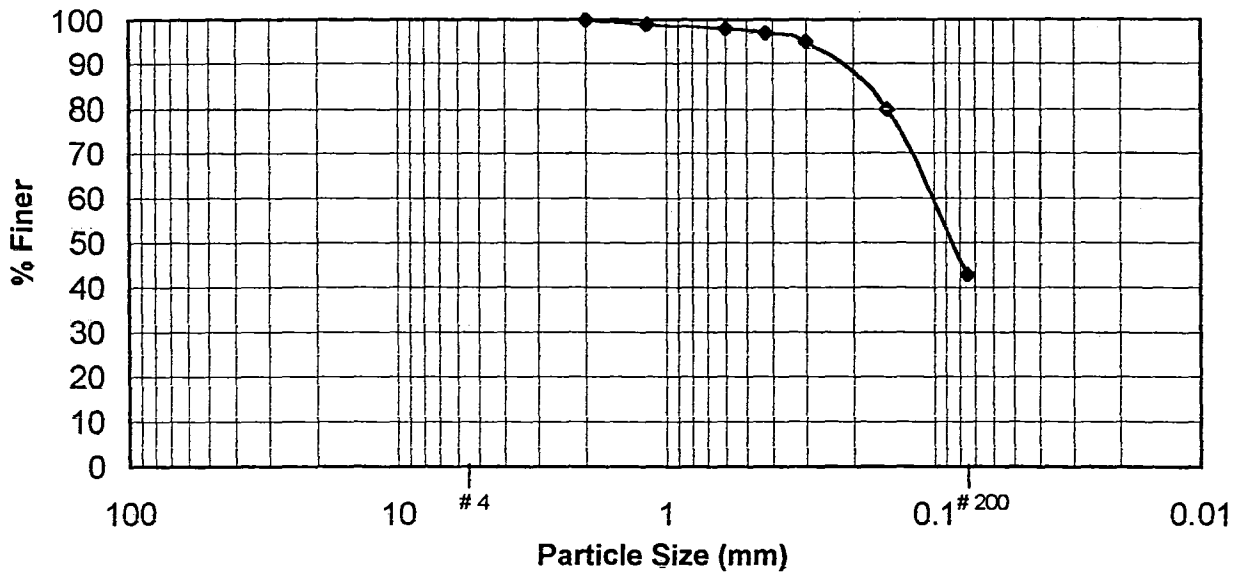
USCS Symbol = SP
USCS Name : Poorly graded Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-3B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	100
#16	1.18	99
#30	0.6	98
#40	0.425	97
#50	0.3	95
#100	0.15	80
#200	0.075	42.9

Gravel Content = 0%
Sand Content = 57.1%
Fines = 42.9%

C_u = n/a
C_c = n/a

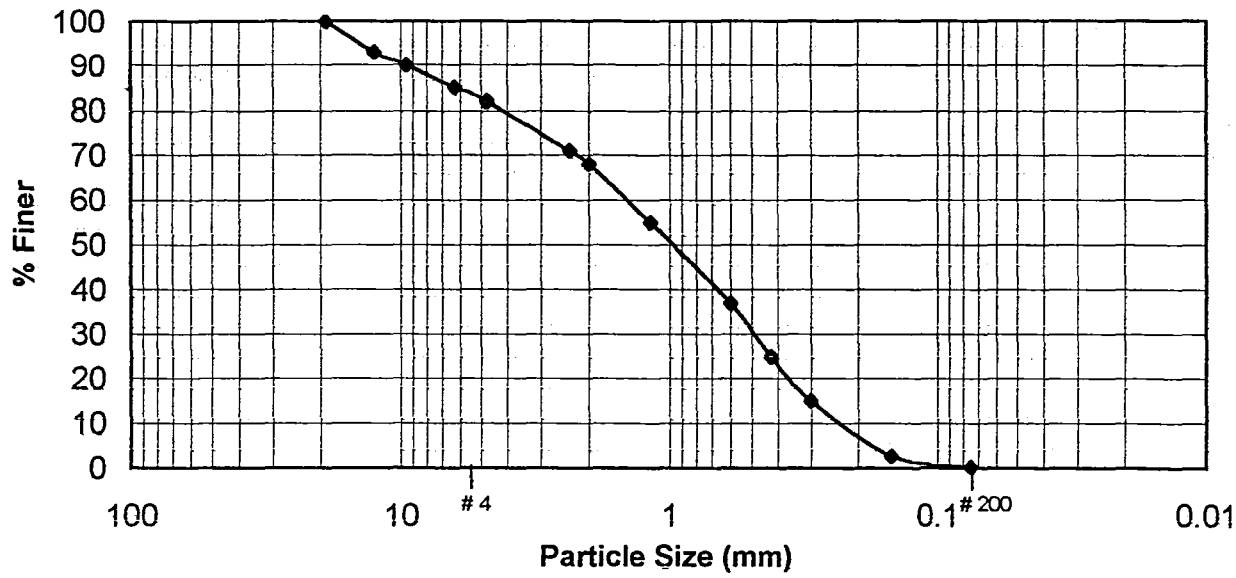
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-4



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	100
1/2"	12.5	93
3/8"	9.5	90
1/4"	6.3	85
#4	4.75	82
#8	2.36	71
#10	2	68
#16	1.18	55
#30	0.6	37
#40	0.425	25
#50	0.3	15
#100	0.15	2.7
#200	0.075	0.3

Gravel Content = 18%
Sand Content = 81.7%
Fines = 0.3%

C_u = 5.9
C_c = .53

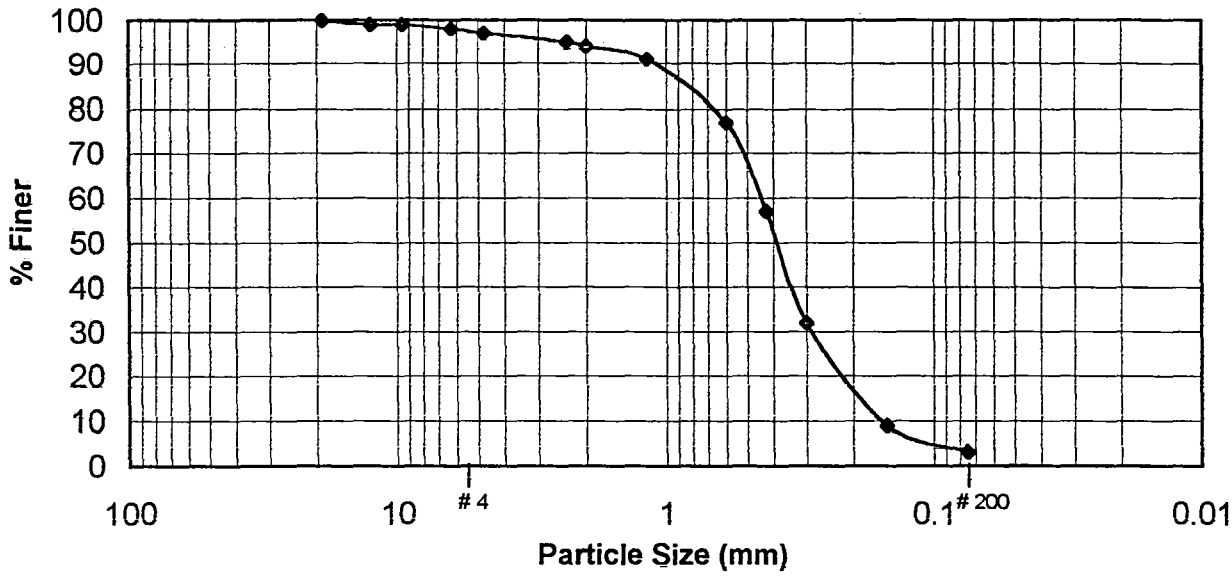
USCS Symbol = SP
USCS Name : Poorly graded Sand with gravel

