
**GEOTECHNICAL INVESTIGATION REPORT
SOUTHEAST VALLEY REGIONAL DRAINAGE SYSTEM
DESIGN OF SANTAN CHANNEL - PHASE 3
ADOT CONTRACT NO. 95-53
TRACS NO. H431401D
MARICOPA COUNTY, ARIZONA**



AGRA Earth & Environmental

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Submitted To:

**DMJM
2777 East Camelback Road
Suite 200
Phoenix, Arizona 85016-4302**

Submitted By:

**AGRA Earth & Environmental, Inc.
3232 West Virginia Avenue
Phoenix, Arizona 85009-1502**



August 6, 1999

AEE Job No. 8-117-001124

August 6, 1999
AEE Job No. 8-117-001124

DMJM
2777 East Camelback Road
Suite 200
Phoenix, Arizona 85016-4302

Attention: **Jeff Minch, P.E.**
Project Manager

Gentlemen:

**RE: GEOTECHNICAL INVESTIGATION REPORT
SOUTHEAST VALLEY REGIONAL DRAINAGE SYSTEM
DESIGN OF SANTAN CHANNEL - PHASE 3
ADOT GENERAL CONSULTANT CONTRACT NO. 95-53
TRACS NO. H431401D
MARICOPA COUNTY, ARIZONA**

Submitted herein is our Geotechnical Investigation Report for Phase 3 of the Santan Channel Project. The report provides the results of our field investigation and laboratory analyses, and presents recommended criteria for the design of Collector Channel A-1, east of 56th Street. Also submitted in this report are recommendations for the new Kyrene Pump Station to be located east of Kyrene Road just north of the Santan Channel alignment.

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

Respectfully submitted,

AGRA Earth & Environmental, Inc.

Tony J. Freiman

Tony J. Freiman, P.E.
Senior Engineer



Reviewed by:

Norman H. Wetz

Norman H. Wetz, P.E.
Senior Geotechnical Engineer



c: Addressee (12)

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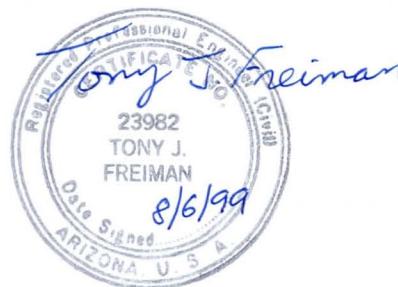
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1.0 INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by AGRA Earth & Environmental, Inc. (AEE) of the Phase 3 portion of the Santan Drainage Channel project located in the vicinity of Pecos Road and 56th Street in Chandler, Arizona. The purpose of the investigation was to examine the geotechnical profile beneath the proposed channel alignment in order to provide recommendations for foundation design, site grading and other earthwork-related elements of the Collector Channel A-1 and the new Kyrene Pump Station.

2.0 PROJECT DESCRIPTION

Details of the project were provided to us by Thomas Monchak, P.E., and Jeff Minch, P.E. of Daniel, Mann, Johnson & Mendenhall (DMJM). The Santan Channel Project is a 6-mile long storm water collection and discharge channel system that will be part of the Southeast Valley Regional Drainage System. The system will consist of a series of concrete-lined channels, multi-barreled reinforced concrete box culverts, and pipe culverts which collect and deliver water to and from a celled drainage basin (Basin B). The Phase 3 portion of the project will consist of the design of Collector Channel A-1. This east-west oriented channel will extend from 54th Street to the east past Country Club Way, a total distance of about 21,365 feet. Overall, the project consists of two collector channels draining to Basin B, which is located just west of Kyrene Road and north of Pecos Road. The western and eastern portions of the channel are about 3,600 feet and 17,765 feet in length, respectively. The section of Channel A-1 from 54th Street to 56th Street will be included as part of the Santan Freeway interchange design and is not part of this project.

The design of the channel system will be split into two segments, other than the eastern and western segments described above. Phase 3A will consist of the East Collector Channel extending from Basin B eastward to McClintock Drive, and the A-1 West Collector Channel from 56th Street to Basin B. Phase 3B will consist of the remainder of the East Collector extending to Price Road, and the Gila Drain Siphon structure.

The channel will intercept off-site flows to the south which would otherwise drain onto or pond against embankments for the planned Santan Freeway. The channel, for the most part, will be trapezoidal in shape and likely will be lined with concrete. Box culvert conduits are planned at the juncture of the East and West Collector Channels (draining into the Basin B), beneath Kyrene Road, and from McClintock Drive to just east of Country Club Way. An open, rectangular-shaped concrete-lined section, about 100 feet in length is planned just east of

McClintock Drive. The bottom of the trapezoidal channel typically will be located 5 to 13 feet below existing site grades, with an average depth of about 10 feet. Preliminary channel side slopes of 1V:2H (vertical to horizontal) are indicated on the 30 percent plans. The rectangular channel will have vertical walls 11.5 feet in height and a bottom width of about 31.5 feet.

A new sewer lift station is planned at a location 450 feet east of Kyrene Road, just north of the Santan Channel alignment. The base of the reinforced concrete structure will be at a depth of about 30 feet below the existing site grades.

3.0 INVESTIGATION

3.1 FIELD INVESTIGATION

Forty-eight test borings were drilled on approximate 450- to 500-foot intervals along the A-1 Channel alignment to depths of about 15 to 16 ½ feet below existing site grades. An additional boring (Boring No. 15A) was drilled to a depth of 41.5 feet below present site grades at the location of the lift station. The borings were advanced using subcontracted CME-75 drill rigs equipped with 6 5/8 inch O.D. hollow-stem auger. Standard penetration testing and open-end drive sampling were performed at selected intervals within the borings. Bulk samples of drill cuttings were also collected as needed. Four backhoe test pits were performed at selected locations along the alignment to depths of about 5 feet. Within the pits, sand-cone density tests were performed at selected depths to obtain data regarding estimated earthwork factors. Included in Appendix A are logs of the borings and test pits. A site plan showing the test locations is presented in the map pocket at the end of this report. The field investigation was supervised by Elizabeth A. Judd, E.I.T., Brad Walldorf, E.I.T., Tiffany Loof, G.I.T. and Stephan D. Parker, all of our firm.

3.2 LABORATORY ANALYSIS

Moisture content, grain-size analysis, Atterberg limits, density, consolidation, moisture-density relationship (standard Proctor) pH, chloride content and soluble sulfate tests were performed on selected samples. The moisture contents and densities of selected soil samples are shown on the boring logs in Appendix A. The remaining test results are presented in Appendix B, along with a brief description of laboratory testing procedures.

4.0 SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1 SITE CONDITIONS

The project alignment is relatively flat, grading downward slightly to the west-southwest. Overall, the ground surface along the alignment drops about 24 feet from the east to west. Portions of the west end of the alignment are in active farmland, although most of the alignment is now fallow. Much of the eastern two-thirds of the alignment was once designated for housing developments. It appears that at one time homes were located between McClintock Drive and County Club Way, and there is limited evidence of past foundations. Many of the asphaltic concrete (AC) paved streets still do exist. Housing developments are present immediately north of the alignment to the east of Kyrene Road. The Gila River Indian Community (GRIC) is located to the south of Pecos Road.

4.2 GEOTECHNICAL PROFILE

The geotechnical profile underlying the project site to the depths investigated can be generalized as somewhat lenticular deposits of mostly fine-grained silty and sandy clay to clayey silt, and silty to clayey sand with some relatively clean sand layers. In general the soils are somewhat more clayey on the west one-half of the alignment. Relatively clean, nonplastic sand layers are present within the upper 10 feet at the east of the project (to the east of Country Club Way).

The soils typically are soft to firm within the upper 2 to 5 feet, becoming harder with depth, mainly due to zones of weak to moderate lime cementation. **Isolated strongly lime cemented zones also were encountered** at depth within the test borings. Some of the near-surface soils have been loosened by past farming and irrigation. These **surficial soils** exhibit the characteristics of a "collapsible" soil and will also be **easily eroded** by moving water. The more silty soils are generally low in plasticity and the more clayey soils are low to medium in plasticity.

4.3 GROUNDWATER CONDITIONS

Groundwater was not encountered to the depth of investigation in any of the borings performed for this project. The soil moisture conditions were described as slightly moist to moist, and moisture contents varied from 4 to 20 percent. The depth to groundwater in the

general project site vicinity, based on maps presented by Hammet and Herther (1995)*, varies from about 105 to 140 feet below the existing ground surface.

5.0 DISCUSSION & RECOMMENDATIONS

COLLECTOR CHANNEL A-1

This portion of the project will consist predominantly of open concrete-lined trapezoidal channels with portions consisting of buried box culverts. The 30 percent plans prepared by DMJM indicate box culverts possibly being utilized between McClintock Drive and Country Club Way, beneath Kyrene Road and at the inlet to Basin B. An open, rectangular, concrete-lined channel approximately 100 feet in length is planned between two sections of box culvert just to the east of McClintock Drive. The rectangular channel apparently will allow surface water at that location to enter the drain system.

The soils encountered in the test borings should be suitable in their native condition for direct support of the lightly loaded lined channel sections. However, the upper 1.5 to 2 feet of soils present in areas of past farming activities (mostly west of McClintock Drive) have been weakened due to tilling and irrigation. Should any portion of the lined channel be constructed within the upper 2.0 feet of existing soils in these areas, it is recommended that overexcavation and compaction of at least the upper 1.5 feet of soils be performed. The limits of overexcavation should extend outward a minimum of 1.5 feet beyond the outer construction limits. Based on the design details, it appears that the top of the trapezoidal channel will be keyed back into soils which currently are below existing site grades. Provided the top of the channel is located at least 1.5 feet below existing site grades, special treatment of the existing soils is not considered necessary. The use of weep holes combined with coarse-grained backfill within the slopes of the concrete-lined channel is considered necessary only for potential water or sewer line breaks located within the near vicinity of the channel. The potential for significant groundwater or surface water infiltration which could cause a hydrostatic blowout of the channel walls is considered to be low.

The surficial soils are loose, are of low density and are easily erodible in areas of the channel alignment. Collector channels and surface drainage adjacent to the primary channel should be designed to prevent erosion of these loose soils.

*References are listed at the end of this report.

The soils present at the planned base of the box culverts and the 100-foot long rectangular channel are considered sufficiently firm in their existing condition for foundation support. Scarification and recompaction of the exposed cut surface is not considered necessary unless soft zones are encountered during construction. Presented in the following sections are recommendations regarding foundation support of the box culverts and criteria for the design of the open channels.

KYRENE PUMP STATION

The soils encountered at the pump station site consist of cemented sandy clays and clayey sands below a depth of 3.5 feet. These soils will provide support, in their native state, for the support of the lift station base. Ancillary structures supported by shallow foundations or slabs should bear on either the cemented sandy clay located at depths of 3.5 feet below the current site grade or upon at least 2.0 feet of structural fill meeting the requirements of Section 203 of the Arizona Department of Transportation (ADOT) Standard Specifications.

5.1 PUMP STATION DESIGN CRITERIA

5.1.1 Downward Loads

Contingent upon the performance of site grading as described in Section 5.5.2, a safe (dead plus live load) bearing pressure of 3.5 kips per square foot is recommended for the pump station foundation. This allowable bearing pressure will be applicable for any foundation, either spread-type or mat-type, founded at a depth greater than 3.5 feet below the existing site grades.

If any shallow foundations, above a depth of 3.5 feet are planned, the recommendations presented in Section 5.0 should be followed.

5.1.2 Lateral Loads

The passive resistance against the edges of footings, stem walls and other vertical foundation elements, in contact with properly compacted backfill or native site soils, should be considered as being equal to the force exerted by a fluid pressure of 300 pounds per square foot per foot of depth for footings placed at a depth of at least 1.5 feet below existing site grades. A coefficient of friction of 0.40 is recommended for computing the lateral resistance between the bases of footings and slabs and the soils when analyzing lateral loads.

A minimum cover depth of 18 inches should be provided above the top of footings. Where shallow footings are placed on fill, the limits of fill should extend laterally beyond the perimeter of footings a distance equal to the depth of fill beneath the footings.

5.1.3 Estimated Settlement

It is estimated that the total settlement of mat-type foundations designed in accordance with the recommendations of Section 5.1.1 will not exceed 3/4 inch for the soil moisture contents of the existing soils at the time of test drilling or for compaction moisture contents in the case of fills. Differential settlements are not expected to exceed 50 percent of the total settlement. Substantial moisture fluctuations in the supporting soils could result in additional vertical movements.

5.1.4 Surface Preparation

The exposed cut surface of the pump station foundation base should be inspected by a geotechnical engineer prior to placement of any base level course material or reinforcing steel. Any soft zones should be overexcavated and replaced with either structural fill meeting ADOT Standard Specification 203 or a one-sack aggregate base cement slurry.

If the excavation activity has loosened the upper cut surface of the pump station base, the cut surface should be fully scarified to a depth of 8 inches, brought to within the range of minus 1 to plus 3 percent of optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density as determined by AASHTO Standard Test Method T-99.

5.1.5 Pump Station Wall Design

Pump station walls likely will be conventional cast-in-place reinforced concrete. The walls, (assuming rigid conditions) will be subjected to earth pressures represented by a hydrostatic load diagram of about 55 pounds per square foot per foot of depth, assuming free-draining wall backfill as recommended in Section 5.1.5 is utilized. Rigid walls designed to restrain hydrostatic as well as earth loads will be subjected to earth pressures represented by a hydrostatic load diagram of about 100 pounds per square foot per foot of depth.

5.1.6 Pump Station Wall Backfill

Free-draining granular backfill should be utilized behind the walls up to an elevation of 2 feet below adjacent finished grade. The grading requirements for the free-draining backfill material, as determined by ADOT Test Method 201 should be as follows:

Sieve Size (square openings)	Percent Passing by Weight
3-inch	100
1.5-inch	80-100
No. 4	10-60
No. 200	0-5

The plasticity index of the fraction of material passing the no. 40 sieve should be nonplastic when tested by AASHTO Standard Test Method T-90.

It does not appear that granular soils meeting these requirements are available in sufficient quantities on-site. The predominantly finer-grained soil present at the site should be utilized in the upper 2.0 feet of backfill (below finished grade) behind the walls.

Where space permits, granular material should be placed in lifts no thicker than 1.5 feet and mechanically compacted. If the gradation of the fill is generally fine enough to permit testing by conventional means, the fill should be compacted to a density of at least 95 percent of maximum dry density as determined in accordance with AASHTO Standard Test Method T-99.

As an alternative, the on-site soils could be utilized as wall backfill if coupled with the use of synthetic drains. Drainage can be efficiently provided by a grid of geotextile drain products such as Miradrain 6000 or an equivalent approved by the geotechnical engineer.

5.2 BOX CULVERT DESIGN CRITERIA

5.2.1 Earth Pressures Against Box Culverts

The earth pressures imposed on the top, bottom and sides of buried, rigid, reinforced concrete box culverts are dependent upon support conditions, the placement and density of backfill, and the surcharge due to roadways or embankments above the box culverts. Design methods presented by Quigley and Duncan (1978) are recommended for calculating earth pressures and have been utilized in formulating the recommendations presented below.

