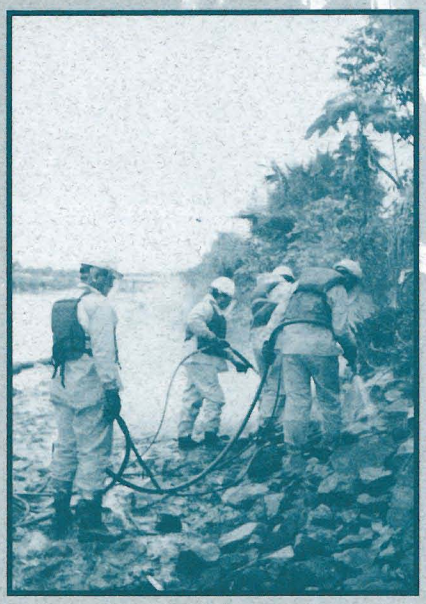
GEOTECHNICAL EVALUATION
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA
FCD PROJECT NO. 1170831
CONTRACT FCD 2001C004
ASSIGNMENT NO. 1



Geotechnical

and

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Ninyo & Moore

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PREPARED FOR:

Flood Control District of Maricopa County
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October 31, 2001
Project No. 600220001

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Mr. Warren Rosebraugh, P.E.
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

Subject: Geotechnical Evaluation
Laveen Area Conveyance Channel
Maricopa County, Arizona
FCD Project No. 1170831
Contract FCD 2001C004
Assignment No. 1

Dear Mr. Rosebraugh:

In accordance with our proposal dated May 17, 2001 and our proposal addendums dated June 14 and June 29, 2001, Ninyo & Moore has performed a Geotechnical Evaluation for the above referenced site. The attached report represents our deliverable for this project and presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site. Our anticipated completion date for this project is October 31, 2001.

We appreciate the opportunity to be of service to you during this phase of the project. If you have any questions or comments regarding this report, please call at your convenience.

Sincerely,
NINYO & MOORE

Steven D. Nowaczyk, P.E.
Senior Project Engineer

Robert W. McMichael, P.E.
Manager/Chief Engineer

SDN/RM/LLG/avv

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1. INTRODUCTION

In accordance with our proposal dated May 17, 2001 and our proposal addendums dated June 14 and June 29, 2001, we have performed a geotechnical evaluation for the Laveen Area Conveyance Channel (LACC) to be located in Maricopa County, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to formulate geotechnical recommendations for design and construction of the new channel. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of our services for the project generally included the following:

- Reviewing readily available aerial photographs and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Marking-out the boring locations based on the 30 percent construction plans that we received from your office and notifying Arizona Blue Stake of the boring locations prior to drilling.
- Drilling, logging, and sampling 20 small-diameter exploratory borings to depths of about 9 to 31 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Performing laboratory tests of selected samples obtained from the borings to evaluate in-situ moisture content and dry density, grain size analysis, Atterberg limits, maximum density/optimum moisture relationship, expansion index, agronomic testing (growability), direct shear tests and corrosivity characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides). The results of the laboratory testing are presented on the boring logs and/or Appendix B. The results from the agronomic testing are presented in Appendix D.
- Collecting sediment samples from the invert of the existing Maricopa Drain for limited environmental testing. The results of these tests are presented in Appendix C.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

3. SITE DESCRIPTION

The project site is located in the central portion of Maricopa County, in the City of Phoenix, Arizona. The proposed LACC will generally follow the alignment of the existing Maricopa Drain, extending from 43rd Avenue toward the southwest, to its outlet at the Salt River (Figure 1). It will cross several agricultural fields and five roadways.

According to the *Fowler, Arizona 7.5-Minute USGS Topographic Quadrangle Map (1952) and Laveen, Arizona 7.5-Minute USGS Topographic Quadrangle Map (1952),* the proposed alignment lies at an average elevation of roughly 1,000 feet relative to mean sea level (MSL). Based on the information from these quadrangle maps, it appears the proposed alignment slopes very gently from the east to the west, with a vertical drop in elevation of about 40 feet.

Three aerial photographs were reviewed for this project. A 1973 photo from the *USDA Soil Survey of Maricopa County, Arizona – Central Part,* a 1997 USGS aerial photograph, and a 1999 aerial photo from *Landiscor's Phoenix Real Estate Photo Book* show the proposed channel alignment as crossing through predominantly agricultural fields, similar to its current condition. Our evaluation of the aerial photographs and visual reconnaissance did not indicate any large disturbed areas that might be indicative of past development or filling.