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-5



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	100
1/2"	12.5	99
3/8"	9.5	99
1/4"	6.3	98
#4	4.75	97
#8	2.36	95
#10	2	94
#16	1.18	91
#30	0.6	77
#40	0.425	57
#50	0.3	32
#100	0.15	9
#200	0.075	3.1

Gravel Content = 5%
Sand Content = 91.9%
Fines = 3.1%

$C_u = 2.2$

$C_c = 1.6$

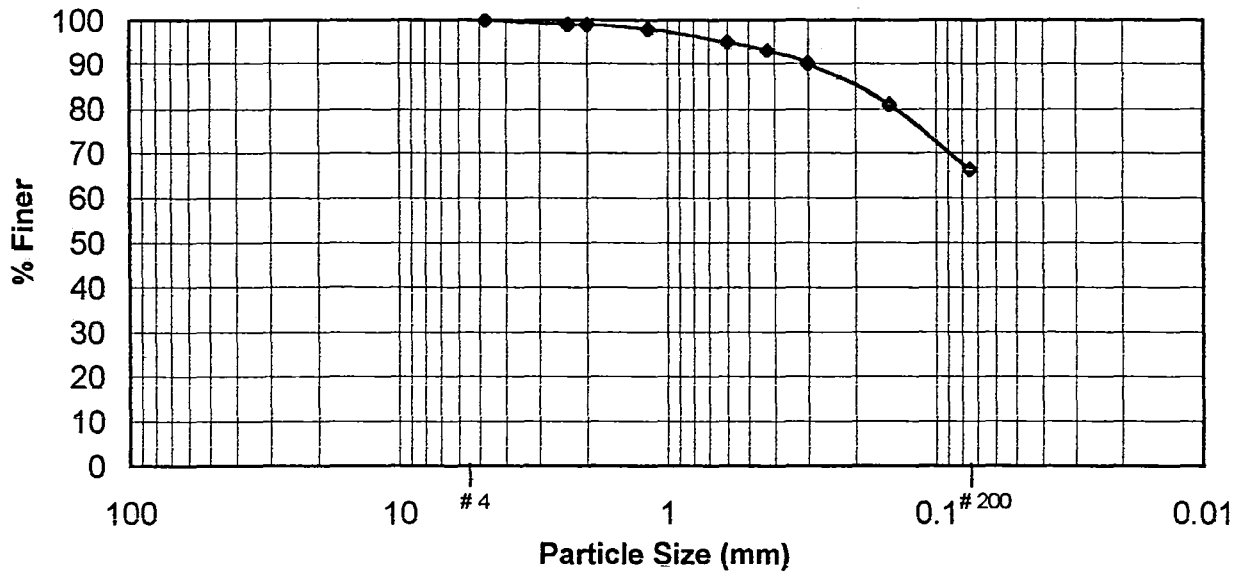
USCS Symbol = SP
USCS Name : Poorly graded Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-6B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	100
#8	2.36	99
#10	2	99
#16	1.18	98
#30	0.6	95
#40	0.425	93
#50	0.3	90
#100	0.15	81
#200	0.075	66.4

Gravel Content = 0%
Sand Content = 35.6%
Fines = 66.4%

C_u = n/a
C_c = n/a

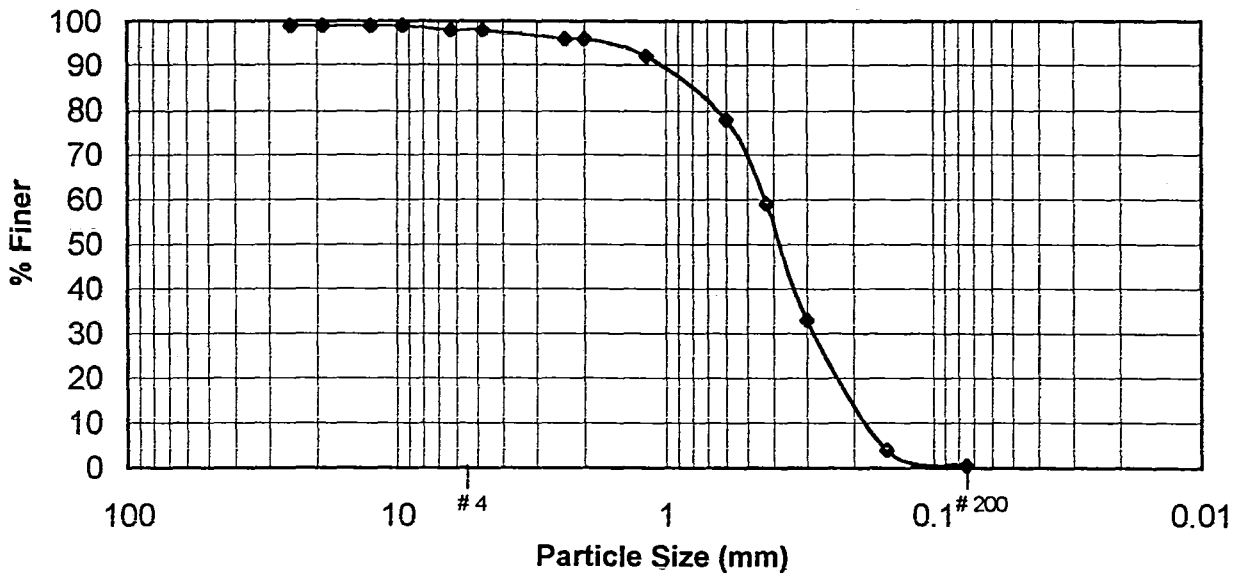
USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-7 Reach 4



Seive #	Size (mm)	% Finer
1 1/2"	37.5	100
1"	25	99
3/4"	19	99
1/2"	12.5	99
3/8"	9.5	99
1/4"	6.3	98
#4	4.75	98
#8	2.36	96
#10	2	96
#16	1.18	92
#30	0.6	78
#40	0.425	59
#50	0.3	33
#100	0.15	4
#200	0.075	0.6

Gravel Content = 2%
Sand Content = 97.4%
Fines = 0.6%

$C_u = 2.2$

$C_c = 1.0$

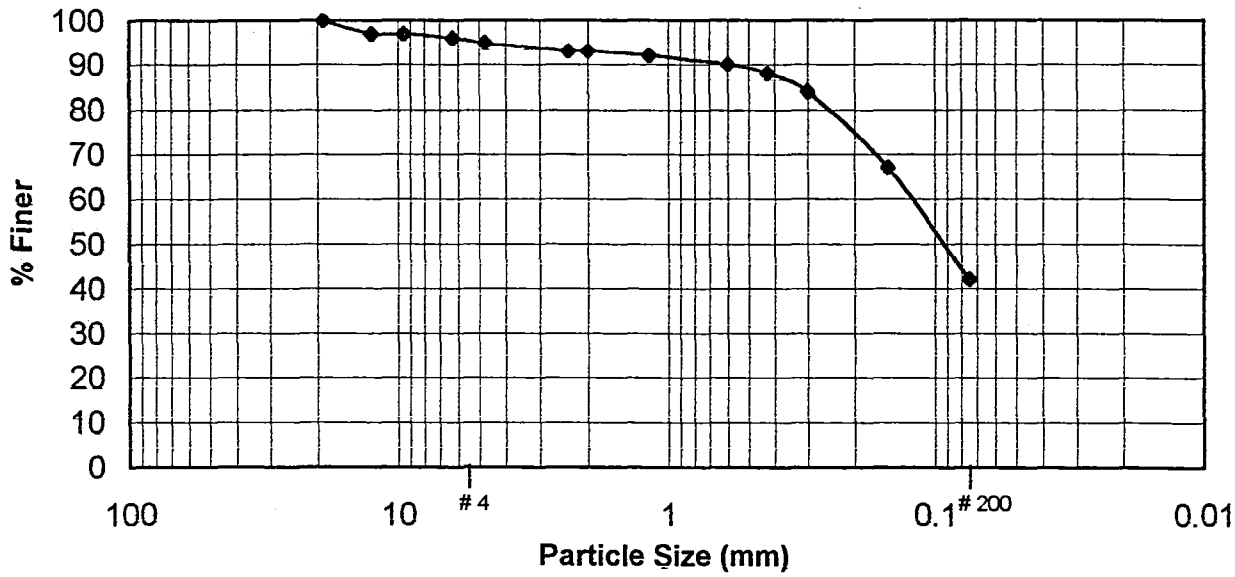
USCS Symbol = SP
USCS Name : Poorly graded Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-8B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	100
1/2"	12.5	97
3/8"	9.5	97
1/4"	6.3	96
#4	4.75	95
#8	2.36	93
#10	2	93
#16	1.18	92
#30	0.6	90
#40	0.425	88
#50	0.3	84
#100	0.15	67
#200	0.075	42.1