The recommended earth pressures are based on the following assumptions:

- The backfill material surrounding the culvert structure is as dense as the in-place natural soils at the site. With this assumption, the problem is treated as a projection embankment condition, and therefore there is no trench effect or bottom effect on the structure.
- The depth below the culvert to an incompressible stratum is greater than twice the width of the culvert. Deeper test borings completed in the general area indicated that the depth to bedrock, or strongly cemented zones of appreciable thickness, is greatly in excess of twice the culvert width.
- The unit weight of compacted structure backfill is 130 pounds per cubic foot (pcf).

The recommended pressure diagrams for the design of the box culvert sections are presented in Figure 1. Values for the crown pressure factor (N) and the edge pressure factor (m) can be interpolated from Figures 2 and 3, respectively, for the box culvert configuration which will be utilized. Alternatively, if it is desired to perform a less rigorous analysis, the simplified earth pressure diagram presented in Figure 4 may be used for design.

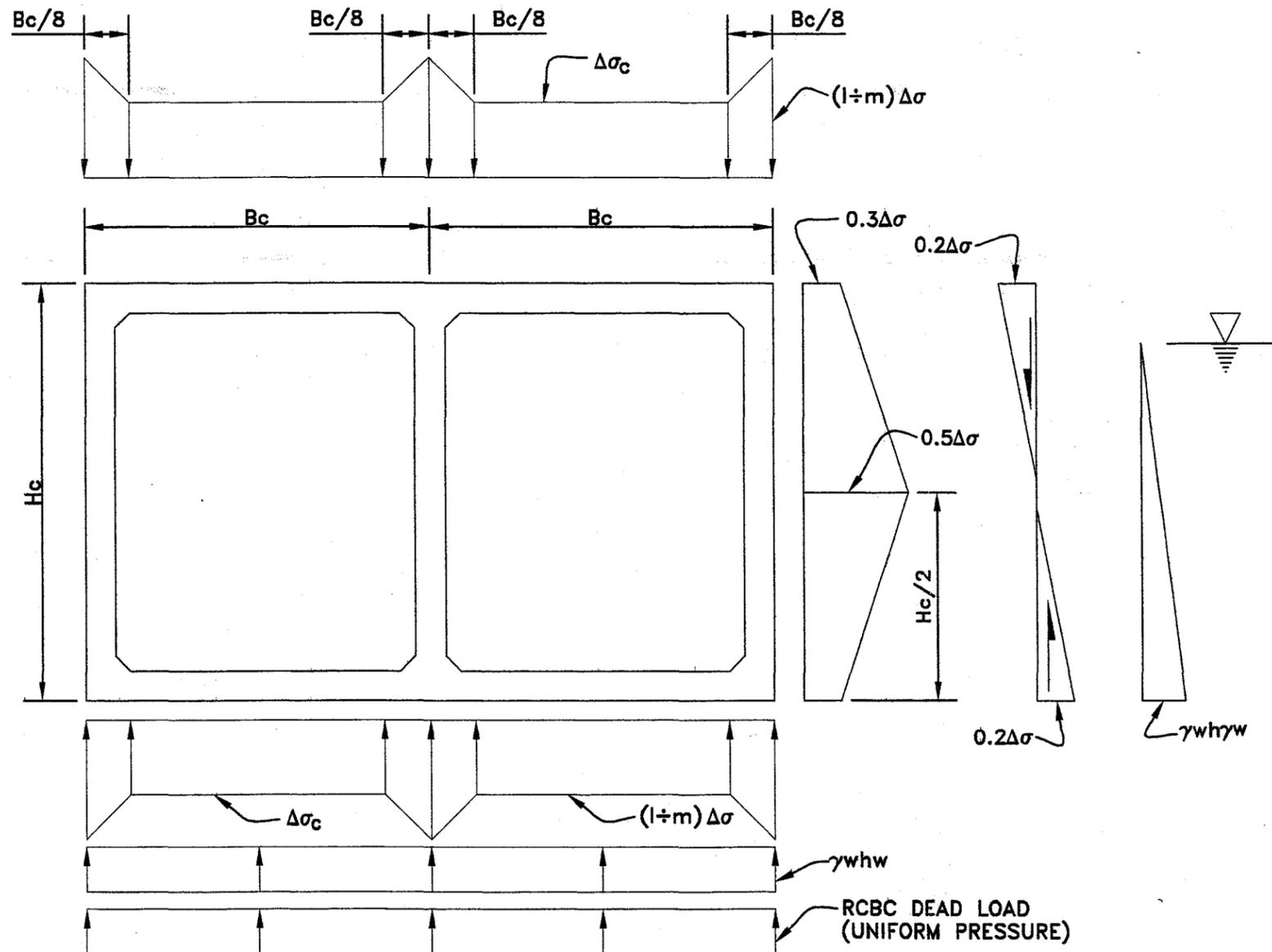
It is not anticipated that groundwater will need to be considered in the design of the box culverts.

5.2.2 Channel Wingwalls

5.2.2.1 Foundation Design

Wingwalls for box culvert inlets and outlets likely will be conventional cantilever-type walls that will be separated structurally from the box culvert. It appears that the wingwalls will be founded on firm native soils or structural fill. It is recommended that a safe soil bearing pressure of 3.0 kips per square foot (ksf) not be exceeded for footings bearing on native soils or properly compacted structure fill meeting the requirements of Section 203 of the Arizona Department of Transportation (ADOT) Standard Specifications (ADOT, 1996). Given the existing soil conditions, it is estimated that the total settlement of wingwall foundations will not exceed 3/4 inch for the above recommended soil bearing pressure. However, significant moisture fluctuations in the supporting fine-grained soils (where present) could result in additional vertical movements.

The location of the resultant of pressure on the base of the footings should be maintained within the middle one-third of the footing at its base (Section 4.4.7 of AASHTO, 1996). The uniform allowable design bearing pressure may be increased by a maximum of 40 percent in accordance with the loading cases presented in Section 3.22 of AASHTO (1996). Allowable



- $\Delta\sigma_c = NH\gamma$
- $N =$ CROWN PRESSURE FACTOR
- $H =$ BACKFILL/OVERBURDEN DEPTH ABOVE RCBC CROWN
- $\gamma =$ UNIT WEIGHT OF BACKFILL
- $m =$ EDGE PRESSURE FACTOR
- $\gamma_w =$ UNIT WEIGHT OF WATER
- $h_w =$ HEIGHT OF GROUND WATER TABLE ABOVE RCBC BASE

NOTE: PRESSURES SHOWN VALID ONLY IF DEPTH TO BEDROCK IS GREATER THAN OR EQUAL TO TWICE B_c .

<p>AGRA Earth & Environmental ENGINEERING GLOBAL SOLUTIONS 3232 West Virginia Avenue Phoenix, Arizona 85009-1502 Tel: (602)272-6848 Fax: (602)272-7239</p>	JOB NO.	6-117-000356
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FIGURE 1
 QUIGLEY & DUNCAN, (1978)
 EARTH & WATER PRESSURE DIAGRAMS
 FOR RECTANGULAR REINFORCED
 CONCRETE BOX CULVERT (RCBC)

CROWN PRESSURE FACTOR FOR HEIGHTS OF SURCHARGE (H) LESS THAN TEN TUNNEL WIDTHS, NATIVE SOIL

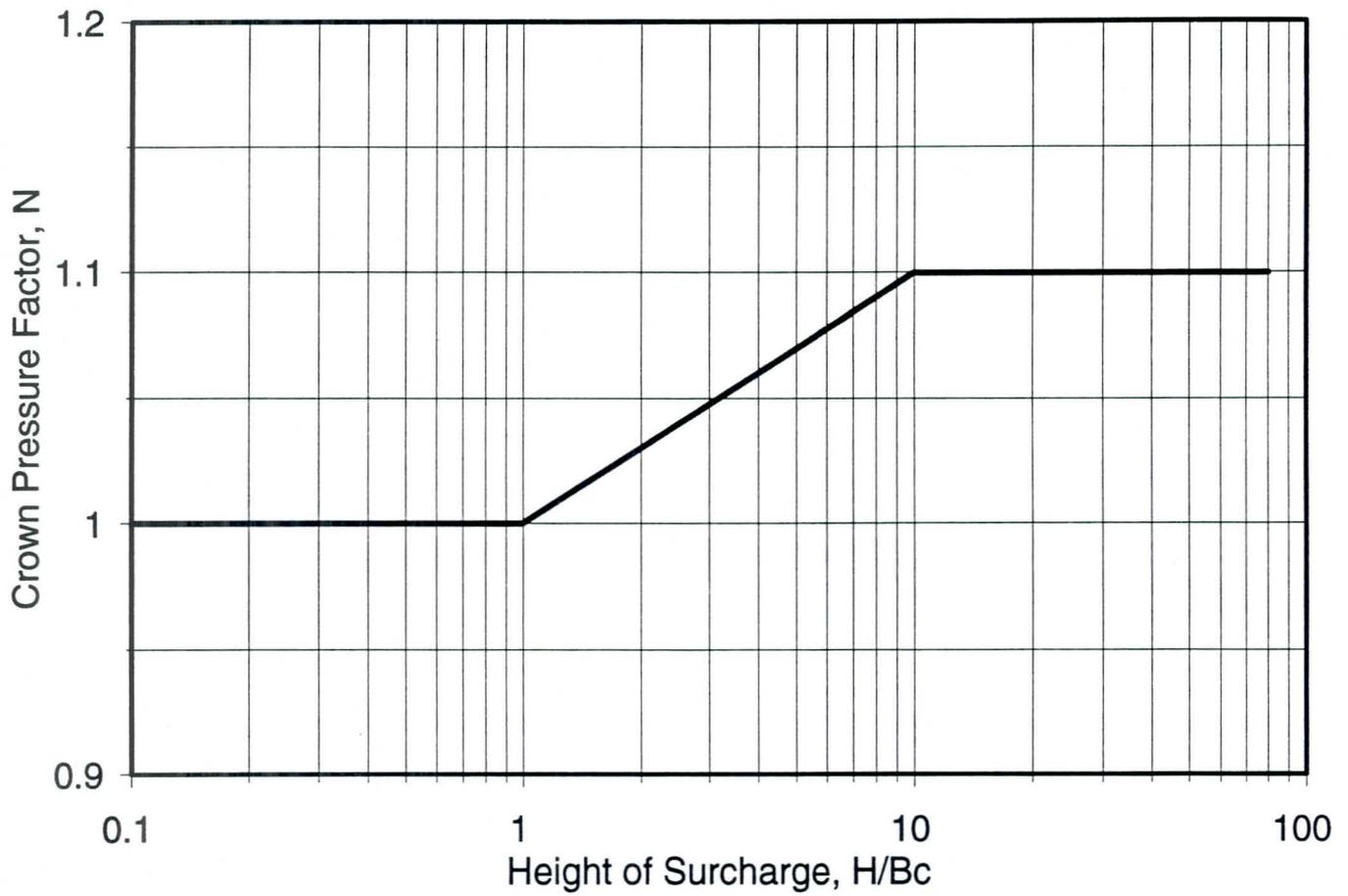


FIGURE 2

EDGE PRESSURE FACTOR FOR RECTANGULAR TUNNELS,
EMBANKMENT CONDITION & DEEP SOIL FOUNDATIONS

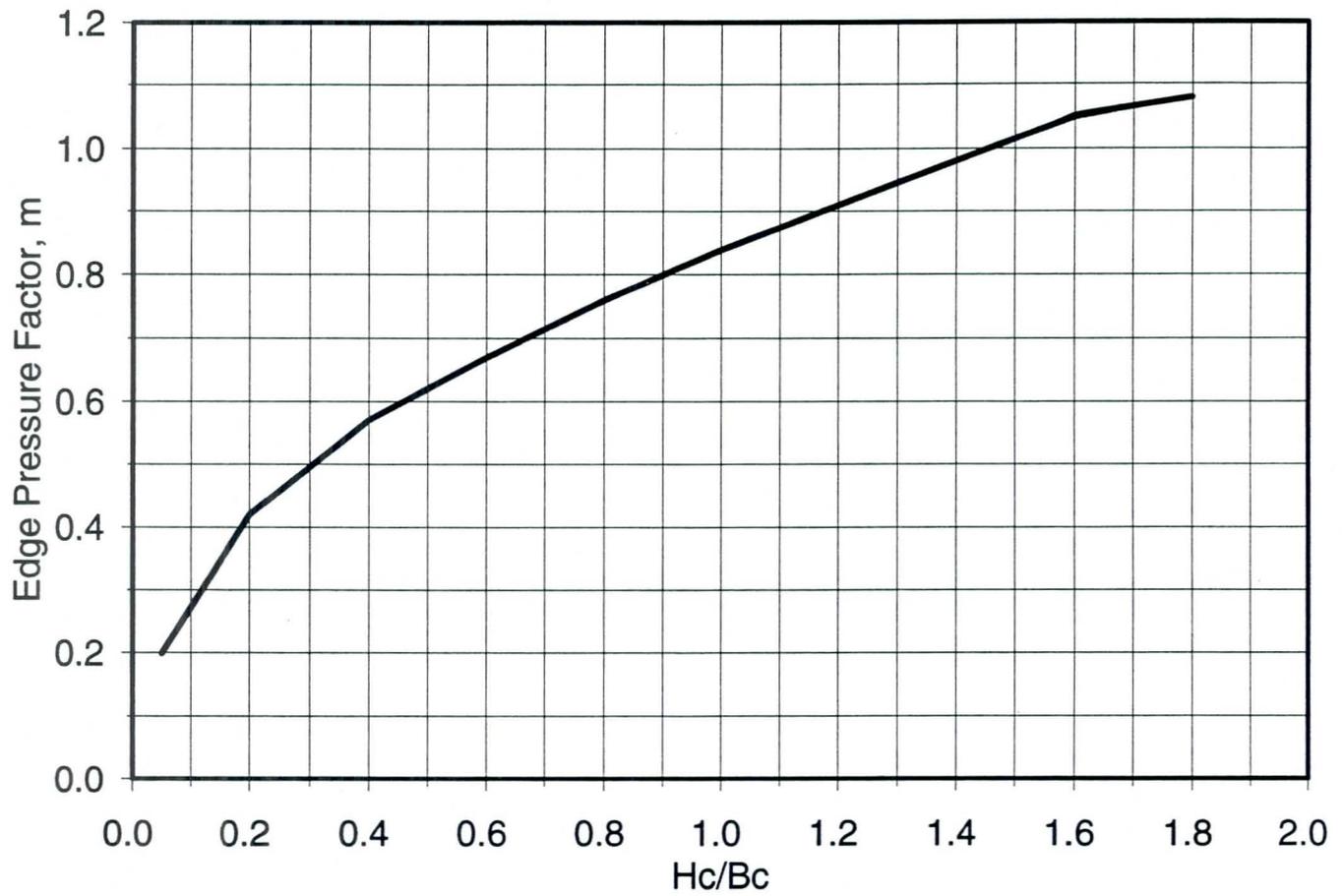
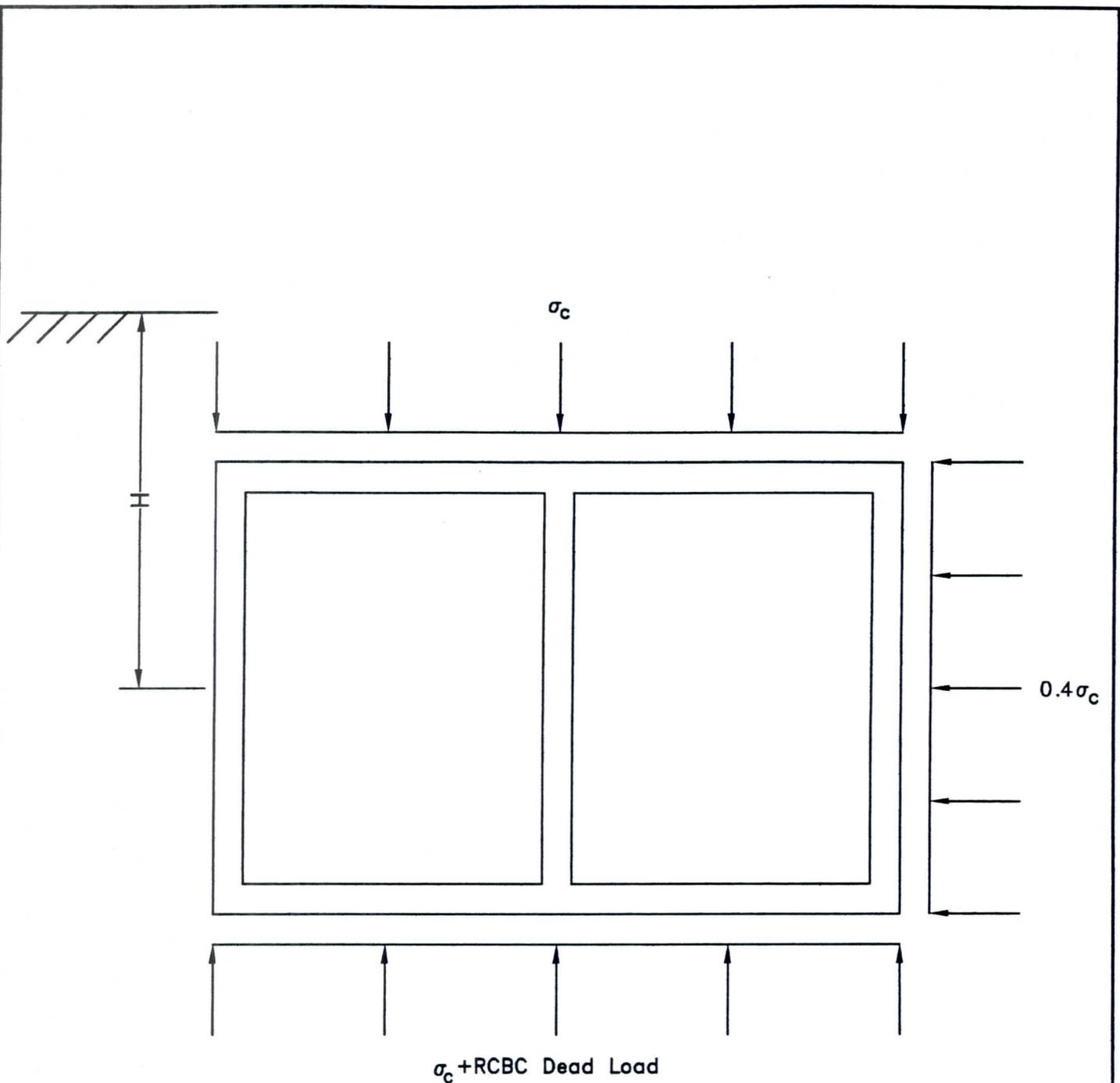