4. PROPOSED CONSTRUCTION

It is anticipated that the proposed LACC will include approximately six miles of unlined earthen channel. The new channel will extend to a depth of about 5 to 9 feet bgs. The project may be modified to include a concrete low-flow channel.

In addition, the project will include the construction of six box culverts, five of which are associated with roadway crossings, and one will be located within an agricultural field. The five roadway box culverts will be located at Baseline Road, about ¼ mile west of 75th Avenue; 63rd Avenue, about ½ mile south of Baseline Road; 59th Avenue, about ¼ mile south of Baseline Road; Baseline road, about ¼ mile east of 59th Avenue; and 51st Avenue, about 1/3 mile north of

Baseline Road. The new culverts will extend to depths of about 7 to 15 feet bgs, with their lengths varying from about 25 to 342 feet.

A total of eight retaining walls will be built along the western segment of the new alignment, specifically, where existing Salt River Project (SRP) high-tension power poles are currently located.

Dual-30 inch diameter jack-and-bores will be located along the 42nd Avenue alignment and will cross beneath Southern Avenue. The bores will be 120 feet long and will extend about 20 feet bgs.

Much of the existing Maricopa Drain will be filled to grade as part of this project. Some segments will include a new 30-inch diameter concrete pipe installed at or near the drain invert prior to the backfilling. This pipe will assist in transporting water from the old drain to the new channel.

5. FIELD EXPLORATION

On June 13, 21, 22, and 28, 2001, Ninyo & Moore conducted a subsurface evaluation at the site in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of the excavation, logging, and sampling of 20, small-diameter borings. A total of 21 borings were proposed in our original proposal; however, boring B-7 was deleted from our scope because of its location within an active agricultural field. The borings were drilled using a CME-75 truck-mounted drill rig. Of these borings, 18 were drilled within or near the new channel or the existing drain (denoted as B-1 through B-6 and B-8 through B-19) and, two were drilled for the jack-and-bore operation (denoted as B-20 and B-21). Bulk and relatively undisturbed soil samples were collected at selected intervals. Detailed descriptions of the soils encountered are presented in the boring logs in Appendix A.

The ground surface elevations at each boring location were not measured for this project. The stationing and lateral offset was estimated based on the 30 percent construction plans we received. The general locations of the borings are denoted on the Boring Location Map (Figure 2).

As part of our scope of services for this project, we collected five sediment samples from the invert of the existing Maricopa Drain for environmental testing. These tests included the analysis of total petroleum hydrocarbons (TPH) using ADHS Method 418.1AZ. We understand that this method is accepted by ADHS for screening of soils. The approximate locations of the sediment samples are also denoted on the Soil Boring Location Map. The results of these tests are presented in Appendix C.

6. LABORATORY TESTING

The soil samples collected from our drilling activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analysis. The analysis included in-situ moisture content and dry density, grain size analysis, Atterberg limits, maximum density/optimum moisture relationship, expansion index, agronomic testing (growability), direct shear testing and corrosivity characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides). The results of the laboratory testing are presented on the boring logs and/or Appendix B.

Agronomic testing consisting of the testing of primary nutrients, secondary nutrients, micro nutrients as well as other agricultural characteristics, was performed by Fruit Growers Laboratory, Inc. of Santa Paula, California. The work performed by Fruit Growers Laboratory also included detailed fertilization recommendations for Bermuda Grass, which may be used in association with the channel lining. The results of these tests are presented in Appendix D.

7. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

7.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, subparallel mountain ranges. The mountain ranges generally trend north-

south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 13 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains, as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains. The surficial geology of the proposed canal is described as latest Quaternary age deposits (<10,000 years old) consisting of sand and silt, with local occurrences of fine gravels and coarse deposits, which contain minimal soil development (Demsey, 1989).

7.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration and laboratory testing and our understanding of the general geology of the area. The following paragraph provides a generalized description of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

Alluvium was encountered at the surface of the borings and extended to the total depth explored. The alluvium consisted of clay (CL), silt (ML), sand (SP, SC, and SM), and gravel (GP, GC, and GM). Caliche nodules were present in borings B-8, B-10, and B-14 to B-18 from the ground surface to 12 feet bgs. Auger refusal was encountered in borings B-5, B-8, B-13, B-14, B-17, B-20, and B-21. Sand, gravel and cobbles (locally known as "SGC") likely caused the auger refusal, which occurred at depths ranging from about 9 to 25 feet bgs.