Gravel Content = 5%
Sand Content = 52.9%
Fines = 42.1%

C_u = n/a
C_c = n/a

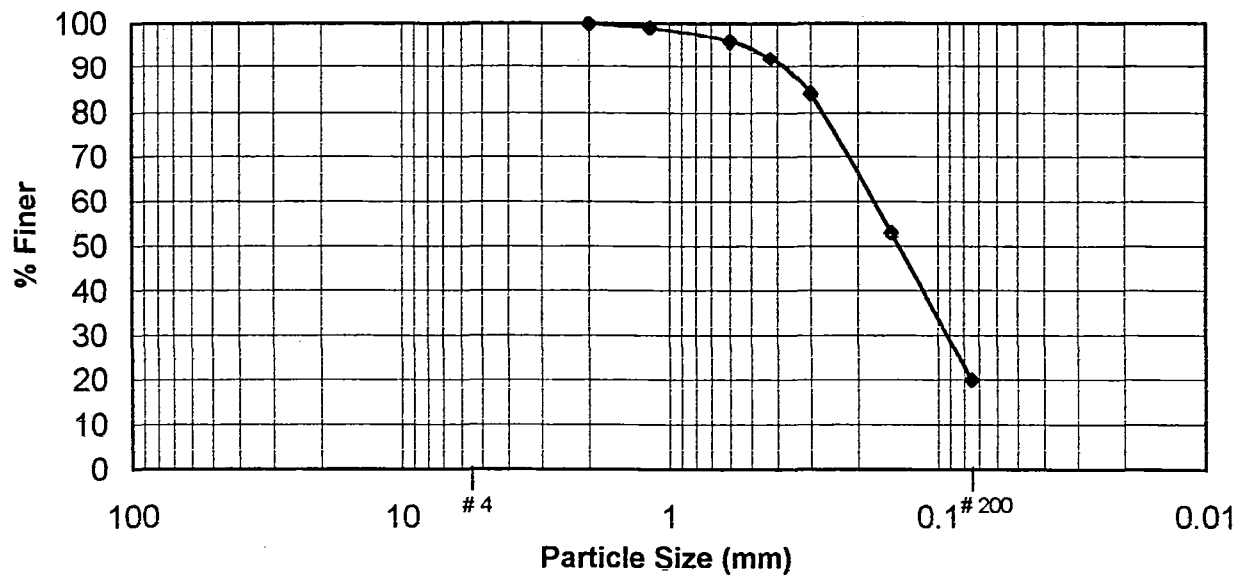
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-9



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	100
#16	1.18	99
#30	0.6	96
#40	0.425	92
#50	0.3	84
#100	0.15	53
#200	0.075	20

Gravel Content = 0%
Sand Content = 80%
Fines = 20%

C_u = n/a
C_c = n/a

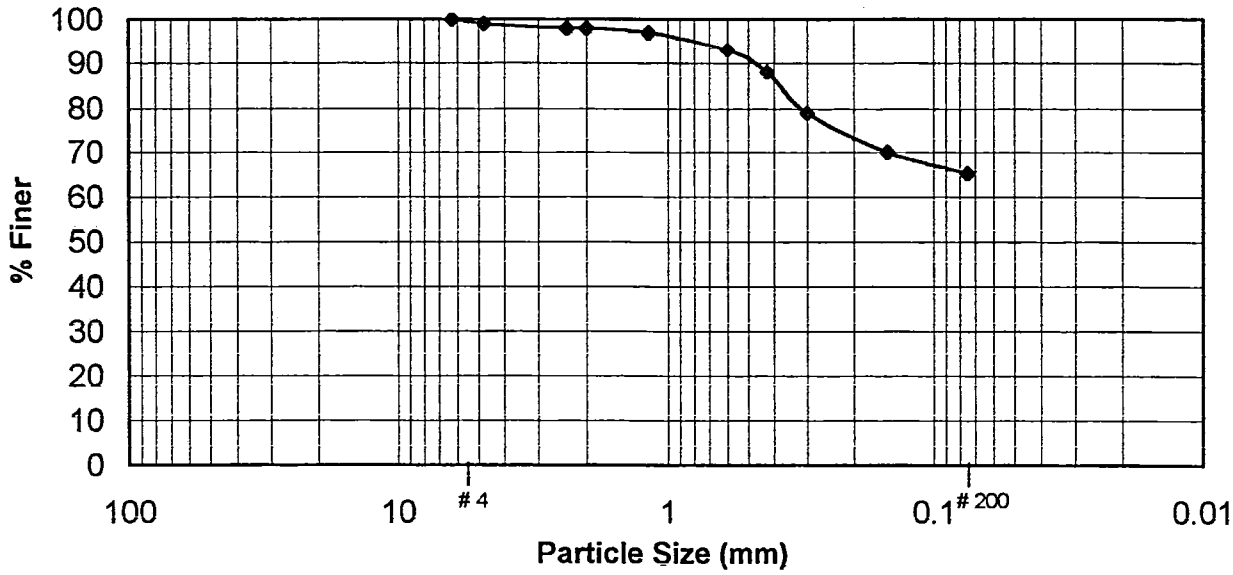
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-10B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	100
#4	4.75	99
#8	2.36	98
#10	2	98
#16	1.18	97
#30	0.6	93
#40	0.425	88
#50	0.3	79
#100	0.15	70
#200	0.075	65.4

Gravel Content = 1%
Sand Content = 33.6%
Fines = 65.4%

C_u = n/a
C_c = n/a

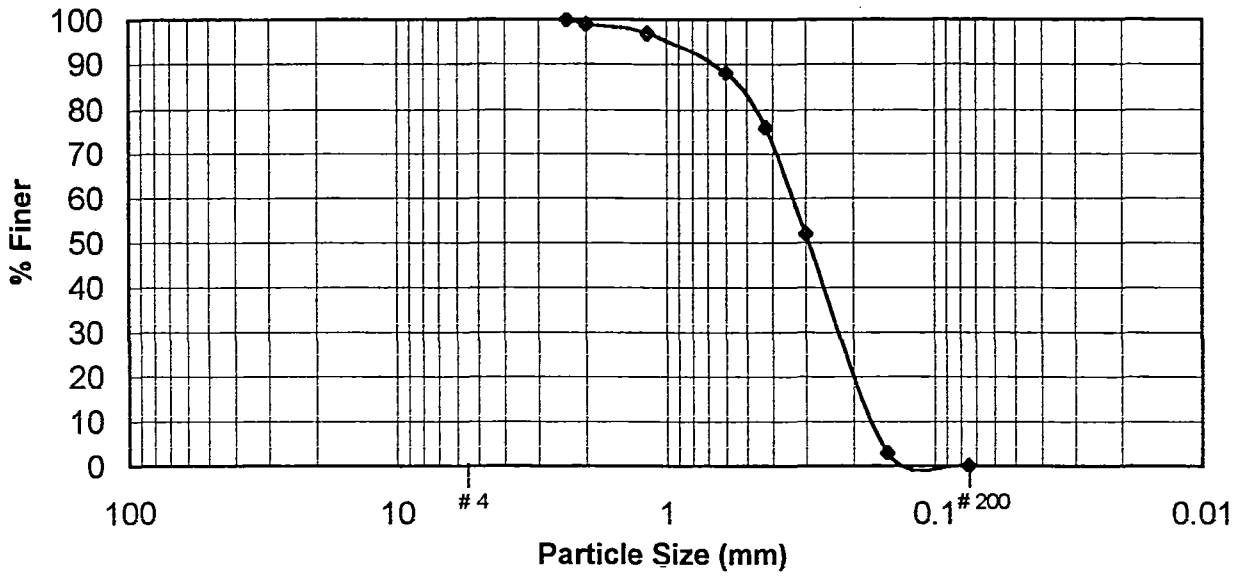
USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	2/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-11