FIGURE 3



γ = Unit weight of backfill

H = Overburden depth
above RCBC crown

$\sigma_c = 1.1\gamma H$

AGRA
Earth & Environmental
 ENGINEERING GLOBAL SOLUTIONS
 3232 West Virginia Avenue
 Phoenix, Arizona 85009-1502
 Tel: (602)272-6848
 Fax: (602)272-7239

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FIGURE 4
Simplified Earth Pressure Diagram
For Concrete Box Culverts

bearing pressures were determined assuming a maximum settlement of 3/4 inch utilizing elastic settlement equations presented in Bowles (1988), and average elastic soil moduli (E_s) determined from Table 4.4.7.2.2A in AASHTO (1996) and Kulhawy and Mayne (1990). The allowable uniform bearing capacity is based on a factor of safety of greater than 3.0 in accordance with Section 4.4.7.1.2 of AASHTO (1996). Load inclination and eccentricity reductions are not included in the bearing capacity analyses presented herein, as such reductions are considered minimal with respect to the high safety factors utilized to determine the allowable pressure values.

5.2.2.2 Resistance to Lateral Loads

The passive resistance against the edges of footings, stem walls and other vertical foundation elements, in contact with properly compacted backfill or native site soils, should be considered as being equal to the force exerted by a fluid pressure of 300 pounds per square foot per foot of depth for footings placed at a depth of at least 1.5 feet below existing site grades. A coefficient of friction of 0.40 is recommended for computing the lateral resistance between the bases of footings and slabs and the soils when analyzing lateral loads.

A minimum cover depth of 18 inches should be provided above the top of footings. Where shallow footings are placed on fill, the limits of fill should extend laterally beyond the perimeter of footings a distance equal to the depth of fill beneath the footings.

5.2.2.3 Earth Pressure

The earth pressures against wingwalls will depend upon the degree of restraint. Rigid, absolutely restrained walls will be subjected to earth pressures represented by a hydrostatic load diagram of about 55 psf per foot of depth. Rotation or lateral translation of the walls equal to about 0.001 times the height will reduce earth pressures to the active state represented by a hydrostatic load diagram of about 35 psf per foot of depth. The recommended fluid pressures are based on the walls having horizontal backfill. If sloping backfills are used, modified pressures can be provided upon request. The above stated lateral earth pressures should also be utilized for design of the planned vertical channel walls if utilized just east of McClintock Drive (or any other location along the Phase 3 channel alignment).

Free-draining granular backfill should be utilized behind wingwalls. This material should meet the requirements for Class 4 aggregate base material (ADOT, 1996). This material should be compacted to at least 95 percent of maximum dry density in accordance with Arizona Test Methods 225, 226 and 227.

5.3 CHANNEL & BOX CULVERT EXCAVATIONS

5.3.1 Excavation Conditions

Based on the test borings, conventional earthmoving equipment likely can be utilized to perform the required excavations. However, ripping with a dozer or other means likely will be necessary in numerous areas where moderately to strongly lime cemented soils are encountered. In general, the more-cemented zones typically are less than about 2 to 3 feet in thickness.

5.3.2 Excavation Slopes

In general, it is recommended that temporary excavations which do not exceed about 15 feet in depth be made no steeper than 0.75H:1V (horizontal to vertical). Should steeper slopes be required due to proximity to existing structures or for purposes of economy, additional stability analyses should be performed by a registered geotechnical engineer. Flatter excavation slopes may be required in some areas if loose man-made fills or uncemented, relatively clean, sandy to gravelly soils are encountered. Caving sandy soils are anticipated to the east of McClintock Drive (about Station 4 + 300). Temporary excavations performed in this area likely will need to be sloped back no steeper than 1.25H:1V. Steeper slopes likely will require the use of trench shields or shoring.

The perimeter of all temporary excavations should be protected against surface water runoff with berms or other measures at the top of the slope. Moderate to severe raveling and erosion of the slopes could occur if impacted by runoff.

Permanent cut slopes should be constructed no steeper than 1.0V:1.5H, provided that the slope is covered with a concrete or shotcrete lining. Unprotected slopes, if required, should be laid back to at least 4H:1V to minimize surface erosion.

5.3.3 Earthwork Factors

Table 1 presents a comparison of in-place ring densities, sand cone densities and laboratory moisture-density relationship (standard Proctor) tests. The average density of 14 relatively undisturbed ring samples and eight sand cone densities was 91 pcf. The average 95 percent compaction density, determined for four standard Proctor tests, was 107 pcf. The average earthwork factor based on the above results is 15 percent shrink when comparing the in-place densities to the 95 percent compaction values. However, since the very firm to hard cemented soils present at depth could not be retrieved undisturbed with the ring sampler, it

TABLE 1
EARTHWORK FACTOR BASED ON COMPARISON OF IN-PLACE RING SAMPLE DENSITIES
& MOISTURE-DENSITY RELATIONSHIP (PROCTOR) TESTS

Test Boring/Pit Number & Depth	USCS	Undisturbed Ring Sample Density (pcf)	Proctor Density (pcf)	95% of Average Proctor Density (pcf)	Average Earthwork Factor
B11@10-11'	CL-ML	108			
B13@5-6'	CL	99			
B15@5-6'	CL-SC	91			
B19@5-6'	SC-SM	104			
B26@5-6'	SM-ML	87			
B28@10-11'	ML	102			
B30@5-6'	SC	117			
B34@5-6'	SC	97			
B38@5-6'	SC-SM	93			
B39@9.5-10.5'	SM-ML	108			
B41@4.5-5.5'	SC-SM	108			
B45@4.5-5.5'	SM	101			
B47@4.5-5.5'	SP-SM	106			
B49@9.5-10.3'	CL-ML	113			
TP1@2.0'	CL	87	102		
TP1@4.0'	CL	90			
TP2@2.0'	ML	90			
TP2@5.0'	ML	89	111		
TP3@2.0'	SM-ML	102	123		
TP3@5.0'	SM-ML	97			
TP4@2.0'	SM	91			
TP4@5.0'	SP	106	116		
AVERAGE		91	113	107	15% Shrink

*Field Density Test Data - Sand Cone Method (ASTM D1556, AASHTO T217 & T224)

is recommended that an earthwork factor (rounded to the nearest 5 percent) of 10 percent shrink be used. This factor is based on the assumption that the excavated materials will be recompacted at 95 percent of standard Proctor density at a nearby location where handling and wind losses will be of limited extent. A ground compaction factor of 0.05 feet is recommended for cut sections at depths of more than 5 feet below existing site grades.

5.4 PUMP STATION EXCAVATION

For the Kyrene Pump Station it is recommended, based on the existing soil conditions, that a temporary excavation slope of 0.75H:1V (horizontal to vertical) not be exceeded, unless verified by additional stability analysis. The additional analysis, to be performed by a registered geotechnical engineer, should take into account any external loadings, such as heavy equipment or spoil piles located near the crest of the slope.

The perimeter of all temporary excavations should be protected against surface water runoff with berms or channels at the top of the slope or by other means. Moderate raveling and erosion of the slopes could occur if impacted by runoff. Heavy equipment and spoil stockpiles should be kept a minimum of 10 feet from the edge of the cut slope.

A check of the global stability of a 0.75H:1V slope using PCSTABL5M (Achilleos, 1988) and the following soil parameters was performed. This program considers a generalized shear surface and utilizes a limiting equilibrium (simplified Janbu or simplified Bishop) method of slices procedure. Random trial shear surfaces are generated and analyzed to determine the critical shear surface. In the simplified Bishop procedure, which was utilized for the stability analysis, it is assumed that the forces on the sides of each slide are in the horizontal direction. This assumption conservatively implies that there is no friction between slices.

Depth (feet)	Moist Unit Weight (lb/ft ³)	Internal Friction Angle (degrees)	Cohesion Intercept (lb/ft ²)
0 - 3	110	32	200
3 - 30	115	30	600

The parameters generally are considered conservative, particularly the cohesion values. The results of the above analysis indicate a safety factor of greater than 2.0.

5.5 CORROSIVITY OF SITE SOILS

Total soluble-sulfate values for four samples tested ranged from 18 to 26 parts per million (ppm). The tests indicate a negligible to low potential for sulfate attack of concrete. According to Section 4.2 of the Building Code Requirements for Reinforced Concrete (ACI 318-89), the use of Type II Portland cement is recommended for sulfate contents up to 1500 ppm. The same four samples were tested for chloride and the results varied from 77 to 203 ppm. The pH for the four samples tested varied from 8.2 to 9.0. The test results are presented in Appendix B.

REFERENCES

Achilleos, E., 1988, User Guide for PCSTABL5M, Joint Highway Research Project JHRP-88/19, School of Engineering, Purdue University, West Lafayette, IN.

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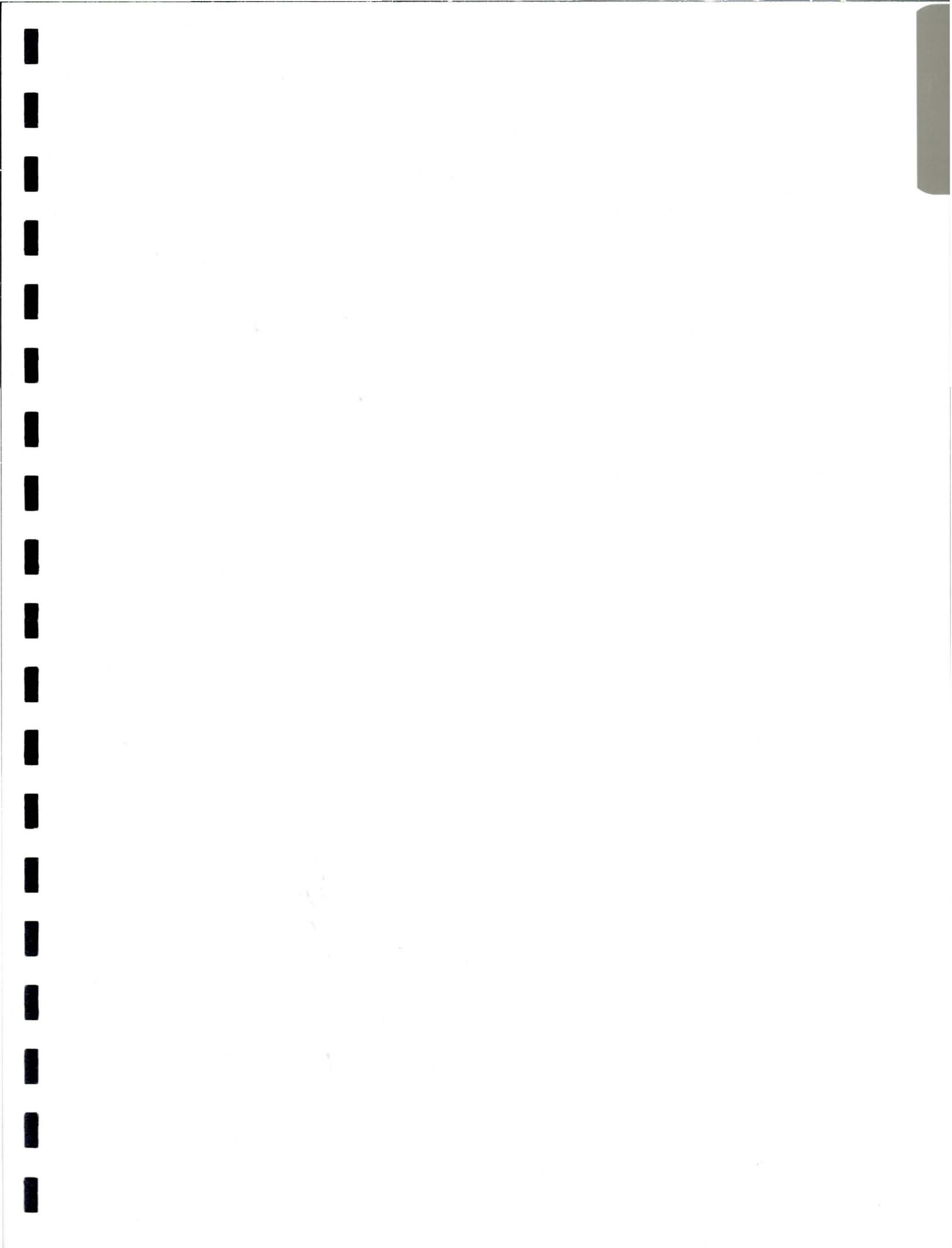
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APPENDIX A

FIELD INVESTIGATION

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Auger Boring Drilling through overburden soils is performed with 6 5/8" O.D., 3 1/4" I.D. hollow stem auger or 4 1/2" 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-55 or CME-75 truck-mounted drill rig is used to advance the auger. The drill rigs are powered with six-cylinder Ford industrial engines capable of delivering about 7,000 to 8,400 foot-pounds torque to the drill spindle. The spindle is advanced with twin hydraulic rams capable of exerting 16,000 to 20,000 pounds downward force.