Table 1 provides a breakdown of the soil types encountered within the proposed channel excavation (e.g., from the ground surface to about 5 to 9 feet bgs):

Table 1 – Percentage of Soil Type Encountered from Ground Surface to Estimated Bottom of Channel

GP/GC/GM	SP	SC/SM	ML	CL
7%	4%	13%	36%	40%

The following table provides a breakdown of the soil types we encountered at the anticipated bottom of the channel excavation (e.g., about 5 to 9 feet bgs):

Table 2 – Percentage of Soil Type Encountered at the Anticipated Bottom of the Channel Excavation

GP/GC/GM	SP	SC/SM	ML	CL
18%	0%	24%	29%	29%

7.3. Groundwater

Groundwater was not encountered in our boring excavations. Based on well data from the Arizona Department of Water Resources (ADWR), the approximate depth to groundwater ranged from about 12 to 125 feet bgs within the project vicinity. Groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors. In general, groundwater is not expected to be a constraint to the construction of the project; however, given the occurrence of relatively pervious zones, perched tailwater resulting from flood irrigation of cropland might be encountered. Construction dewatering is further discussed in Section 10.5.1.

8. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, faulting and seismicity, surface rupture, and liquefaction.

8.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in southern Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to

1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation, resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an ongoing geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces (Schumann and Genualdi, 1986).

Based on our field reconnaissance and review of the referenced material, there are no known earth-fissures underlying the subject site. The closest earth fissure to this site is approximately 14 miles to the northwest, where water levels have dropped approximately 300 feet. Water levels in the area of the site have dropped 0 to 100 feet. Continued groundwater withdrawal in the area may result in subsidence of the valley and the formation of new fissures or the extension of existing fissures.

8.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Carefree fault zone, located approximately 35 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced.

Based on a Probabilistic Seismic Hazard Assessment for the Western United States issued by the United States Geological Survey (1999), the site is located in a zone where the peak ground accelerations that have a 10 percent, 5 percent, and 2 percent probability of being exceeded in 50 years are 0.05g, 0.06g, and 0.09g, respectively. Seismic design parameters, according to the 1997 Uniform Building Code (UBC), are presented in the following table.

Table 3 – Seismic Design Parameters

Parameter	Value	1997 UBC Reference
Seismic Zone Factor, Z	0.075	Table 16 – I
Soil Profile Type	S_D	Table 16 – J
Seismic Coefficient C_a	0.12	Table 16 – Q
Seismic Coefficient C_v	0.18	Table 16 – R
Near-Source Factor, N_a	1.0	Table 16 – S
Near-Source Factor, N_v	1.0	Table 16 – T
Seismic Source Type	C	Table 16 – U

8.3. Liquefaction Potential

Based on the SPT values at the site, the lack of near surface water and the low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction is considered to be negligible.

9. CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- The on-site soils should generally be excavatable to planned depths with conventional earthmoving construction equipment in good working condition. However, excavation of caliche-cemented zones or SGC deposits may be relatively slow and/or necessitate the use of more substantial equipment.
- We anticipate that the jack-and-bore crossing beneath Southern Avenue will encounter SGC deposits. Based upon recent District experience in the immediate vicinity, the size of cobbles and boulders should generally not preclude jack-and-bore operations.

- Groundwater was not observed in our borings. However, based on data from ADWR, the groundwater table is anticipated to range from about 12 to 125 feet bgs. It is possible that seepage of groundwater will be noted in excavations due to flood irrigation of agricultural fields. The contractor should be prepared to deal with nuisance groundwater.
- No known or reported geologic hazards are reported underlying or adjacent to the site.
- Corrosivity test results indicate that subgrade soils at the site may be corrosive to ferrous metals and that the soils in some areas present a severe sulfate exposure to concrete. Accordingly, special provisions to address corrosion potential may be needed.

10. RECOMMENDATIONS

The following sections present our geotechnical recommendations for the proposed channel. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

10.1. Earthwork

The following sections provide our earthwork recommendations.