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	100
#10	2	99
#16	1.18	97
#30	0.6	88
#40	0.425	76
#50	0.3	52
#100	0.15	3
#200	0.075	0.2

Gravel Content = 0%
Sand Content = 98.8%
Fines = 0.2%

C_u = 1.8
C_c = 0.8

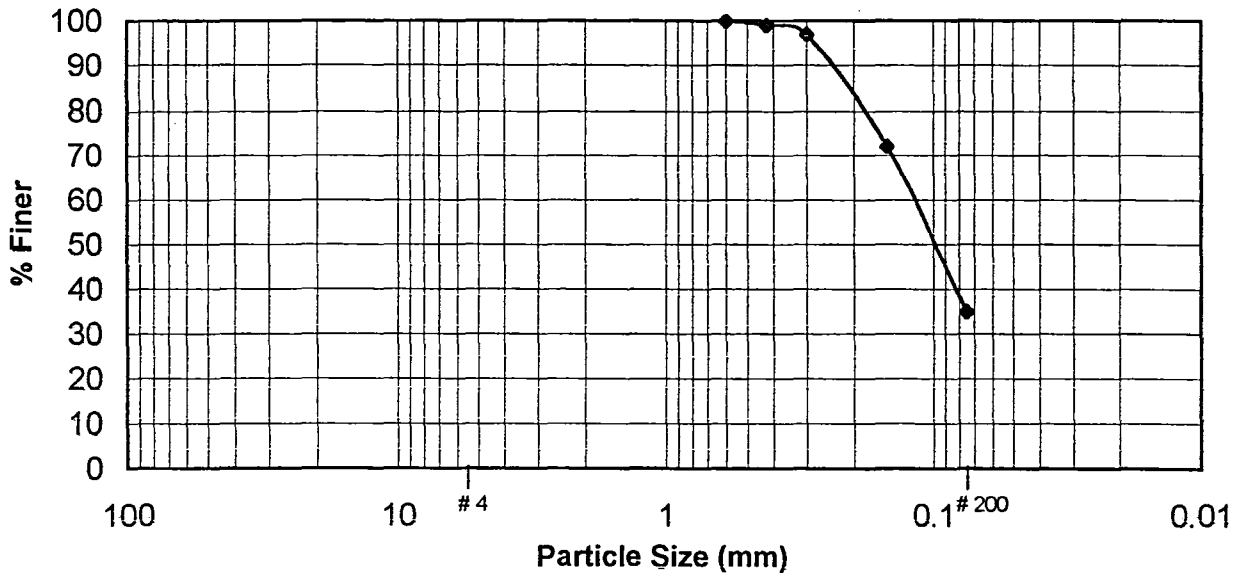
USCS Symbol = SP
USCS Name : Poorly graded Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-12B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	
#16	1.18	
#30	0.6	100
#40	0.425	99
#50	0.3	97
#100	0.15	72
#200	0.075	35

Gravel Content = 0%
Sand Content = 65%
Fines = 35%

C_u = n/a
C_c = n/a

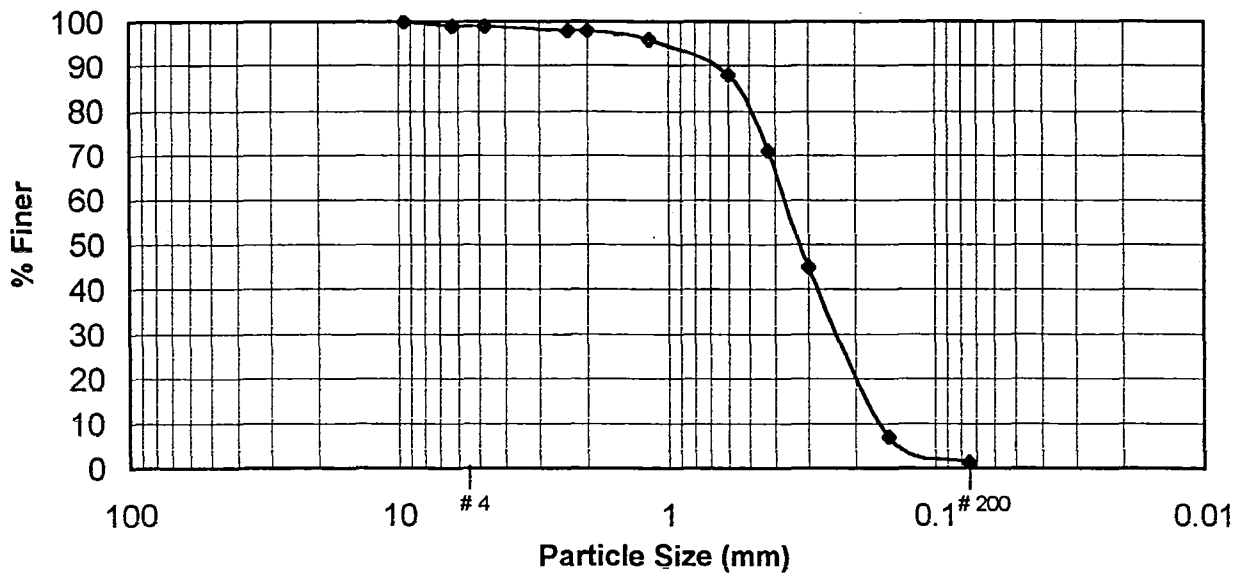
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-13



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	100
1/4"	6.3	99
#4	4.75	99
#8	2.36	98
#10	2	98
#16	1.18	96
#30	0.6	88
#40	0.425	71
#50	0.3	45
#100	0.15	7
#200	0.075	1.5

Gravel Content = 1%
Sand Content = 97.5%
Fines = 1.5%

$C_u = 2.2$

$C_c = 0.8$

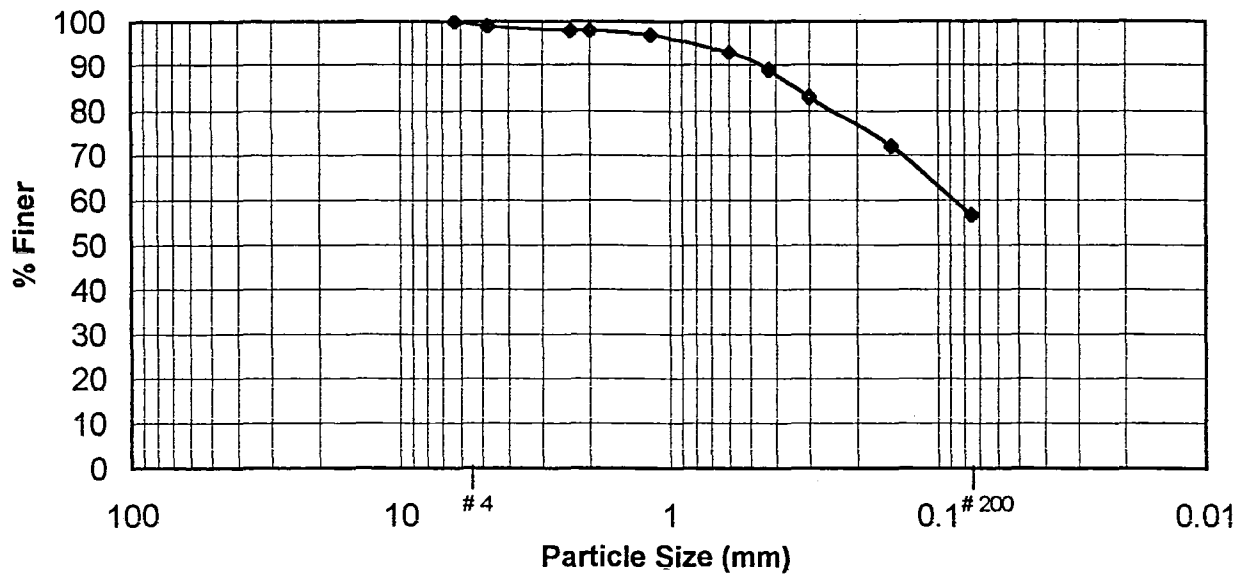
USCS Symbol = SP
USCS Name : Poorly graded Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for QC-14 Reach 1