Generally, refusal to penetration of the auger is adopted as top of the SGC or river-run material, which normally requires other techniques for penetration. Grab samples or auger cuttings may be taken as necessary. Standard penetration tests or 2.42" 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" O.D. by 6" I.D. or 6 5/8" O.D. by 4" 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' increments, as noted on the boring logs. Standard penetration tests or 2.42" diameter ring samples taken are noted on the boring logs.

Odex System The Odex (overburden drilling with the eccentric method) system, also referred to as the DTH (down-the-hole hammer) system, consists of a pneumatic-rotary percussion down-the-hole hammer operating at the bottom being drilled through a 5" diameter steel casing. The eccentric button percussion bit overreams the boreholes and allows advancement of the casing. The same compressed air or air-detergent (foam) mixture that operates the hammer also serves to expel the cuttings from the borehole, where they can be collected as grab samples. Retraction of the eccentric drill bit allows removal of the hammer from the center of the casing to facilitate standard penetration testing (ASTM D1586) where noted on the boring logs.

TEST DRILLING EQUIPMENT & PROCEDURES (CONT.)

Schramm Rotadrill The Schramm T64H truck-mounted drill rig is a top drive rotary rig capable of up to 85,500 inches/pounds of torque with a pulldown capacity of 35,000 lbs. Drilling is performed with either 4", or larger, diameter Tricone roller bits or 4" to 6" diameter down-the-hole hammer. Cutting removal is facilitated by compressed air or air/water mixtures and collected in a cyclone. Where noted on the boring logs, grab samples of the cuttings were collected. When casing is required to stabilize the borehole, an Aardvark drill through casing hammer is utilized, permitting simultaneous drilling and driving of the casing. Casing penetration is recorded on the boring logs in feet per minute. Standard penetration, 2.42" diameter ring samples, Shelby tubes, pitcher tube or Denison samples taken are noted on the boring logs.

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" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" 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 samplers 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.

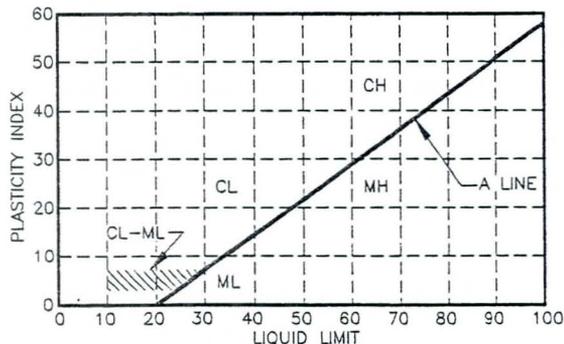
UNIFIED CLASSIFICATION SYSTEM FOR SOILS

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.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		Limits plot below "A" line & hatched zone on plasticity chart Limits plot above "A" line & hatched zone on plasticity chart	GM	Silty gravels, gravel-sand-silt mixtures.
			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.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	SP	Poorly graded sands, gravelly sands.
Limits plot below "A" line & hatched zone on plasticity chart Limits plot above "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.	
		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

**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.

<u>N</u>	<u>Relative Density</u>
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.

<u>N</u>	<u>Relative Consistency</u>	<u>Remarks</u>
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.

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

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 1

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 0+520
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.0'
 DATUM PEC Survey

Depth In Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	4-11-14			SC-SM	slightly moist firm to very firm	CLAYEY TO SILTY SAND , poorly graded, subrounded to subangular, weakly lime cemented, nonplastic to low plasticity, brown
5				U	35					
10				X	S	11-16-30		11		
								SC	slightly moist hard	CLAYEY SAND , poorly graded, subrounded to subangular, weakly lime cemented, low to medium plasticity, light brown note: sand & gravel sized moderately to strongly lime cemented nodules
15			X	S	30-50/5"					Stopped Auger at 15' Sampler refsued at 15'11"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 2

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 0+660
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	4-10-14			CL	slightly moist firm	SANDY CLAY , weakly lime cemented, low to medium plasticity, brown
5			X	S	20-50/ 5 1/2"			SC-SM	slightly moist hard	CLAYEY TO SILTY SAND , poorly graded, subrounded to subangular, weakly to moderately lime cemented, low to medium plasticity, light brown note: gravel & sand sized moderately to strongly lime cemented nodules
10			X	S	26-50/ 5 1/2"					
15			X	S	13-23- 50/5"					
20										Stopped Auger at 15' Sampler refused at 16'5"
25										

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GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 3

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 0+828
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	3-4-10			CL	slightly moist moderately firm to hard	SILTY CLAY , medium to high plasticity, dark brown
1										
2										
3										
4										
5				U	57					
6								ML	slightly moist very hard to very firm	SANDY SILT , poorly graded, subrounded to angular, weakly lime cemented, low plasticity, light brown note: some weakly to moderately lime cemented lenses
7										
8										
9										
10				S	29-49-50/4"		18			
11										
12										
13										
14										
15				S	14-22-24					
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

Stopped Auger at 15'
 Stopped Sampler at 16'6"

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 4

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 0+988
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	2-2-3			CL/CH	moist soft	SILTY CLAY , medium to high plasticity, brown
5			X	S	12-40-50/5"			SC-SM	slightly moist hard	CLAYEY SAND , considerable silt, poorly graded, subangular to angular, weakly to moderately lime cemented, medium plasticity, light brown to tan note: some sand & gravel sized moderately to strongly lime cemented nodules
10				U	63		19			
15			X	S	20-50/5"					
20										Stopped Auger at 15' Sampler refused at 15'11"
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 5

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 1+147
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S	S	4-7-12			CL	moist moderately firm	SILTY CLAY , some fine grained sand, medium to high plasticity, dark brown
5			S	S	14-14-17			SM	moist to slightly moist very firm to hard	SILTY SAND , poorly graded, subrounded to subangular, weakly to moderately lime cemented, nonplastic to low plasticity, light brown
10			S	S	25-28-50/4"					
15			S	S	38-35-28			SC-CL	slightly moist hard	CLAYEY SAND TO SANDY CLAY , poorly graded, subrounded to subangular, weakly to moderately lime cemented, low to medium plasticity, brown to light brown
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

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GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 6

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION Sta. 1+307
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1155.7'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	3-2-2			CL	slightly moist very soft to soft	SILTY CLAY , some fine grained sand, medium to high plasticity, dark brown
5				U	35			CL-ML	slightly moist firm to very firm	SILTY TO SANDY CLAY , weakly lime cemented, low to medium plasticity, brown
10				S	8-11-17					
15				S	1-31-50/4"		15	SM	slightly moist hard	SILTY SAND , poorly graded, subangular to angular, weakly to moderately lime cemented, low plasticity, light brown note: gravel & sand sized strongly lime cemented nodules Stopped Auger at 15' Sampler refused at 16'4"
20										
25										

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GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample



PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 8

JOB NO. 8-117-001124 DATE 12/21/98

LOCATION _____
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.7'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0			X	S	4-10-16			CL	slightly moist very firm	SANDY CLAY , low to medium plasticity, light brown	
5			X	S	50/5 1/2"			SC-CL	slightly moist hard	CLAYEY SAND TO SANDY CLAY , some fine grained gravel, poorly graded, subangular to angular, weakly to moderately lime cemented, medium plasticity, light brown	
10			X	S	22-30-44		20				
15			X	S	18-24-36						
20										Stopped Auger at 15' Stopped Sampler at 16'6"	
25											

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GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 9

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION _____
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1156.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	13-16-16			CL	slightly moist very firm	SANDY CLAY , predominantly fine grained sand, low to medium plasticity, light brown
5				U	100/10"			SC	slightly moist hard	CLAYEY SAND & GRAVEL , poorly graded sand & gravel, angular to subangular, weakly to moderately lime cemented, low to medium plasticity, brown
10				S	23-50/ 5 1/2"			CL	slightly moist hard	SANDY CLAY , weakly to moderately lime cemented, low to medium plasticity, white to light brown
15				S	23-33-30					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 10

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION _____
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1157.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	16-16-20			CL	slightly moist very firm	SANDY CLAY , predominantly fine grained sand, low to medium plasticity, brown
5				S	16-20-25			SC	slightly moist very firm	CLAYEY SAND & GRAVEL , poorly graded, angular to subangular, weakly lime cemented, low to medium plasticity, light brown
10				S	19-25-40			CL-ML	slightly moist hard	SANDY CLAY TO CLAYEY SILT , predominantly fine grained sand, weakly lime cemented, low to medium plasticity, brown
15				S	13-17-21			SC-CL	slightly moist hard to very firm	CLAYEY SAND TO SANDY CLAY , poorly graded sand, subangular to angular, weakly to moderately lime cemented, low to medium plasticity, light brown note: sand & gravel sized strongly lime cemented nodules
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 11

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+140
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1157.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
									slightly moist firm to hard	SANDY CLAY , weakly to moderately lime cemented, low to medium plasticity, brown
5				S	40-40-50/3"			SC-SM	slightly moist hard	SILTY TO CLAYEY SAND , poorly graded, angular to subangular, weakly to moderately lime cemented, low to medium plasticity, white to light brown note: sand & gravel sized strongly lime cemented nodules
10				U	100	108	12			
15				S	27-50/4"					
										Stopped Auger at 15' Sampler refused at 15'10"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 12

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+250
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1158.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	3-5-9			CL	slightly moist moderately firm	SILTY CLAY , low to medium plasticity, light brown
5			X	S	15-30-48			CL	slightly moist to moist hard to very firm	SANDY CLAY , weakly to moderately lime cemented, low to medium plasticity, light brown note: moderately to strongly lime cemented nodules
10			X	S	15-30-34					
15			X	S	15-20-14					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 13

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+420
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1159.8
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	12-7-9			CL	slightly moist firm	SANDY CLAY , predominantly fine grained sand, low to medium plasticity, brown
5				U	36	98	10	CL-SC	slightly moist firm to hard	SANDY CLAY TO CLAYEY SAND , poorly graded sand, angular to subangular, weakly lime cemented, low to medium plasticity, light brown
10			X	S	14-18-22					
15			X	S	18-20-25					Stopped Auger at 15' Stopped Sampler at 16'6"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 14

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+580
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1167.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	4-7-7			CL	slightly moist moderately firm	SILTY TO SANDY CLAY , low to medium plasticity, brown
								CL-SC	slightly moist firm to hard	SANDY CLAY TO CLAYEY SAND , predominantly medium to fine grained sand, subrounded to subangular, weakly to moderately lime cemented, low to medium plasticity, light brown
5			X	S	13-16-18					
10			X	S	25-50/5"					
15			X	S	19-22-21					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 15

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+660
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1162.8'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0			X	S	2-5-5			CL	slightly moist moderately firm	SANDY CLAY , low to medium plasticity, brown note: surface debris including concrete & household rubbish	
5				U	20	91	7	CL-SC	slightly moist firm to hard	SANDY CLAY TO CLAYEY SAND , predominantly medium to fine grained sand, subrounded to subangular, weakly lime cemented, low to medium plasticity, brown to light brown	
10			X	S	50/5"						
15			X	S	23-38-28						
20											
25											

Stopped Auger at 15'
 Stopped Sampler at 16'6"

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 15A

JOB NO. 8-117-001124 DATE 3/11/99

LOCATION _____
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. _____
 DATUM _____

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per. Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			⊗	S	12-16 15			SC	slightly moist very firm	CLAYEY SAND , some silt, predominantly medium to fine grained, subrounded to subangular, low to medium plasticity, brown
5				U	51	97	10	CL	slightly moist to moist hard	SANDY CLAY , fine grained sand, weakly to moderately lime cemented, medium plasticity, light brown
10			⊗	S	50/4"					
15			⊗	S	19-27- 37					
20			⊗	S	10-19- 25			CL/SC	moist very firm to hard	SANDY CLAY TO CLAYEY SAND , predominantly medium to fine grained sand, subrounded to subangular, weakly lime cemented, low to medium plasticity, brown to light brown note: some thin layers of moderate to strong lime cementation
25			⊗	S	8-32- 45					
30				U	50	108	19	CL/SC	slightly moist to moist hard to firm	SANDY CLAY TO CLAYEY SAND , poorly graded sand, subrounded to subangular, weakly to moderately lime cemented, medium plasticity, brown note: some sand & gravel-sized (moderately to strongly lime cemented) nodules
35			⊗	S	22-23- 29					
40			⊗	S	10-10- 14					
45										Stopped Auger at 40' Stopped Sampler at 41'6"
50										

BORING LOG 81171124.GPJ_AGRA_ALB.GDT 4/2/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 16

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+800
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1163.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	2-10-10			CL	slightly moist firm	SANDY CLAY , predominantly fine grained sand, low to medium plasticity, brown
5				S	11-17-24			SC-SM	slightly moist very firm to hard	SILTY SAND TO CLAYEY SAND , poorly graded, angular to subangular, weakly to moderately lime cemented, low to medium plasticity, brown to whitish brown note: some sand & gravel sized strongly lime cemented nodules
10				S	25-48-50/5"					
15				S	11-12-34					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 17

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 0+940
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1168.3'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0		[Hatched Pattern]	X	S	7-7-7			SC-SM	slightly moist moderately firm to firm	CLAYEY TO SILTY SAND , predominantly fine grained, weakly lime cemented, low to medium plasticity, brown	
5			X	S	7-9-9		4				
10									CL-SC		slightly moist hard
15			X	S	18-24-28			CL	moist hard	SANDY CLAY , predominantly fine grained sand, weakly lime cemented, low to medium plasticity, brown	
20										Stopped Auger at 15' Stopped Sampler at 16'6"	
25											

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/98

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 18

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+080
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1165.2'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		[Hatched pattern]	X	S	8-15-21			SC-CL	slightly moist very firm	SANDY CLAY TO CLAYEY SAND , fine grained sand, low to medium plasticity, brown note: some fill stockpiles at surface
5			X	S	5-15-15					
10			X	S	10-17-32			SC-SM	slightly moist very firm to hard	
15			X	S	15-50/5 1/2"				Stopped Auger at 15' Sampler refused at 15'11 1/2"	
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 19

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+220
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1165.7'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	8-10-12			CL	slightly moist moderately firm	SANDY CLAY , fine grained sand, low to medium plasticity, brown
								SC-SM		SILTY SAND TO CLAYEY SAND , poorly graded, subrounded to subangular, weakly to moderately lime cemented, low to medium plasticity, light brown
5				U	38	104	5		slightly moist firm to hard	
10			X	S	13-15-21		14			
15			X	S	13-23-28					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 20