10.1.1. Excavations

Our evaluation of the excavation characteristics of the on-site materials is based on the results of 20 exploratory borings, our site observations, and our experience with similar materials. In our opinion, excavation of the on-site materials can generally be accomplished to depths up to about 9 feet bgs with conventional earthmoving equipment in good operating condition. However, scattered caliche nodules were encountered within the top 9 feet in some of the borings, which may be somewhat more difficult to excavate.

Auger refusal was encountered in borings B-5, B-8, B-13, B-14, B-17, B-20, and B-21. We believe that buried stream channel deposits locally known as SGC likely caused the auger refusal, which occurred at depths ranging from about 9 to 25 feet bgs. Table 4 summarizes the auger refusal depths.

Table 4 – Summary of Auger Refusal Depths

Boring No.	Depth to Auger Refusal for Ground Surface
B-5	22 feet
B-8	25 feet
B-13	9 feet
B-14	16 feet
B-17	13 feet
B-20	20.3 feet
B-21	17.5 feet

The presence of relatively shallow auger refusal and potentially large diameter cobbles may affect the excavation for some of the deeper box culverts and jack-and-bore operations. However, a deeper larger-diameter jack-and-bore crossing performed for the District at about 43rd Avenue did not encounter large cobbles. Depending on the actual density and gradation of the SGC encountered during construction, heavy-duty excavation (e.g., hydraulic) equipment may be needed.

We recommend that trenches and excavations be designed and constructed in accordance with OSHA regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20 feet deep based on a description of the soil types encountered. Trenches greater than 20 feet deep should be designed by the Contractor's engineer based on site-specific geotechnical analyses. For planning purposes, we recommend that the OSHA soil classification for the encountered alluvial soil be considered as Type C.

In general, temporary slopes above the water table and excavations in alluvium soils should be inclined no steeper than 1:1 (horizontal: vertical). Temporary excavations that encounter seepage, if any, may call for shoring or may be stabilized by placing sandbags or gravel along the base of the seepage zone and should be evaluated on a case-by-case basis.

10.1.2. Slopes and Earthwork Factors

The earthwork factors given below are based on comparisons between the in-place density and Proctor tests performed in our laboratory. The slope factors are based on the soil type anticipated within the channel excavation

Table 5 – Recommended Earthwork Parameters

Approximate Location	Estimated Earthwork Factor	Steepest Recommended Cut Slope (H:V)
Station 10+00 to 60+00	+/- 10% Shrink	1:1
Station 60+00 to 300+00	+/- 15% Shrink	1:1
Station 300+00 to 318+37	+/- 20% Shrink	1:1
Jack-and-Bore Operation	+/- 15% Shrink	1:1

The shrink factors listed in the table above represent an average of the material observed with varying consistencies and contains scattered hard zones that resulted in auger refusal during our field work. Potential bidders should consider this in preparing estimates and should review the available data to make their own conclusions regarding excavation conditions.

Fill sections, if any, constructed with materials from areas of on-site excavation should be constructed with slopes no steeper than 2:1 (H:V).

10.1.3. Temporary Earth Retaining Systems

As an alternative to laying back the side walls, the excavations may be shored or braced. Temporary earth retaining systems will be subject to lateral loads resulting from earth pressures. Shored or braced trench and access shaft excavations in alluvium soils may be designed using the parameters on Figure 3. Trench boxes may also be a suitable alternative to laying back the side walls. Some sloughing is possible at the ends of the trench box, and any loose material should be removed prior to backfilling of the trench.

The design earth pressure diagram assumes that spoils from the excavation or other surcharge loads will not be placed above the excavation within a 1:1 plane extending up and back from the base of the excavation. If spoil piles are placed closer than this to the braced excavation, the resulting surcharge loads should be considered in the bracing or trench box design. We recommend that an experienced structural engineer design the shoring system. The shoring parameters presented in this report should be considered as guidelines.

10.1.4. Grading, Fill Placement, and Compaction

Vegetation and debris from the clearing operation should be removed from the site and disposed of at a legal dumpsite. Demolition debris should be removed from the site and disposed of at a legal dumpsite. Obstructions that extend below finish grade, if present, should be removed and the resulting holes filled with compacted soil.

The geotechnical consultant should carefully evaluate any areas of soft or wet soils prior to placement of fill or other construction. Of particular concern, are softened materials or sediments in the existing Maricopa Drain. Drying or overexcavation and replacement of such materials should be anticipated.