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	100
#4	4.75	99
#8	2.36	98
#10	2	98
#16	1.18	97
#30	0.6	93
#40	0.425	89
#50	0.3	83
#100	0.15	72
#200	0.075	56.7

Gravel Content = 1%
Sand Content = 42.3%
Fines = 56.7%

C_u = n/a
C_c = n/a

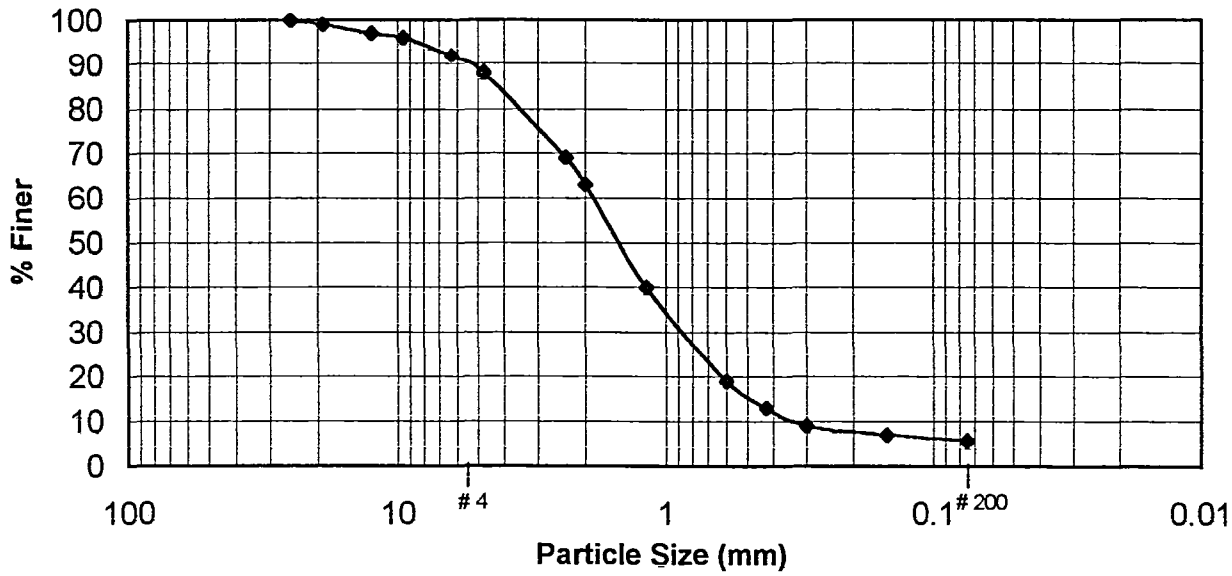
USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-15



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	100
3/4"	19	99
1/2"	12.5	97
3/8"	9.5	96
1/4"	6.3	92
#4	4.75	88
#8	2.36	69
#10	2	63
#16	1.18	40
#30	0.6	19
#40	0.425	13
#50	0.3	9
#100	0.15	7
#200	0.075	5.8

Gravel Content = 12%
Sand Content = 82.2%
Fines = 5.8%

$C_u = 5.9$

$C_c = 1.3$

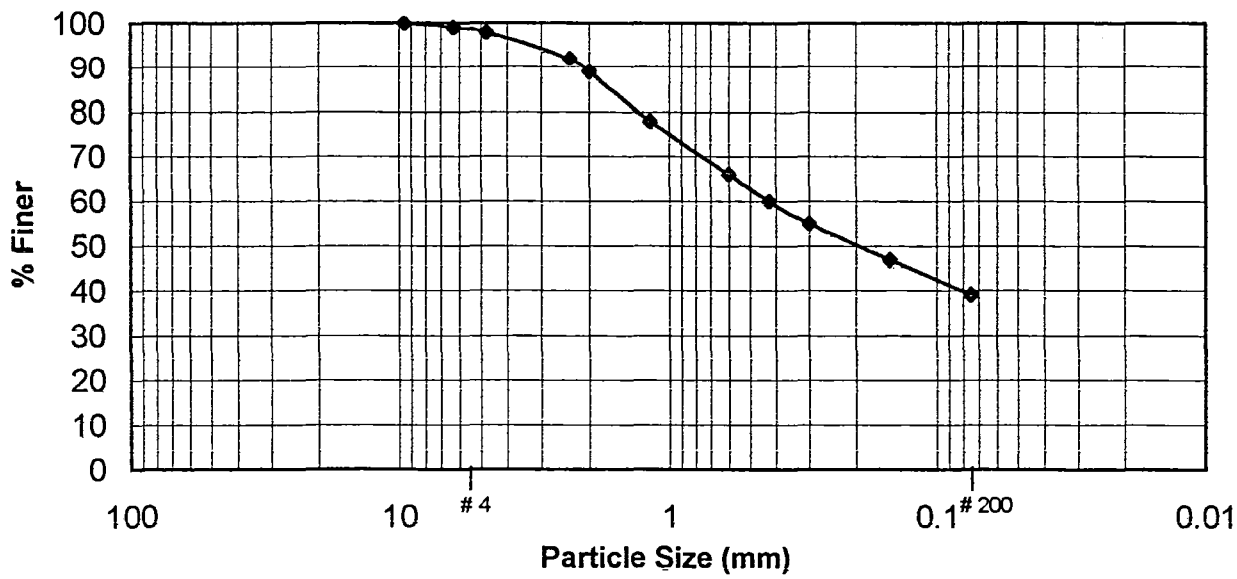
USCS Symbol = SP-SM
USCS Name : Poorly graded Sand with Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-16



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	100
1/4"	6.3	99
#4	4.75	98
#8	2.36	92
#10	2	89
#16	1.18	78
#30	0.6	66
#40	0.425	60
#50	0.3	55
#100	0.15	47
#200	0.075	39.1