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+360
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1166.5'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
5			X	S	7-9-11			CL-SC	slightly moist firm	SANDY CLAY TO CLAYEY SAND , predominantly medium to fine grained sand, weakly lime cemented, low to medium plasticity, brown note: some moderately lime cemented nodules
10			X	S	23-25-27			SC-SM	slightly moist hard to very firm	SILTY SAND TO CLAYEY SAND , poorly graded sand, weakly lime cemented, low plasticity, light brown to whitish brown note: some moderately lime cemented nodules
15			X	S	8-13-26					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 23

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+500
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1166.5
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
5			S	9-13- 28			8			
10			S	9-14- 33				moist to slightly moist very firm to hard	SILTY SAND TO SANDY SILT , fine grained sand, weakly lime cemented, low plasticity to nonplastic, brown	
15			S	14-17- 25				slightly moist very firm	SILTY CLAY , weakly lime cemented, low to medium plasticity, brown	
20									Stopped Auger at 14'6" Stopped Sampler at 16'	
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH 81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 24

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+640
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1167.7
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
5			S	7-4-12				SM/SP	moist moderately firm to hard	SILTY SAND TO SANDY SILT , fine grained sand, low plasticity to nonplastic, light brown
10			U	65		16		ML/CL	moist to slightly moist hard	SANDY SILT TO SANDY CLAY , fine grained sand, weakly lime cemented, low to medium plasticity, brown
15			S	20-18-38						
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 25

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+780
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1168.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist firm	SANDY SILT , fine grained sand, weakly lime cemented, nonplastic, light brown
5			X	S 7-12-17						
10			X	S 20-30-39				ML	slightly moist hard	CLAYEY SILT , weakly lime cemented, light brown to grayish brown
15			X	S 5-6-11				CL	slightly moist firm	SILTY CLAY , medium plasticity, light brown to grayish brown
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 26

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 1+920
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1169.3'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist	SANDY SILT , fine grained, nonplastic, light brown
5				U	36	87	4	SM-ML	slightly moist firm to hard	SANDY SILT , trace of gravel, weakly lime cemented, low plasticity, light brown note: some moderately to strongly lime cemented nodules below 14'
10				S	25-18-21					
15				S	18-40-40					
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 27

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+060
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1168.9'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist firm	SANDY SILT , predominantly fine grained sand, nonplastic, brown
5				S 7-8-10						
10				S 12-15-19				SM-ML	moist to slightly moist very firm	SANDY SILT , weakly lime cemented, low plasticity, light brown note: some moderately lime cemented nodules
15				S 50/4"				MI	slightly moist hard	CLAYEY SILT , some gravel, moderately lime cemented, low plasticity, light brown Stopped Auger at 15' Sampler refused at 15'4"
20										
25										

GEOTECH_BH 81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 28

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+203
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1168.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist very firm to firm	SANDY SILT , fine grained sand, nonplastic, brown
5				S 14-17-19						
10				U 23	102	10				
15				S 17-25-50/4"				ML	slightly moist hard	CLAYEY SILT , some fine grained sand, low plasticity, reddish brown note: moderately lime cemented below 15'6"
20										Stopped Auger at 15' Sampler refused at 16'4"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 29

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+340
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1167.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist firm to very firm	SANDY SILT , fine grained, weakly lime cemented, nonplastic, brown
5			S 25-20-11					SM	slightly moist	SILTY SAND , fine grained, nonplastic, reddish brown
10			S 15-15-23					ML	slightly moist very firm	SANDY SILT , trace of gravel, weakly lime cemented, nonplastic to low plasticity, light brown
15			S 7-50/6"					SM	slightly moist hard	SILTY SAND , fine grained, weakly to moderately lime cemented, nonplastic, brown note: moderately to strongly lime cemented nodules below 15'
20										Stopped Auger at 15' Sampler refused at 16'
25										

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 30

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+480
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1169.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
5				U	90	116	10		slightly moist hard	CLAYEY SAND TO SANDY SILT, trace to some fine grained gravel, weakly lime cemented, low to medium plasticity, light brown
10				S	13-20-33					
15				S	12-33-50/3"					
20										Stopped Auger at 15' Sampler refused at 16'3"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 31

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+620
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1169.7
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist	SANDY SILT , fine grained, nonplastic, light brown
5			S	27-50/5"				ML	slightly moist hard	CLAYEY SILT , weakly to moderately lime cemented, low plasticity, light brown
10			S	20-19-29				ML-CL	slightly moist very firm	CLAYEY SILT , some fine grained sand, weakly lime cemented, low to medium plasticity, light brown note: some fine grained sand lenses
15			S	12-18-19						
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 32

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+760
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1169.7'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML	slightly moist firm to hard	SANDY SILT , fine grained sand, nonplastic, brown note: weakly to moderately lime cemented below 10'
5			X	S 9-10-16						
10			X	S 39-50/5"						
15			X	S 22-38-50/5"				ML	slightly moist hard	CLAYEY SILT , some fine grained, weakly to moderately lime cemented, low plasticity, brown
20										Stopped Auger at 15' Sampler refused at 16'4"
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH 81171124.GPJ_AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 33

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 2+900
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1171.0'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML-CL	slightly moist firm to hard	SANDY SILT , fine grained sand, low plasticity, light brown
5			X	S 7-10-12						
10			X	S 12-15-50/5"						
15			X	S 19-38-50/5"				ML	slightly moist hard	GRAVELLY SILT , fine grained gravel, weakly lime cemented, nonplastic, light brown note: some clay below 16' note: some moderately lime cemented lenses
20										Stopped Auger at 15' Sampler refused at 16'5"
25										

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH 81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 34

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+040
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1171.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									slightly moist to moist firm	CLAYEY SAND , some silt, fine grained, low to medium plasticity, brown
5			U		19	97	10			
10			S	26-23-27					slightly moist very firm to hard	SILTY SAND , trace to some fine grained gravel, weakly lime cemented, nonplastic to low plasticity, brown note: some moderately to strongly lime cemented nodules below 14'
15			S	10-16-22						
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH 81171124.GPJ_AGRA_ALB.GDT 1/9/99

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 35

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+180
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1172.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
5				S 7-6-7						
10				S 17-28-50/5"						
15				S 24-27-26				CL	slightly moist hard	SANDY CLAY , trace of gravel, medium grained sand, weakly to moderately lime cemented, low to medium plasticity, light brown note: considerable moderately to strongly lime cemented nodules below 13'
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 36

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+320
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1172.8'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM-SC	slightly moist moderately firm	CLAYEY SAND TO SILTY SAND , fine grained sand, low plasticity, brown note: strongly lime cemented lense at 10'
5				S 4-4-6						
10				S 50/3"						
								SM	slightly moist firm to hard	SILTY SAND , fine to medium grained, weakly to moderately lime cemented, light brown
15				S 17-18-27				ML	slightly moist very firm	SANDY SILT , some clay, trace of fine grained gravel, predominantly fine grained sand, weakly lime cemented, low plasticity, brown
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 37

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+460
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1172.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0									SM	slightly moist moderately firm	SILTY SAND , fine grained, low plasticity, light brown
5			X	S 6-8-9					SP	slightly moist medium dense	SAND , fine to medium grained, nonplastic, brown
			X						ML	slightly moist hard	SANDY SILT , trace of gravel, fine grained sand, weakly to moderately lime cemented, nonplastic to low plasticity, light brown
10			X	S 40-50/4"							
15			X	S 14-21-37							
20											Stopped Auger at 15' Stopped Sampler at 16'6"
25											

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH 81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 38

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+600
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1174.3'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SC-SM	slightly moist firm to very firm	SILTY TO CLAYEY SAND , trace of fine grained gravel, fine grained, low plasticity, brown
5				U	44	93	4			
10				S	17-31-50/3"			SC	slightly moist hard	CLAYEY SAND , some fine grained gravel, weakly to moderately lime cemented, low to medium plasticity, brown
15				S	26-42-41			SM	slightly moist hard	SILTY SAND , some fine grained gravel, fine grained, weakly lime cemented, nonplastic, brown
20										Stopped Auger at 15' Stopped Sampler at 16'6"
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 39

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+740
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1174.5'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								ML/SM	slightly moist very firm	SILTY SAND TO SANDY SILT , predominantly fine grained sand, nonplastic to low plasticity, light brown
5				S 12-16-17						
10				U 39	108	4				
15				S 24-50/5"				ML/CL	moist very firm	SILTY CLAY , low to medium plasticity, weakly to moderately lime cemented, light brown
20										Stopped Auger at 14'6" Sampler refused at 15'5"
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

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PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 40

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 3+877
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1176.5'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									slightly moist to moist medium dense	SILTY SAND TO SILTY GRAVEL , gap graded sand, fine grained gravel, subangular to subrounded, low plasticity, light brown to brown
5			S 14-15-15					SM	moist very firm	SILTY SAND , trace of fine grained gravel, predominantly fine grained, subrounded, low plasticity to nonplastic, brown
10			S 19-24-28					SM/ML	moist hard	SANDY SILT TO SILTY SAND , fine grained sand, weakly to moderately lime cemented, low plasticity, brown note: some moderately to strongly lime cemented gravel sized clay nodules below 14'
15			S 50/6"							Stopped Auger at 14' Sampler refused at 14'6"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 41

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+040
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1179.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	slightly moist	SILTY SAND , some fine grained gravel, predominantly fine grained sand, subrounded, low plasticity, light brown
5			U	88	108	7		SC-SM	slightly moist to moist hard to very firm	SILTY SAND TO CLAYEY SAND , fine grained, weakly lime cemented, low plasticity, reddish brown note: moderately lime cemented below 14'
10			S A	22-26- 21						
15			S	50/4"						Stopped Auger at 14'6" Sampler refused at 14'10"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 42

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+180
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1174.9'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	moist to slightly moist	SILTY SAND , trace of fine grained gravel, predominantly fine grained sand, subangular to subrounded, low plasticity to nonplastic, brown
5			S	5-5-5					moderately firm	
10			S	30-50/ 5 1/2"				SM/SC	moist to slightly moist	
15			S	20-15-18					hard to very firm	SILTY SAND TO CLAYEY SAND , predominantly fine to medium grained, weakly to moderately lime cemented, low plasticity to nonplastic, brown note: trace to some strongly lime cemented gravel sized nodules
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH 81171124.GPJ_AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 43

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+309
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1175.3'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	moist	SILTY SAND , trace of fine grained gravel, predominantly fine grained, subangular to subrounded, nonplastic, brown note: considerable fine grained gravel below 3'
5			S A	6-6-6				SP	moist medium dense	SAND , trace fine grained gravel, predominantly medium grained, subrounded to subangular, nonplastic, brown
10			U	80		16		SM	moist hard	SILTY SAND , fine grained, weakly to moderately lime cemented, low plasticity to nonplastic, brown to light brown note: occasional moderately to strongly lime cemented nodules from 9'6" to 13'
15			S	17-35-35				SP/SM	moist hard	SAND TO SILTY SAND , predominantly fine grained, low plasticity to nonplastic, brown
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GEOTECH_BH 81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 44

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+460, 6' R
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1176.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM/ML	moist	SANDY SILT TO SILTY SAND , predominantly fine grained sand, low plasticity to nonplastic, brown note: layer of sandy clay from 2' to 4'
5			X	S 5-6-8				SP	moist medium dense	SAND , trace of fine grained gravel, predominantly medium grained, subrounded to subangular, nonplastic, brown
10			X	S 11-20-28				SM	moist very firm	SILTY SAND , predominantly fine grained, low plasticity to nonplastic, brown
15			X	S 25-30-35			16	SM	moist hard	SAND , fine to medium grained, nonplastic, brown SILTY SAND , predominantly fine grained, weakly lime cemented, low plasticity, brown
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 45

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+614
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1177.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	moist	SILTY SAND , predominantly fine grained, low plasticity, reddish brown to brown note: trace of fine grained gravel from 7' to 9'
5			U		15	101	10		moderately firm	
10			S		7-7-8					
								SC/SM	moist	CLAYEY SAND TO SILTY SAND , fine grained, low to medium plasticity, brown
									moderately firm	
15			S		21-35-35			SM	moist	SILTY SAND , predominantly fine grained, weakly lime cemented, nonplastic, brown
									hard	
20										Stopped Auger at 14'6" Stopped Sampler at 16'
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT_1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 46

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+740
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1179.1'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM/SC	moist moderately firm	SILTY SAND TO CLAYEY SAND , predominantly fine grained, low to medium plasticity, brown
5			X	S 5-5-7						
10			X	S 15-17-20				SP	moist dense to very dense	SAND , predominantly medium to fine grained, subrounded to subangular, nonplastic, brown note: some fine grained gravel from 9' to 10' note: occasional lenses of low plasticity silt note: moderately lime cemented clay layer below 14'6"
15			X	S 50/4"						Stopped Auger at 14'6" Sampler refused at 14'10"
20										
25										

GEOTECH_BH 8:117:124.GPJ_AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 47

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 4+880
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1179.6'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SP-SM	moist medium dense	SAND TO SILTY SAND , predominantly fine to medium grained, subrounded to subangular, nonplastic, brown note: trace of fine grained gravel below 7'
5				U	15	106	10			
10				S	8-18-30			SM	moist very firm to hard	SILTY SAND , predominantly fine grained, weakly to moderately lime cemented, nonplastic, brown
15				S	50/4"					Stopped Auger at 14'6" Sampler refused at 14'10"
20										
25										

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT_1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE
 A - Auger cuttings; NR - No Recovery
 S - 2" O.D. 1.38" I.D. tube sample
 U - 3" O.D. 2.42" I.D. tube sample
 T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 48

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 5+020
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1180.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				A				SM/SC	moist	SILTY SAND TO CLAYEY SAND , trace of fine grained gravel, predominantly fine to medium grained, subangular to subrounded, low plasticity, brown
5			S	7-7-12			7	SP-SM	moist medium dense	SILTY SAND , trace of fine grained gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic, brown
10			S	14-13-19				ML/SM	moist very firm to hard	SILTY SAND TO SANDY SILT , fine grained sand, low plasticity to nonplastic, brown note: grading to fine to medium grained sand with increase in lime cementation (moderate to strong) below 14'
15			S	50/3 1/2"						Stopped Auger at 14'6" Sampler refused at 14'9 1/2"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 49

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 5+160
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1180.8'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SP-SM	moist medium dense	SILTY SAND , trace of fine grained gravel, predominantly fine to medium grained sand, subrounded, low plasticity, brown
5			X	S 5-5-6						
10				U	105	113	16	CL/ML	moist hard	SANDY CLAY , some silt, fine grained sand, weakly lime cemented, low to medium plasticity, brown
15			X	S 50/3"				SP	moist very dense	SAND , fine grained, nonplastic, brown note: moderately lime cemented below 14' note: trace of fine grained gravel below 14'6" Stopped Auger at 14'6" Sampler refused at 14'9"
20										
25										

GEOTECH_BH 81171124.GPJ AGRA_ALB.GDT 1/9/99

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▽		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST BORING NO. 50

JOB NO. 8-117-001124 DATE 12/22/98

LOCATION Sta. 5+300
 RIG TYPE CME-75
 BORING TYPE 6 5/8" Hollow Stem Auger
 SURFACE ELEV. 1181.4'
 DATUM PEC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM/SC	moist	SILTY SAND TO CLAYEY SAND , trace of fine grained gravel, predominantly fine to medium grained sand, subrounded, low plasticity, brown
5			X	S	12-9-11			SP-SM	moist medium dense	SILTY SAND , trace of fine grained gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic, brown note: some increase in gravel with depth
10			X	S	22-32-32			ML	moist hard	SANDY SILT , fine grained sand, weakly to moderately lime cemented, low plasticity, brown note: grading to silty sand with depth
15			X	S	30-50/ 4 1/2"					Stopped Auger at 14'6" Sampler refused at 15'4 1/2"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
▽	none	
▼		