Imported soils and soils generated from on-site excavation activities that exhibit very low to low expansive potential and are relatively impermeable, are generally suitable for use as engineered fill. Very low to low expansive potential soils are defined as having an Expansion Index (by ASTM D 4829) of 50 or less, or a swell potential of 1.5 percent or less, when tested in accordance with ASTM D-4546-96, Method B when remolded at 98 percent of its standard Proctor (ASTM D 698-91) maximum dry density and at a moisture content of 2 percent below their optimum. Our laboratory testing indicated that the soils generated from on-site excavation activities will typically exhibit very low or low expansion potential.

Suitable fill should not include organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 6 inches in dimension. This material should be disposed of offsite or in non-structural areas.

We recommend that new fill be placed in horizontal lifts approximately 9 inches in loose thickness and compacted by appropriate mechanical methods, to 98 percent or more relative compaction, in accordance with ASTM D 698-91 at a moisture content within 2 percent of its above optimum.

10.1.5. Imported Fill Material

Imported fill, if utilized, should consist of clean, granular material with a very low or low expansion potential. Import material in contact with ferrous materials or concrete should also have low corrosion potential (minimum resistivity greater than 2,000 ohm-cm or the average value for the site, chloride content less than 25 parts per million [ppm], and soluble sulfate content of less than 0.1 percent). The geotechnical consultant should evaluate such materials and details of their placement prior to importation.

10.2. Box Culverts

Box culverts will be used at six locations along the project alignment. Based on conversations with your office, we understand that the scour depth associated with these culverts will be about 4 feet below the bottom of the culvert. Consequently, the base of the box culverts will also be about 4 feet below the bottom of the culverts. Based on the soil boring information and the proposed depth of the culverts, we recommend that an allowable bearing capacity of up to 3,000 pounds per square foot (psf) be used for static conditions.

Total and differential settlement of up to about one inch and one-half inch, respectively, may occur. Distortions of no more than about 1 inch (vertical) over 20 feet (horizontal) are possible.

Following the excavation for the culverts, and prior to the placement of concrete, the geotechnical consultant should carefully evaluate the exposed surface. Based on the results of

this evaluation, remediation of the exposed surface may be needed. This could include scarification of the exposed surface or removal and replacement of unsuitable soils. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations.

Culverts that are subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.4 (total frictional resistance equals the coefficient of friction multiplied by the dead load). An ultimate passive resistance value of 250 pounds psf per foot of depth can be used. The ultimate lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces.

10.3. Jack-and-Bore Tunneling

As mentioned earlier, we understand that there will be dual-30 inch diameter jack-and-bore crossings beneath Southern Avenue at the 42nd Avenue alignment. These crossings will be made at depths of roughly 20 feet bgs. Our borings B-20 and B-21, that were drilled in that area, met auger refusal on dense SGC deposits at depths of 20.3 and 17.5 feet, respectively. We understand that a large diameter jack-and-bore crossing, about 1,000 feet to the west, did not encounter cobbles or boulders larger than about 8 to 10 inches. However, auger refusal precluded evaluation of the conditions at the proposed jack-and-bore location for this project.

Design of shaft shapes, dimensions, and ground support systems for jack-and-bore excavations will be at the contractor's option in order to be compatible with his construction equipment and methods. Soldier piles with lagging or shored excavations may serve as a suitable system for rectangular shafts, while circular steel ribs in conjunction with timber lagging or liner plates may be suitable for circular shafts. Driven sheeting may be difficult to install because of hard ground conditions and the possibility of encountering buried boulders or large caliche cemented pieces.

Jacking reaction force is developed by the action of the jack-and-bore operation against the surface of the opposite wall of the jacking pit. The jacking force is resisted by the bearing of the wall. The allowable jacking force may be calculated using the lateral earth pressures shown on Figure 4.

Caving of the pipe shaft may occur, particularly where looser surface soils are present. For stability and safety purposes, and to reduce ground movement, a full perimeter shaft support system may be needed as the excavation progresses. Surface subsidence associated with jack-and-bore operations was not evaluated as part of our analysis, but should be minor.

10.4. Soil-Cement Stabilization

We understand that a soil-cement treated surface may be utilized for this project. This surface would be located either along the top or the bottom of the channel alignment, or both. We recommend that soil-cement treated surfaces associated with this project consist of 6 or more inches of soil-cement treated soil placed in accordance with MAG Section 311. It should be noted that this type of improvement is typically applied to unpaved roadways with average daily traffic (ADT) volumes less than about 300 vehicles, which we assume will be more than the anticipated traffic volumes associated with this application. Nevertheless, some maintenance and repair of this layer may be needed during the life of this channel.