Gravel Content = 2%
Sand Content = 58.9%
Fines = 39.1%

C_u = n/a
C_c = n/a

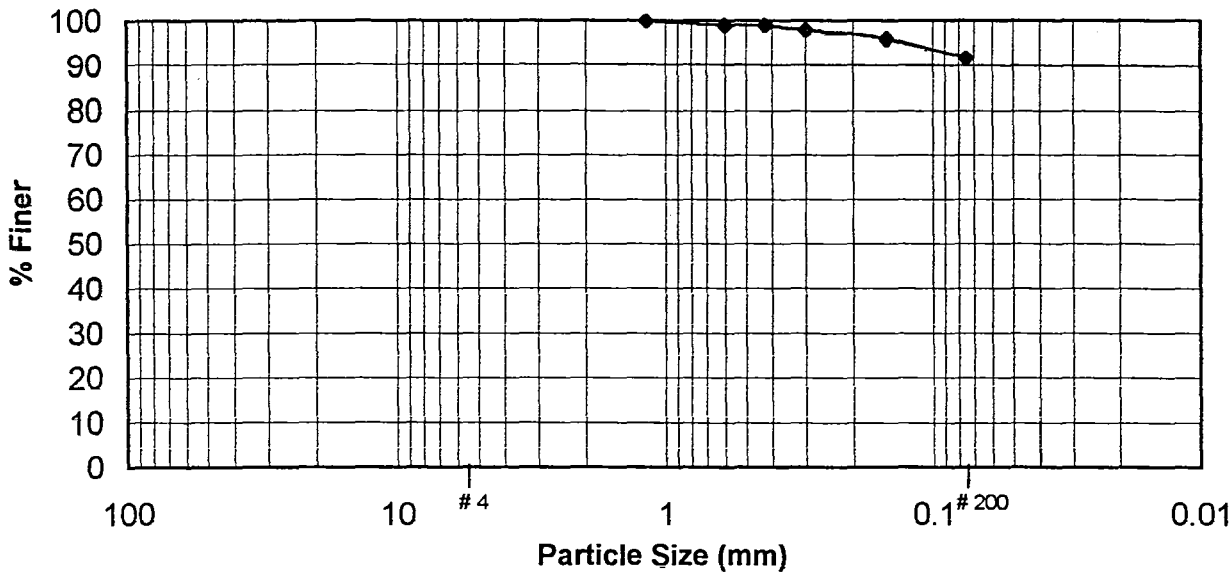
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-17



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	
#16	1.18	100
#30	0.6	99
#40	0.425	99
#50	0.3	98
#100	0.15	96
#200	0.075	91.6

Gravel Content = 0%
Sand Content = 8.4%
Fines = 91.6%

C_u = n/a
C_c = n/a

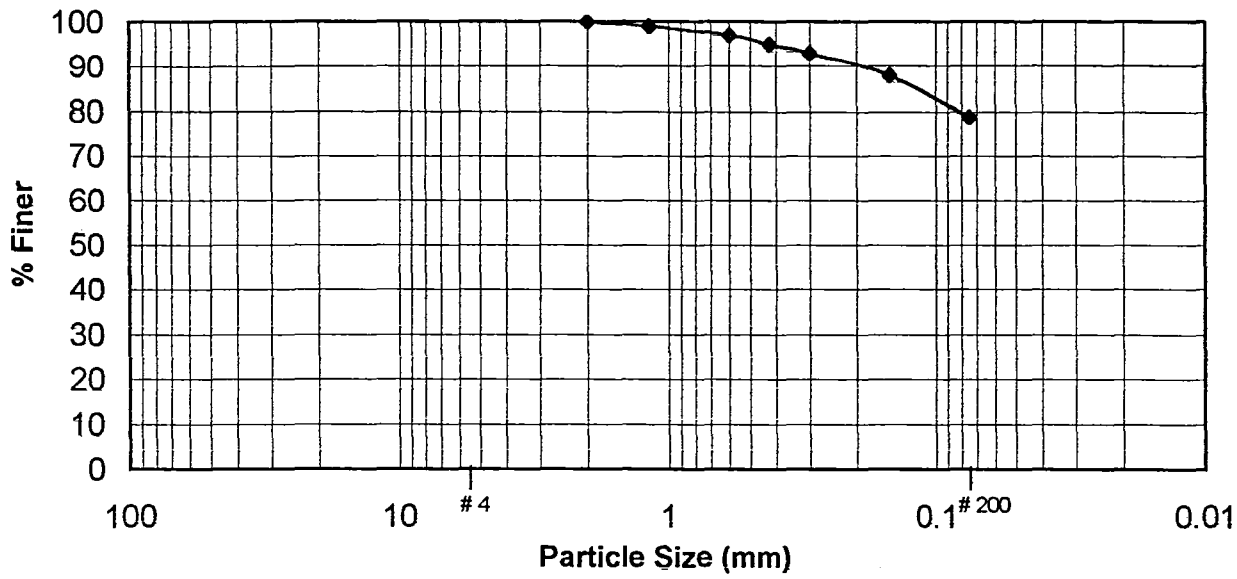
USCS Symbol = ML
USCS Name : Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-18



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	100
#16	1.18	99
#30	0.6	97
#40	0.425	95
#50	0.3	93
#100	0.15	88
#200	0.075	78.8

Gravel Content = 0%
Sand Content = 21.2%
Fines = 78.8%

C_u = n/a
C_c = n/a

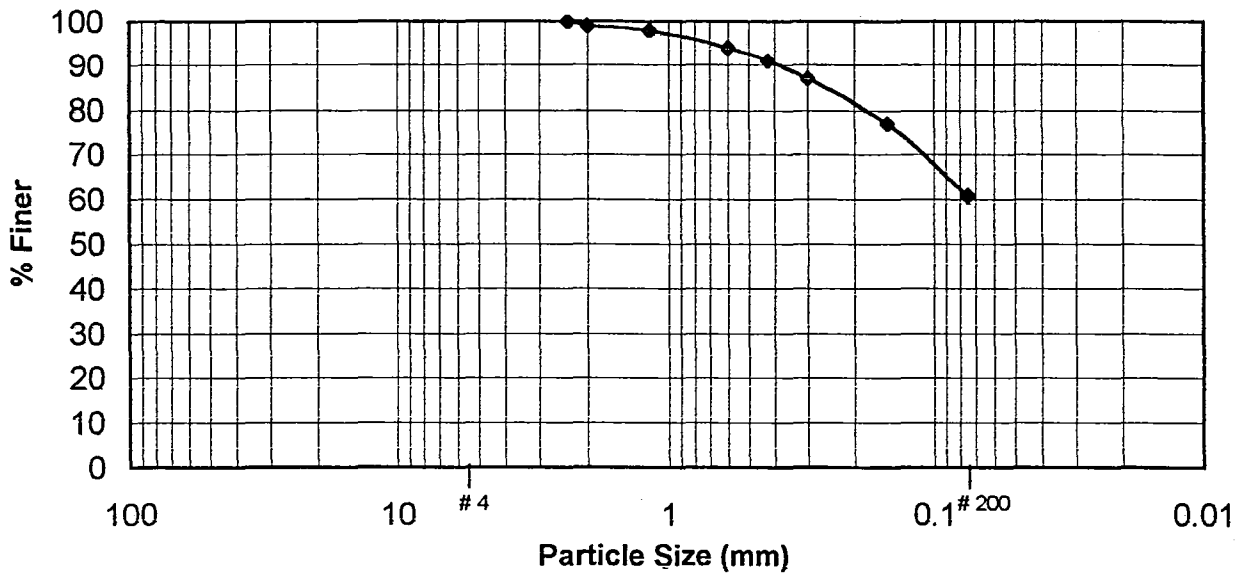
USCS Symbol = ML
USCS Name : Silt with sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-19



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	100
#10	2	99
#16	1.18	98
#30	0.6	94
#40	0.425	91
#50	0.3	87
#100	0.15	77
#200	0.075	60.9