SAMPLE TYPE

- A - Auger cuttings; NR - No Recovery
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - 1" O.D. thin-walled tube sample

GEOTECH_BH_81171124.GPJ_AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST PIT NO. TP1

JOB NO. 8-117-001124 DATE 1/7/99

BACKHOE TYPE CASE 580
 LOCATION Sta. 0+200
 SURFACE ELEV. 1158.0'+/-
 DATUM PEC Survey

GROUNDWATER

DEPTH	HOUR	DATE
	none	

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					ML	slightly moist	CLAYEY SILT , some fine grained sand, weakly lime cemented, low plasticity, light brown
					CL	moist	SILTY CLAY , some fine grained sand, weakly to moderately lime cemented, medium plasticity, light brown to whitish brown note: cementation increases with depth
		D					
		D					
5						Stopped Backhoe at 5'	
10							
15							
20							
25							

SAMPLE TYPE

- B - Undisturbed Block Sample
- D - Disturbed Bulk Sample
- U - 3" O.D. 2.42" I.D. tube sample

GEOTECH_TP_81171124.GPJ AGRA_ALB.GDT 1/9/99

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST PIT NO. TP2

JOB NO. 8-117-001124 DATE 1/7/99

BACKHOE TYPE CASE 580
 LOCATION Sta. 1+550
 SURFACE ELEV. 1167.0'+/-
 DATUM PEC Survey

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					ML	slightly moist to moist	SANDY SILT , fine grained sand, weakly lime cemented, nonplastic, light brown note: moderately lime cemented below 2'
		D					
5		D					
							Stopped Backhoe at 5' Sampled to 5'6"
10							
15							
20							
25							

GEOTECH_TP_81171124.GPJ_AGRA_ALB.GDT 1/9/99

SAMPLE TYPE

- B - Undisturbed Block Sample
- D - Disturbed Bulk Sample
- U - 3" O.D. 2.42" I.D. tube sample

PROJECT Santan Drainage Channel - Phase 3

LOG OF TEST PIT NO. TP4

JOB NO. 8-117-001124 DATE 1/8/99

GROUNDWATER

DEPTH	HOUR	DATE
	none	

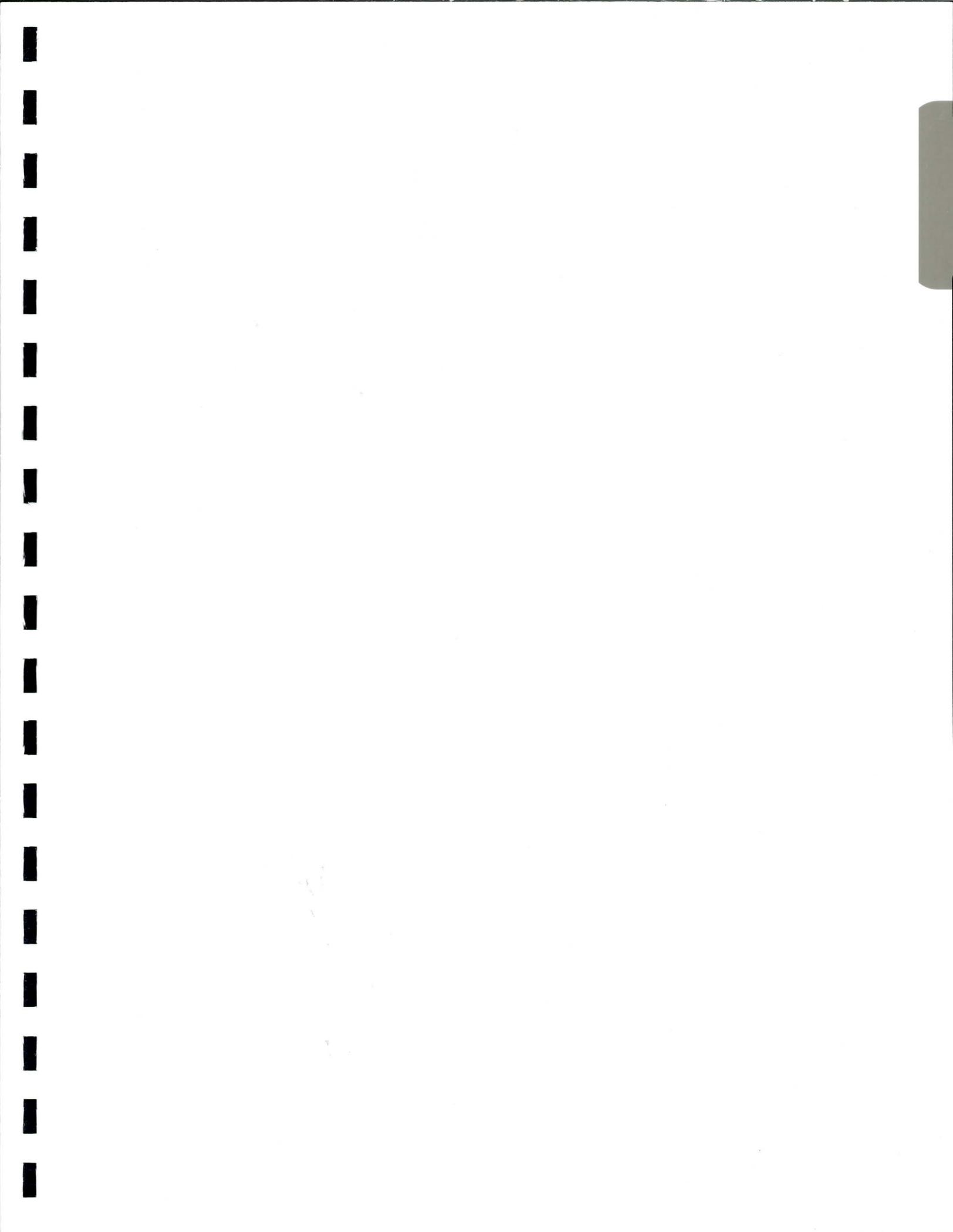
BACKHOE TYPE CASE 580
 LOCATION Sta. 4+670
 SURFACE ELEV. 1178.0'+/-
 DATUM PEC Survey

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM	moist	SANDY SILT , trace of clay, fine to medium grained subangular sand, weakly to moderately lime cemented, low plasticity to nonplastic, light brown note: increase in sand with depth, occasional coarse grained subangular gravel
		D					
5					SP	slightly moist	SAND , trace of silt, well graded, subangular, nonplastic, brown note: occasional coarse grained subangular gravel Stopped Backhoe at 5' Sampled to 5'6"
		D					
10							
15							
20							
25							

GEOTECH_TP_81171124.GPJ AGRA_ALB.GDT 1/9/99

SAMPLE TYPE

- B - Undisturbed Block Sample
- D - Disturbed Bulk Sample
- U - 3" O.D. 2.42" I.D. tube sample



APPENDIX B
LABORATORY TEST RESULTS

LABORATORY TESTING PROCEDURES

Consolidation Tests Soiltest or Clockhouse apparatus of the "floating-ring" type are employed for the one-dimensional consolidation tests. They are designed to receive 1 inch high 2.5 inch O.D. brass liner rings with soil specimens as secured in the field. Procedures for the tests generally are those outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. For soils which are essentially saturated, each increment of load is maintained until the deformation versus log of time curve indicates completion of primary consolidation. For partially saturated soils, each increment of load is maintained until the rate of deformation is equal or less than 3/10,000 inch per hour. Applied loads are such that each new increment is equal to the total previously applied loading. Porous stones are placed in contact with the top and bottom of the specimens to permit free addition or expulsion of water. For partially saturated soils, the tests are normally performed at in situ moisture conditions until consolidation is complete under stresses approximately equal to those which will be imposed by the combined overburden and foundation loads. The samples are then submerged to show the effect of moisture increase and the tests continued under higher loadings. Generally, the tests are continued to about twice the anticipated curve due to overburden and structural loads with a rebound curve then being established by releasing loads.

Expansion Tests The same type of consolidometer apparatus described above is used in expansion testing. Undisturbed samples contained in brass liner rings are placed in the consolidometers, subjected to appropriate surcharge loads and submerged. The loads are maintained until the expansion versus log of time curve indicates the completion of "primary swell".

Direct Shear Tests Direct shear tests are run using a Clockhouse or Soiltest apparatus of varying strain-control. The machine is designed to receive one of the 1 inch high 2.42 inch diameter specimens obtained by tube sampling. Generally, each sample is sheared under a normal load equivalent to the effective overburden pressure at the point of sampling. In some instances, samples are sheared at several normal loads to obtain the cohesion and angle of internal friction. When necessary, samples are saturated and/or consolidated before shearing in order to approximate the anticipated controlling field loading conditions.

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
 LOCATION: 56TH ST TO PRICE RD; CHANDLER

JOB NO: 8-117-001124
 WORK ORDER NO: 1
 DATE SAMPLED: 12-29-98

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

B30 @ 5'-6'	SC	36	14	40	53	76	84	88	91	93	93	95	97	98	99	100	100	100	100	100	100	100	100	50
B34 @ 5'-6'	SC	32	14	30	46	74	84	90	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	52
B38 @ 5'-6'	SC-SM	25	5	34	54	82	90	95	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100	55
B1 @ 10'-16'6"	SM	NV	NP	18	26	34	37	41	50	57	60	69	71	75	87	95	100	100	100	100	100	100	100	58
B3 @ 10'-11'6"	ML	31	3	59	66	69	70	71	73	75	75	78	79	81	83	92	100	100	100	100	100	100	100	66
B4 @ 10'-11'	SM	59	23	32	36	41	44	49	60	71	76	87	90	95	100	100	100	100	100	100	100	100	100	70
B6 @ 15'-16'	SM	34	5	37	45	52	55	57	63	68	71	77	80	89	93	100	100	100	100	100	100	100	100	79
B8 @ 10'-11'6"	CL	48	26	57	66	76	80	84	90	92	93	95	96	97	98	100	100	100	100	100	100	100	100	86
B11 @ 10'-11'	SM	41	13	44	51	55	57	59	65	69	72	79	83	89	95	100	100	100	100	100	100	100	100	98
B15 @ 5'-6'	CL	28	11	56	70	90	94	96	97	98	98	99	99	100	100	100	100	100	100	100	100	100	100	113

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER

JOB NO: 8-117-001124
WORK ORDER NO: 1
DATE SAMPLED: 12-29-98

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

B17 @ 5'-5'6"	SC-SM	23	5	40	57	87	94	96	97	97	97	97	97	98	98	100	100	100	100	100	100	100	100	121	
B19 @ 10'-11'6"	SM	42	7	28	35	44	49	55	66	77	81	93	97	100	100	100	100	100	100	100	100	100	100	130	

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER

JOB NO: 8-117-001124
WORK ORDER NO: 1
DATE SAMPLED: 12-29-98

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

B23 @ 4'6"-6'	SC-SM	25	4	40	63	84	90	94	98	99	100	100	100	100	100	100	100	100	100	100	100	100	1
B24 @ 9'6"-10'6"	ML	47	13	54	62	68	71	73	79	84	86	92	94	98	99	100	100	100	100	100	100	100	5
B39 @ 9'6"-10'6"	SM	NV	NP	18	24	34	40	48	64	75	79	91	94	96	100	100	100	100	100	100	100	100	9
B41 @ 4'6"-5'6"	SC-SM	25	5	47	57	76	84	90	96	98	99	100	100	100	100	100	100	100	100	100	100	100	14
B43 @ 9'6"-10'6"	SM	37	2	24	31	39	44	49	58	66	69	78	82	87	90	97	100	100	100	100	100	100	22
B44 @ 14'6"-16'	SM	37	8	25	34	50	55	59	65	71	73	80	84	94	99	100	100	100	100	100	100	100	27
B45 @ 4'6"-5'6"	SM	23	1	43	60	81	87	92	97	98	98	99	100	100	100	100	100	100	100	100	100	100	28
B47 @ 4'6"-5'6"	SM	NV	NP	24	33	52	63	73	85	91	93	97	98	100	100	100	100	100	100	100	100	100	34
B48 @ 4'6"-6'	SM	NV	NP	14	22	38	50	61	72	79	80	86	88	91	94	97	100	100	100	100	100	100	38
B26 @ 5'-6'	SM	22	3	36	54	85	94	97	98	99	99	99	100	100	100	100	100	100	100	100	100	100	47

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER

JOB NO: 8-117-001124
WORK ORDER NO: 2
DATE SAMPLED: 1-8-99

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

TP-1 @ 2'	SC	43	21	45	54	64	68	72	79	84	86	93	96	99	100	100	100	100	100	100	100	100	136
TP-2 @ 5'	SM	27	5	43	65	88	94	96	98	98	98	100	100	100	100	100	100	100	100	100	100	100	140
TP-3 @ 2'	SC-SM	21	4	35	47	71	83	90	96	98	99	99	99	99	100	100	100	100	100	100	100	100	141
TP-4 @ 5'	SP-SM	NV	NP	8.5	12	28	45	63	81	89	91	99	99	99	100	100	100	100	100	100	100	100	144

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER

JOB NO: 8-117-001124
WORK ORDER NO: 3
DATE SAMPLED: 3-11-99

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

15A @ 5-6'	CL	39	19	69	79	89	92	93	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	146
15A @ 30-31'	CL	45	22	53	58	60	61	61	63	65	67	72	76	82	89	95	100	100	100	100	100	100	100	151

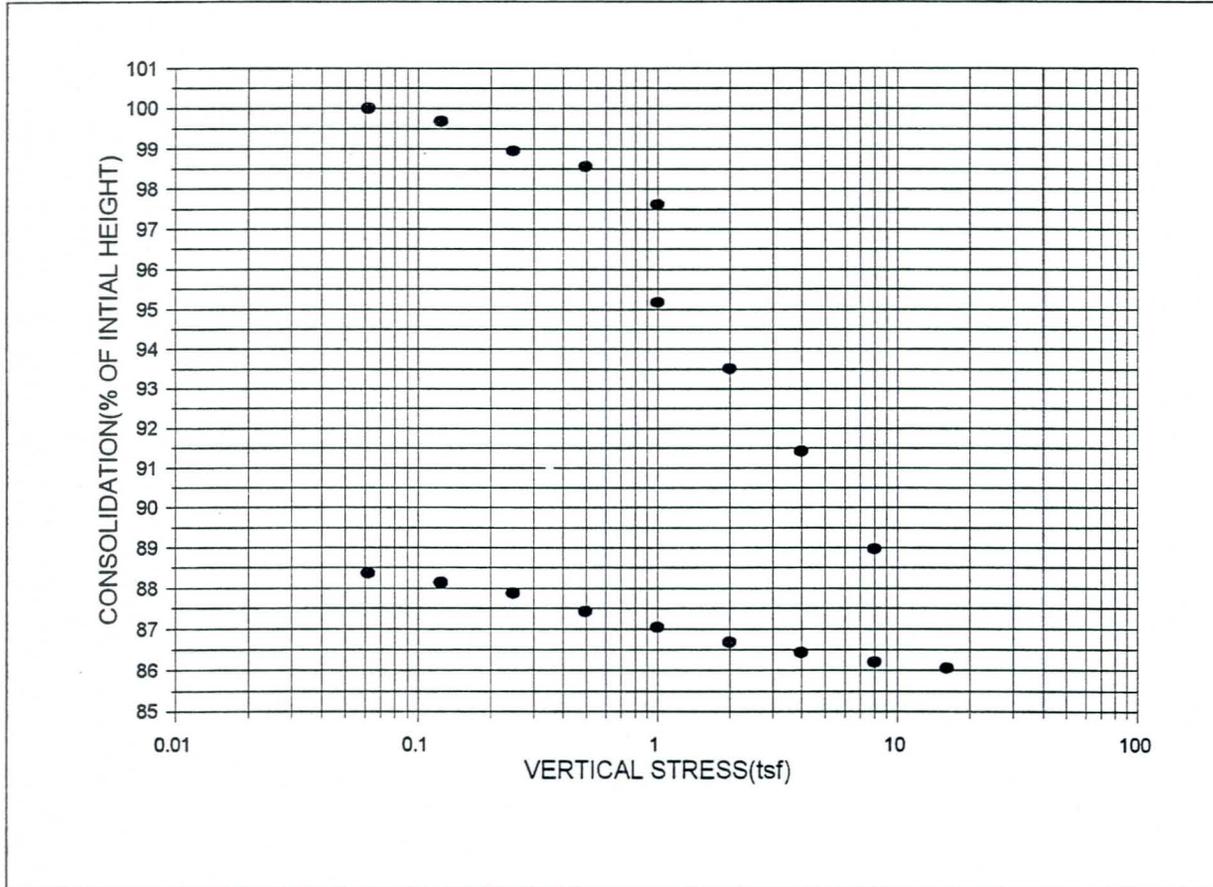
AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL:
SAMPLE SOURCE: B 36 @ 9'6" TO 10'6"
SAMPLE PREPARATION: INSITU

JOB NO: 8-117-001124
WORK ORDER NO: 1
LAB NO: 9
DATE SAMPLED: 12-31-98

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL MOISTURE CONTENT	6.0%	FINAL MOISTURE CONTENT	15.6%
INITIAL DRY DENSITY(pcf)	103.0	FINAL DRY DENSITY(pcf)	119.1
INITIAL DEGREE OF SATURATION	0.3	FINAL DEGREE OF SATURATION	1.1
INITIAL VOID RATIO	0.6	FINAL VOID RATIO	0.4
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	1 tsf



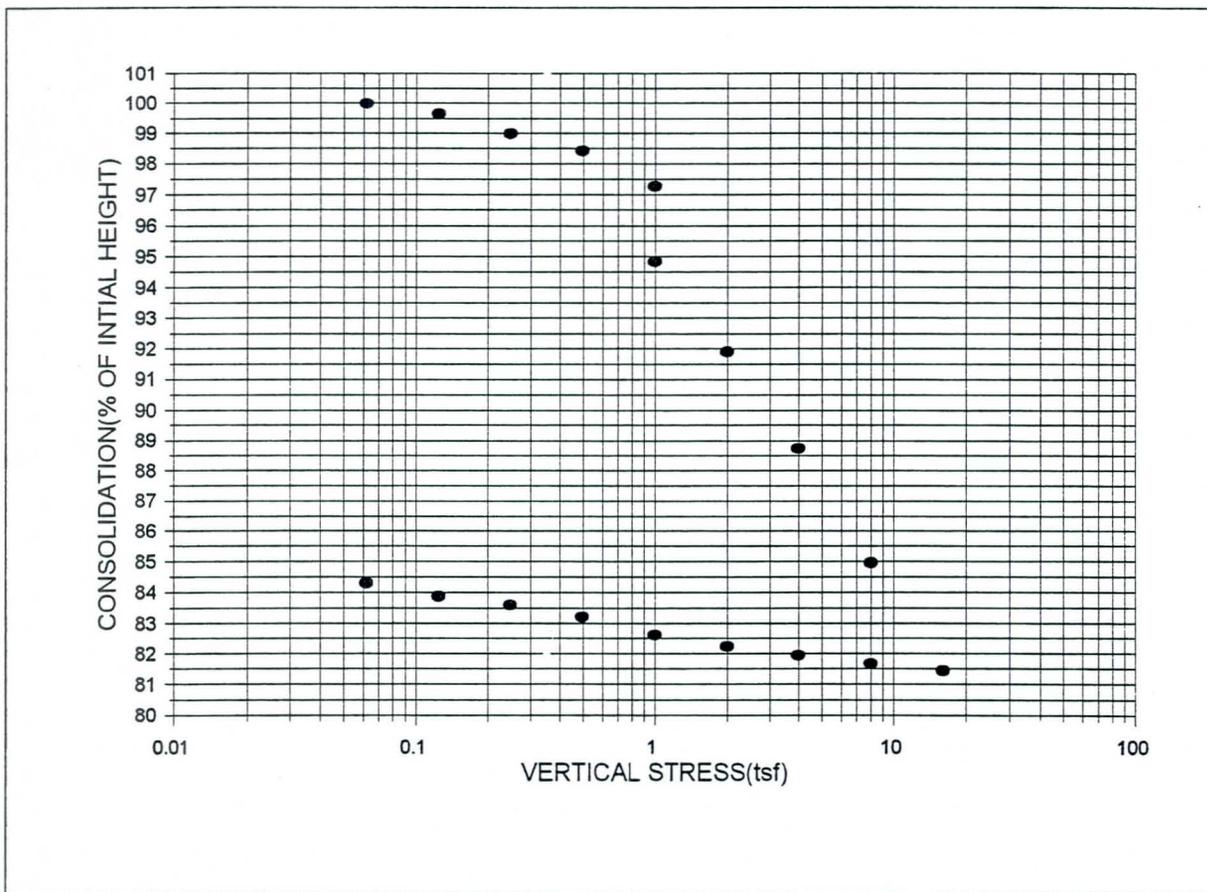
AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL:
SAMPLE SOURCE: B 45 @ 4'6" TO 5'6"
SAMPLE PREPARATION: INSITU

JOB NO: 8-117-001124
WORK ORDER NO: 1
LAB NO: 28
DATE SAMPLED: 12-31-98

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL MOISTURE CONTENT	14.1%	FINAL MOISTURE CONTENT	19.9%
INITIAL DRY DENSITY(pcf)	94.9	FINAL DRY DENSITY(pcf)	115.9
INITIAL DEGREE OF SATURATION	0.5	FINAL DEGREE OF SATURATION	1.2
INITIAL VOID RATIO	0.7	FINAL VOID RATIO	0.4
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	1 tsf



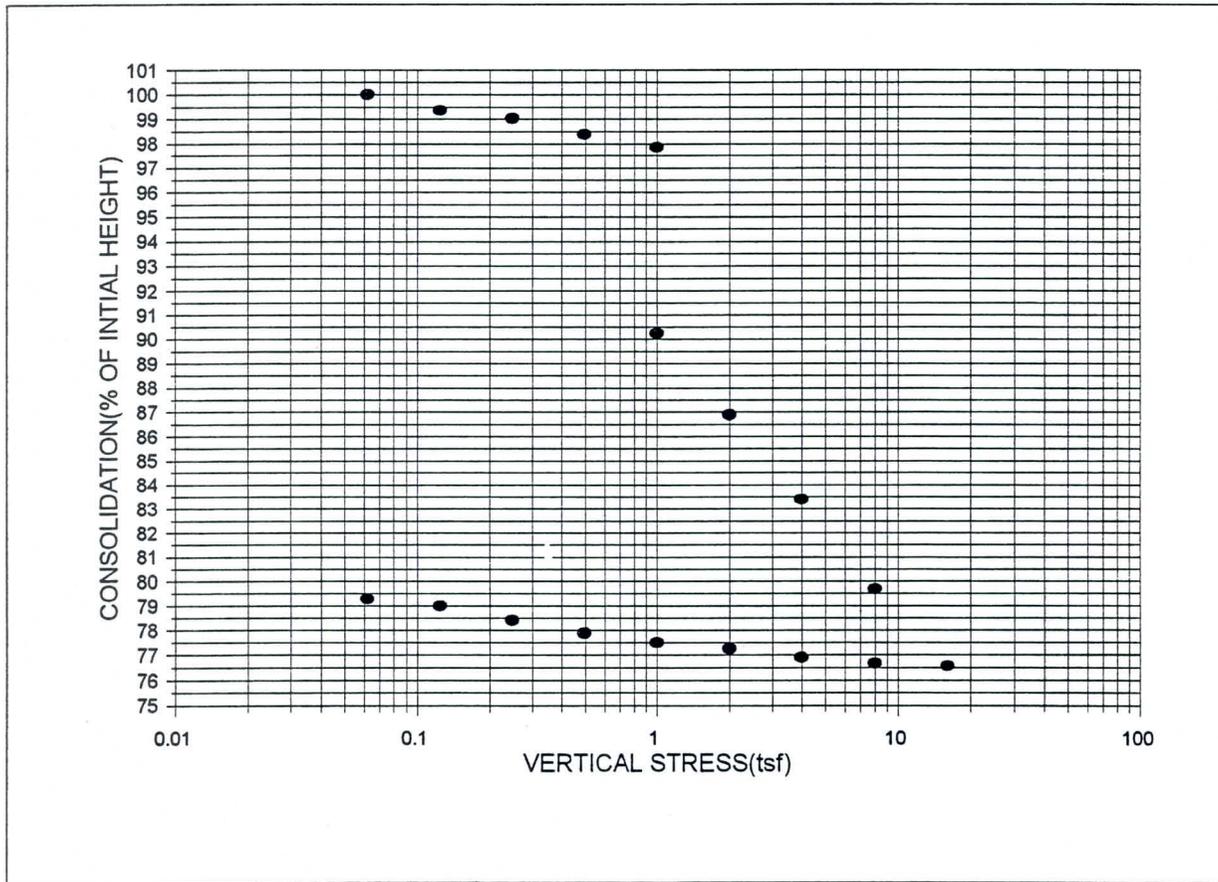
AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL:
SAMPLE SOURCE: B 15 @ 0 TO 1'6"
SAMPLE PREPARATION: INSITU

JOB NO: 8-117-001124
WORK ORDER NO: 1
LAB NO: 113
DATE SAMPLED: 12-31-98

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL MOISTURE CONTENT	6.5%	FINAL MOISTURE CONTENT	16.5%
INITIAL DRY DENSITY(pcf)	90.0	FINAL DRY DENSITY(pcf)	116.9
INITIAL DEGREE OF SATURATION	0.2	FINAL DEGREE OF SATURATION	1.1
INITIAL VOID RATIO	0.8	FINAL VOID RATIO	0.4
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	1 tsf



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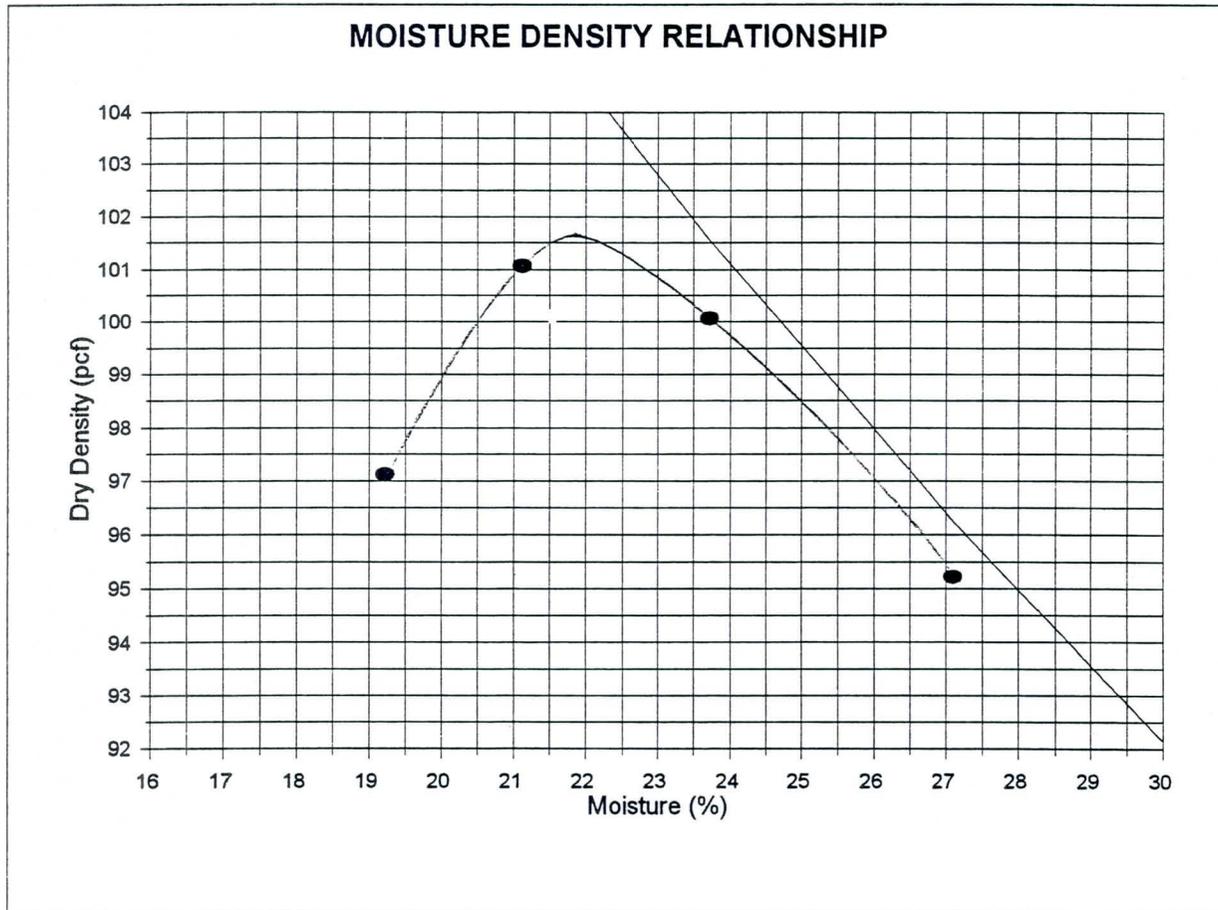
PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL: TP-1 @ 2'
SAMPLE SOURCE:

JOB NO: 8-117-001124
WORK ORDER NO: 2
LAB NO: 136
SAMPLE DATE: 1-8-99

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORT (12,400 ft-lbf/cu.ft) (ASTM D698A)

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

101.6
21.8



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

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

AGRA Earth & Environmental, Inc.