Gravel Content = 0%
Sand Content = 39.1%
Fines = 60.9%

C_u = n/a
C_c = n/a

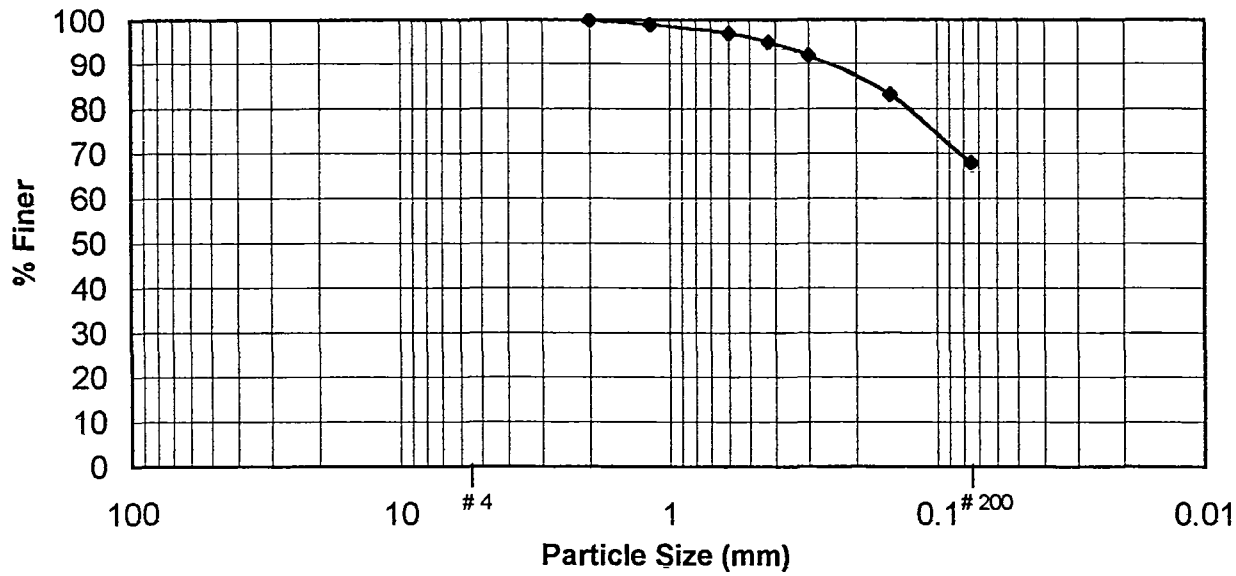
USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-20



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	100
#16	1.18	99
#30	0.6	97
#40	0.425	95
#50	0.3	92
#100	0.15	83
#200	0.075	67.9

Gravel Content = 0%
Sand Content = 32.1%
Fines = 67.9%

C_u = n/a

C_c = n/a

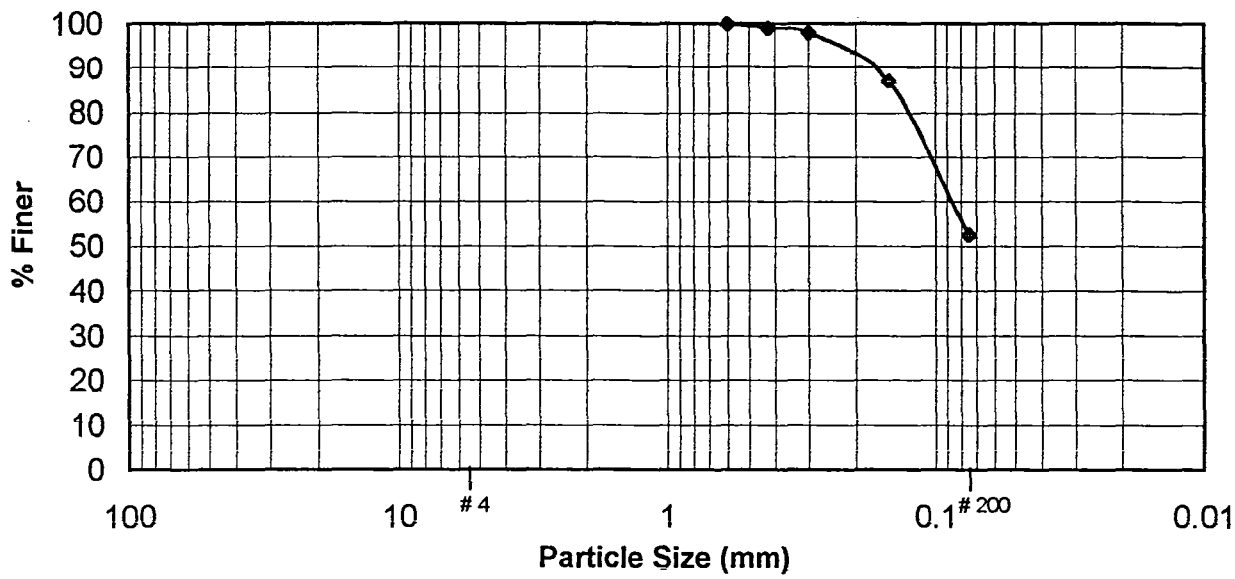
USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-21B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	
#16	1.18	
#30	0.6	100
#40	0.425	99
#50	0.3	98
#100	0.15	87
#200	0.075	52.6

Gravel Content = 0%
Sand Content = 47.4%
Fines = 52.6%

C_u = n/a
C_c = n/a

USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
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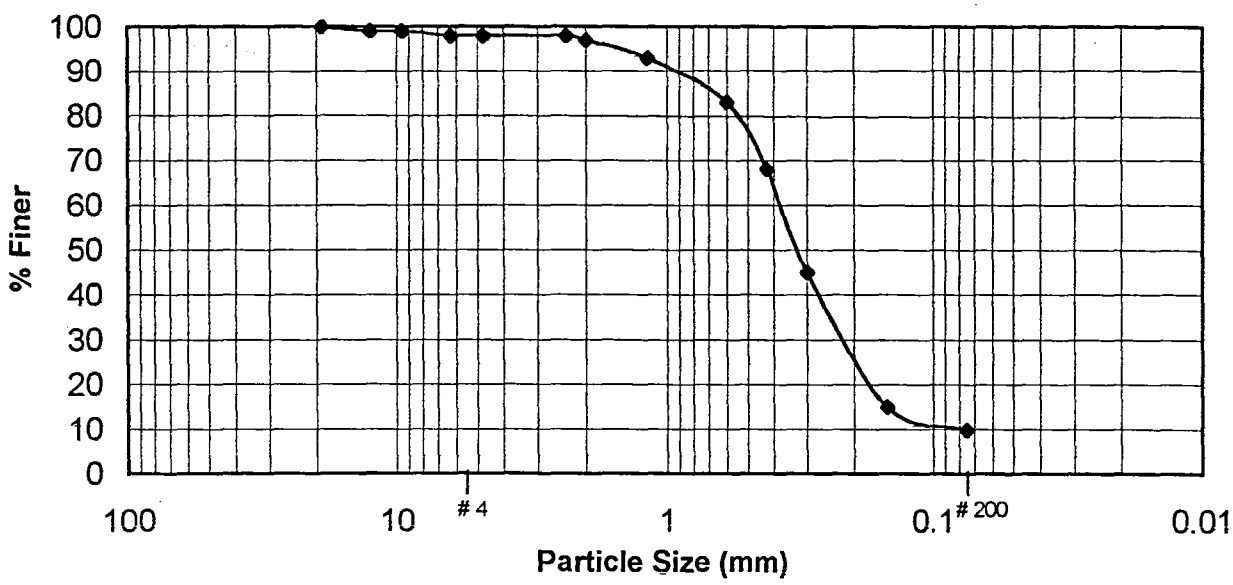
Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-22



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	100
1/2"	12.5	99
3/8"	9.5	99
1/4"	6.3	98
#4	4.75	98
#8	2.36	98
#10	2	97
#16	1.18	93
#30	0.6	83
#40	0.425	68
#50	0.3	45
#100	0.15	15
#200	0.075	9.9