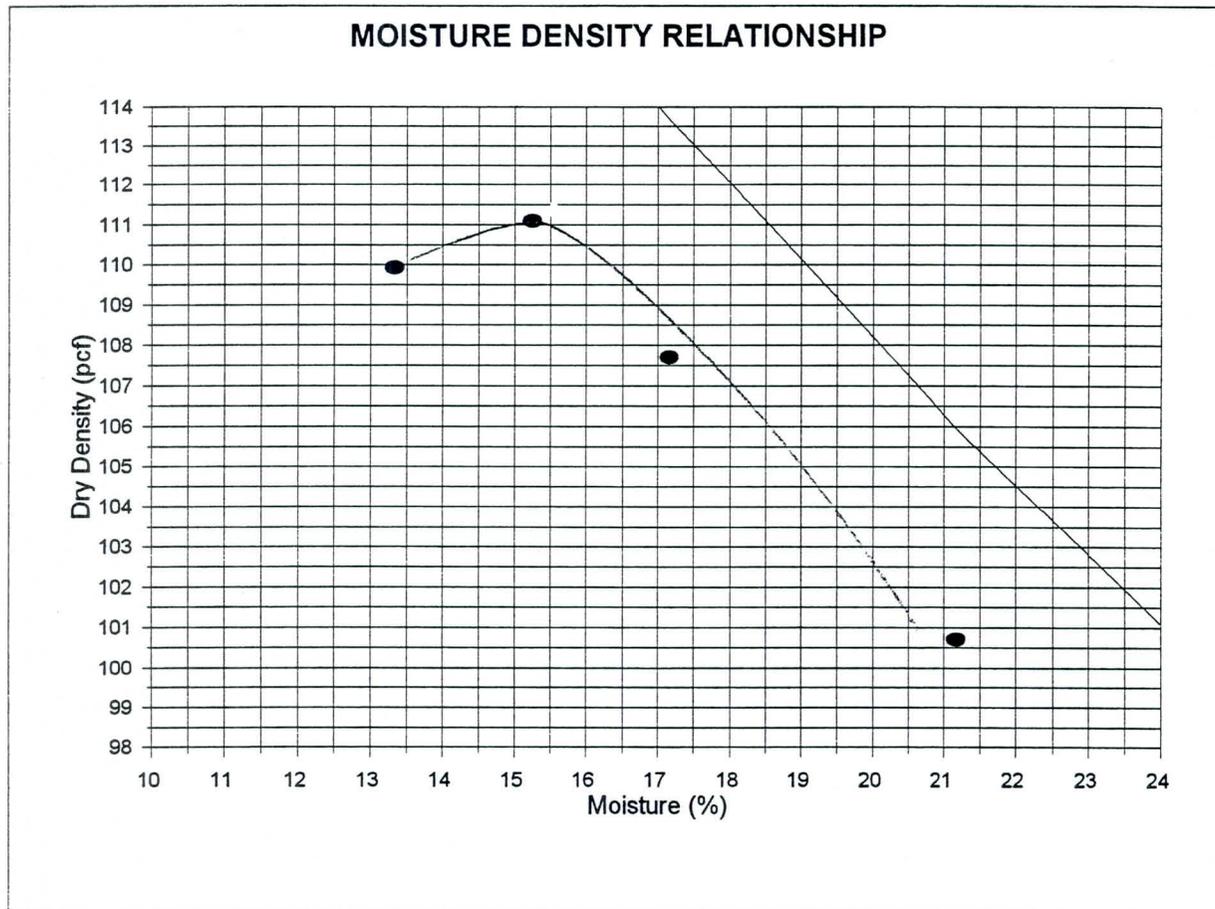
PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL: TP-2 @ 5'
SAMPLE SOURCE:

JOB NO: 8-117-001124
WORK ORDER NO: 2
LAB NO: 140
SAMPLE DATE: 1-8-99

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORT (12,400 ft-lbft/cu.ft) (ASTM D698A)

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

111.0
15.3



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

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

AGRA Earth & Environmental, Inc.

PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL: TP-3 @ 2'
SAMPLE SOURCE:

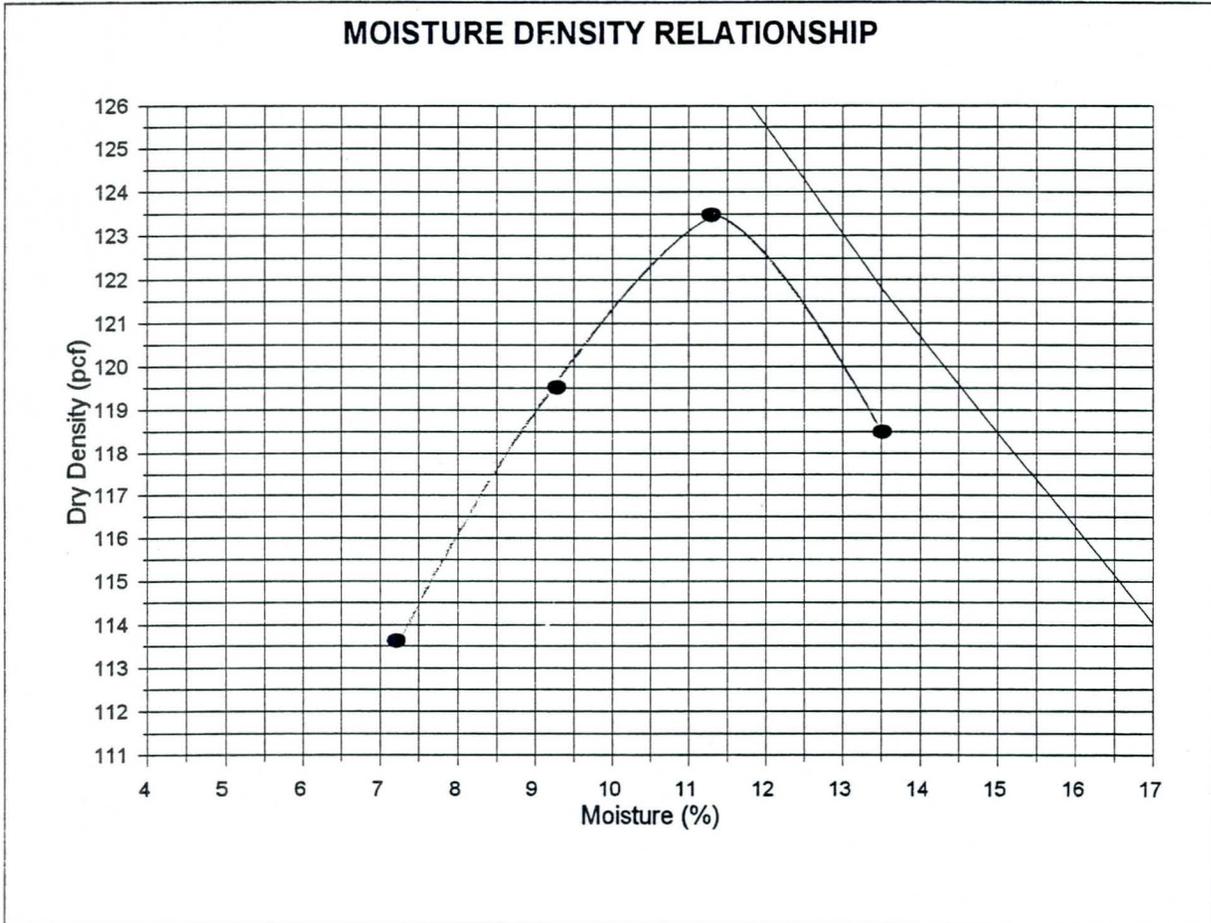
JOB NO: 8-117-001124
WORK ORDER NO: 2
LAB NO: 141
SAMPLE DATE: 1-8-99

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORT (12,400 ft-lbft/cu.ft) (ASTM D698A)

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

123.5
11.3

MOISTURE DENSITY RELATIONSHIP



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

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

AGRA Earth & Environmental, Inc.

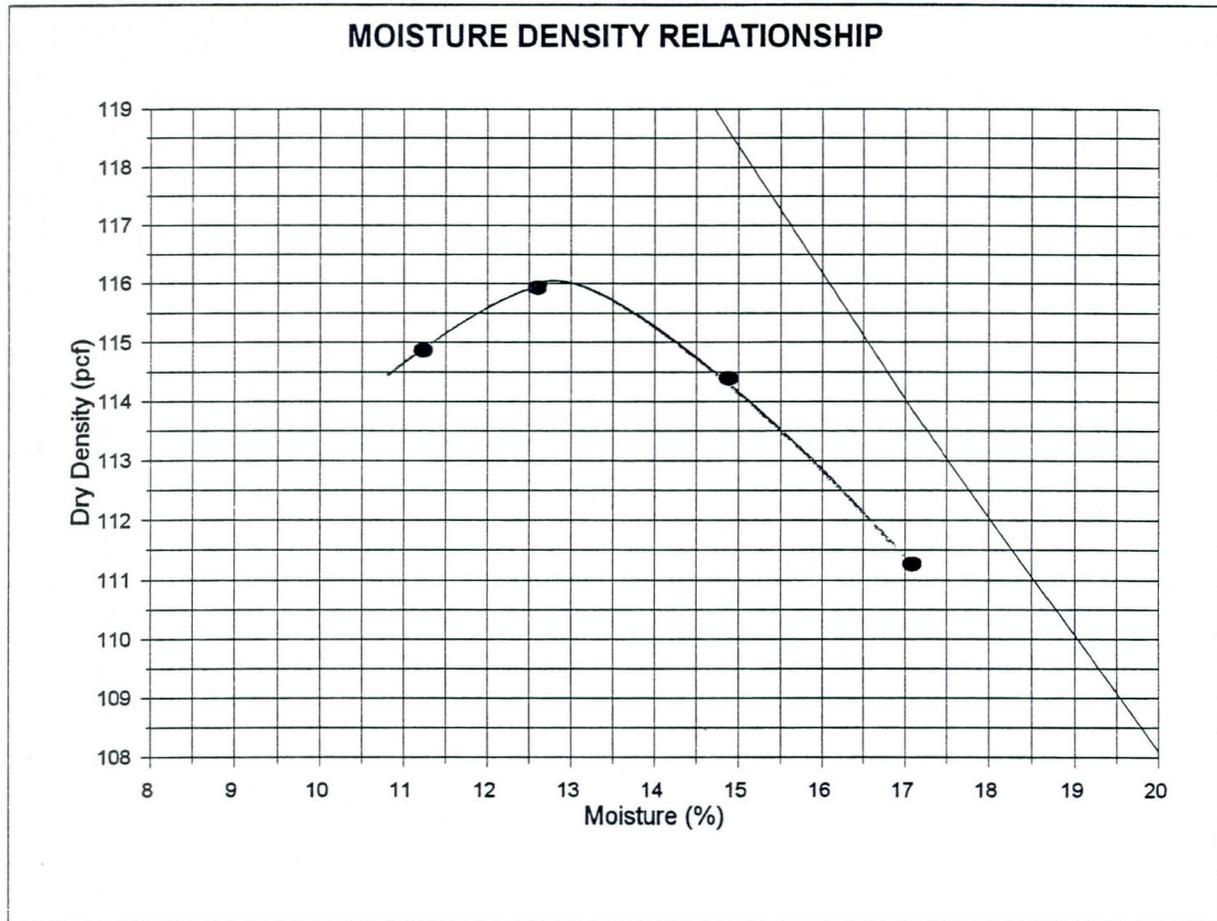
PROJECT: SANTAN DRAINAGE CHANNEL - PHASE 3
LOCATION: 56TH ST TO PRICE RD; CHANDLER
MATERIAL: TP-4 @ 5'
SAMPLE SOURCE:

JOB NO: 8-117-001124
WORK ORDER NO: 2
LAB NO: 144
SAMPLE DATE: 1-8-99

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORT(12,400 ft-lbft/cu.ft) (ASTM D698A)

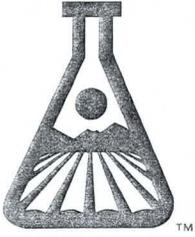
MAXIMUM DRY DENSITY (pcf):
OPTIMUM MOISTURE (%):

116.2
13.0



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

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



IAS Laboratories

2515 East University Drive
Phoenix, Arizona 85034
(602) 273-7248
Fax (602) 275-3836

RECEIVED

JAN 8 1999

January 5, 1999

Submitted by: Cliff Metz

Report to: Agra Earth & Environmental

Report NO: 6607366

Job # 8-117-001124

SOIL ANALYSIS

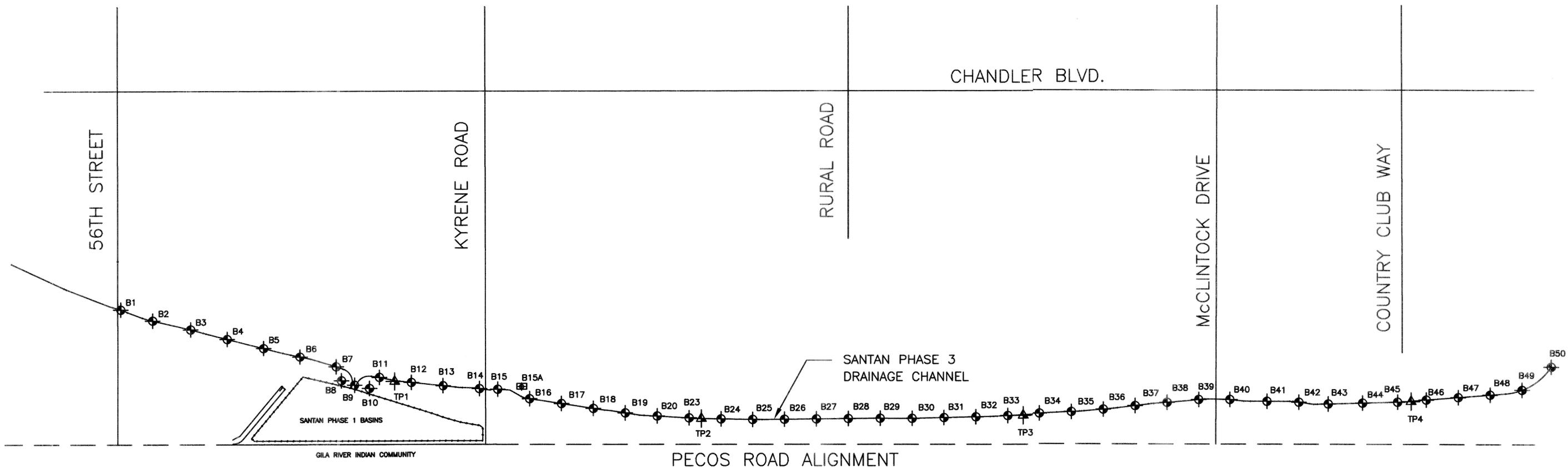
<u>Sender ID</u>	<u>Lab NO</u>	<u>pH*</u>	<u>SO₄-S** (ppm)</u>	<u>Chloride* (ppm)</u>
B27@5	351	8.2	26	203
B35@5	352	8.6	14	106
6 @10-11.5	353	8.3	19	144
#16 @10-11.5	354	9.0	18	76.7

*Analyses performed on a 1:1 water:soil extract.

pH Reference: Methods of Soil Analysis, ASA, No.9, Part 2, 10-3.3:

Chloride Reference: Methods of Analysis for Soils, Plants and Waters, Chapman and Pratt, p.100.

** Analysis performed by method referenced in Soil Sampling and Methods of Analysis, 1993, Canadian Society of Soil Science, p.67.



EXPLANATION

-  BORING LOCATION
-  TEST PIT LOCATION



3		
2		
1		
NO.	DESCRIPTION	INITIALS/DATE

REVISIONS		
SANTAN FREEWAY DRAINAGE CHANNEL PHASE 3		
AGRA Earth & Environmental <small>ENGINEERING GLOBAL SOLUTIONS</small>		
<small>3232 West Virginia Avenue Phoenix, Arizona 85009-1502</small>	<small>Tel: (602)272-6848 Fax: (602)272-7239</small>	
SCALE 1" = 700'	JOB NO. 8-117-001124	
DESIGNED KHD	DATE 1/99	
DRAWN GWH	DATE	
CHECKED LAH	DATE	
APPROVED	SIGNED	