Gravel Content = 2%
Sand Content = 88.1%
Fines = 9.9%

$C_u = 5.1$

$C_c = 1.5$

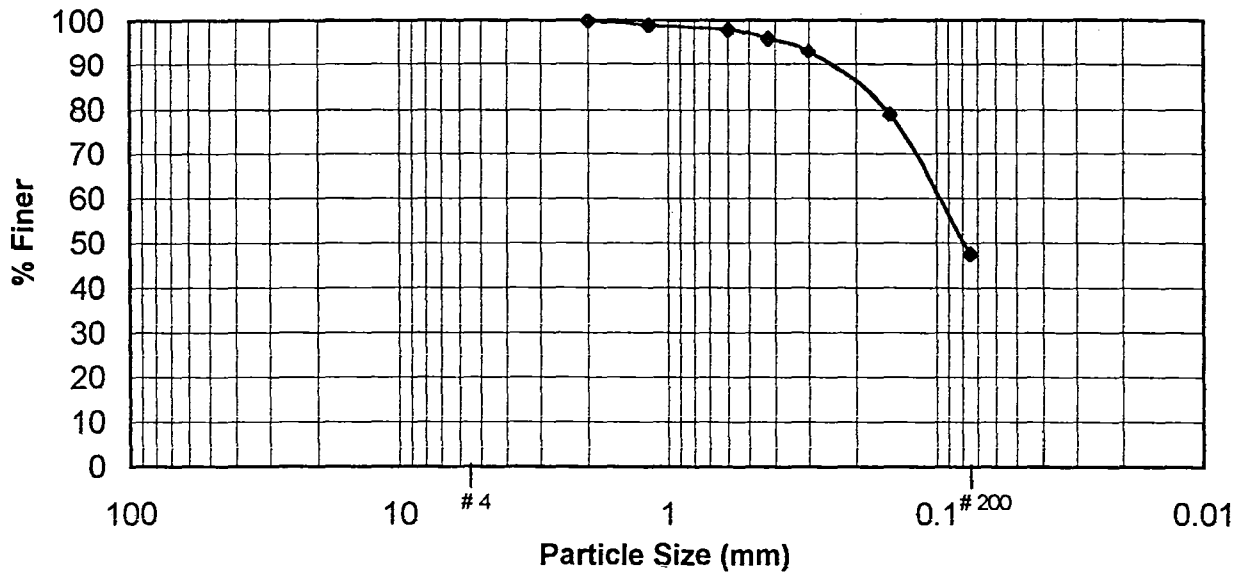
USCS Symbol = SP-SM
USCS Name : Poorly graded Sand with silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-23B



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	100
#16	1.18	99
#30	0.6	98
#40	0.425	96
#50	0.3	93
#100	0.15	79
#200	0.075	47.5

Gravel Content = 0%
Sand Content = 52.5%
Fines = 47.5%

C_u = n/a
C_c = n/a

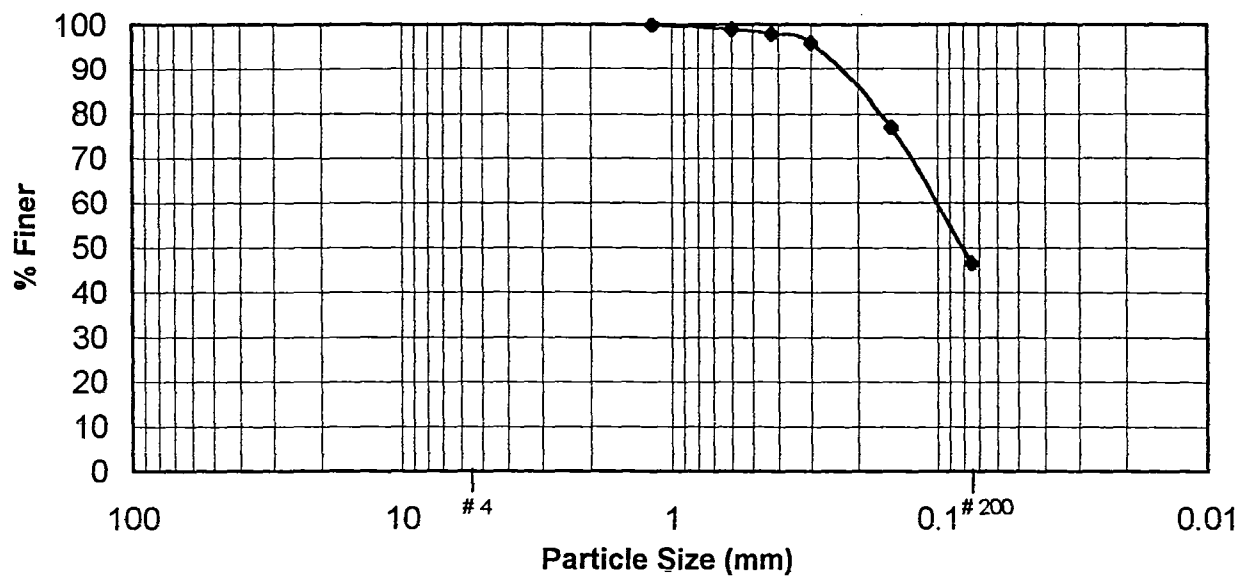
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-24



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	
#16	1.18	100
#30	0.6	99
#40	0.425	98
#50	0.3	96
#100	0.15	77
#200	0.075	46.6

Gravel Content = 0%
Sand Content = 53.4%
Fines = 46.6%

C_u = n/a
C_c = n/a

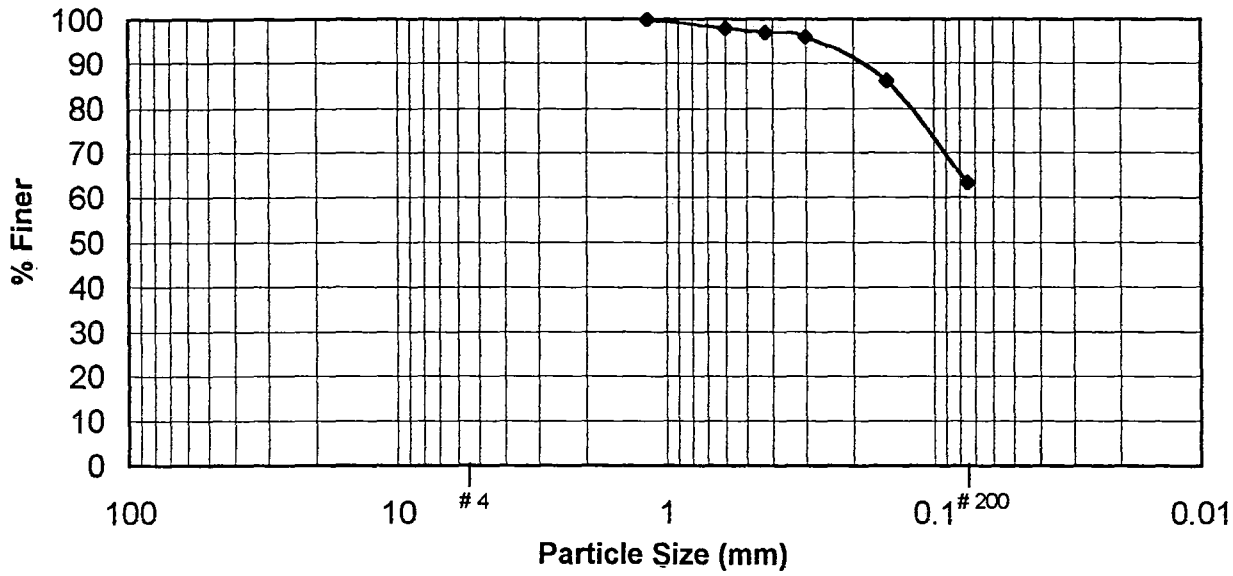
USCS Symbol = SM
USCS Name : Silty Sand

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner

Queen Creek - Sanokai Wash Hydraulic Master Plan
Flood Control District of Maricopa County, Arizona

Sediment Sample Analysis
Queen Creek / Sanokai Wash

Particle Size Analysis for SW-25



Seive #	Size (mm)	% Finer
1 1/2"	37.5	
1"	25	
3/4"	19	
1/2"	12.5	
3/8"	9.5	
1/4"	6.3	
#4	4.75	
#8	2.36	
#10	2	
#16	1.18	100
#30	0.6	98
#40	0.425	97
#50	0.3	96
#100	0.15	86
#200	0.075	63.3

Gravel Content = 0%
Sand Content = 36.7%
Fines = 63.3%

C_u = n/a
C_c = n/a

USCS Symbol = ML
USCS Name : Sandy Silt

Hoque & Associates, Inc.	
Sampled by :	Ken Turner
Sample date:	3/17/99
Tested by :	Ken Turner