The MAG Section identified above does not specify a minimum percentage of cement needed. The percentage of cement needed for this type of application is typically based on a desired compressive strength and the composition of the soils used. We recommend utilizing a compressive strength of 400 or more pounds per square inch. However, the percentage of cement content needed may differ along the alignment because of the variety of soil types encountered. The following table represents a typical range of cement content percentages needed to achieve a maximum dry density of about 120 pcf for various soil gradations.

Table 6 – Typical Variation in Cement Content

Material Retained on No 4 Sieve (%)	Typical Cement Content (%)
0 to 14	7 to 8
15 to 29	6 to 8
30 to 45	6 to 9
45 and greater	soil-cement not recommended

It should also be noted that soil-cement treated surfaces may be difficult to manufacture from soil types with excessive amounts of clay and silt.

10.5. Pipe Installation and Trench Backfill

As mentioned previously, much of the existing Maricopa Drain will be equipped with a 30-inch diameter concrete drainage pipe. Care should be used in the installation of the pipe and the restoration of grade. Future construction over the area should reflect the presence of the pipe and backfilled channel.

10.5.1. Construction Dewatering

A shallow groundwater table is not anticipated along the alignments during construction. However, groundwater (tailwater) seepage and surface run-off may be encountered where the alignments cross existing drainage courses. The need for dewatering could be expected in the larger drainage courses along the alignments, near any irrigation canals, and/or tailwater sumps, if present. Stream flow and surface run-off will vary seasonally depending on local rainfall.

Given the low probability of encountering significant seepage along the alignments, we anticipate that the excavations that do encounter nuisance seepage or surface run-off, could be dewatered by sumping the water from the bottom of the excavation. However, saturated sands, if encountered, may need more aggressive means of dewatering such as well points.

10.5.2. Pipe Bedding and Modulus of Soil Reaction (E')

Overexcavation of soft or saturated channel sediments prior to placement of bedding materials should be expected. The excavated material should be replaced with suitable fill.

We recommend that the new pipe be supported on 6 or more inches of granular bedding material such as graded sand or crushed rock with a maximum particle size of 3/4-inch or less. Crushed rock with a particle size of 3/4-inch or less, derived from excavated boulders, if any, would also be suitable for use as pipe bedding material. Bedding materials should be durable and relatively clean, with no more than 10 percent (by weight) passing the No. 200 sieve. Bedding materials should be compacted in lifts. The compaction requirements should be in accordance with the recommendations in this report and the Uniform Standard Specifications for Public Works Construction (Maricopa Association of Governments, 1992). Pipe bedding and trench backfill details are presented on Figure 5.

The modulus of soil reaction (E') is used to characterize the stiffness of soil backfill placed at the sides of buried pipe for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. It is our understanding that the depth of pipe will generally be about 8 to 16 feet. For granular backfill soils, we recommend using an E′ value of 1,500 pounds per square inch (psi).

10.5.3. Trench Backfill

The soils encountered along the alignments, as well as any crushed materials generated during construction, should generally be suitable for reuse as backfill in the trench zone, provided they are free of organic material, clay lumps, debris, and rocks greater than 6 inches in diameter. Deleterious material, such as non-soil objects, trash, or debris, was generally not encountered during our reconnaissance or subsurface exploration; however, if encountered during construction, these materials should not be reused. It is possible that cobble pieces and/or caliche deposits greater than 6 inches in diameter could be generated in some of the excavations. Particles larger than 6 inches should be

screened or crushed to a finer size. Potential fill soil imported to the site should consist of non-expansive, non-corrosive, durable, and graded granular material. The project geotechnical consultant should evaluate materials prior to importation. Estimated shrinkage factors were provided in Table 5.

Where the alignments cross known drainage courses, we recommend that the backfill material within the pipe zone either consist of a graded material that will not readily allow the infiltration of the surrounding native soils or the perimeter of the pipe zone be lined with a non-woven filter fabric. Consequently, we recommend that the content of rock in the backfill greater than 1-1/2 inches in diameter not exceed 40 percent of the backfill volume, and the content of material passing the No. 200 sieve should be 10 percent or less.

Backfill should be placed at a moisture content within one percent below to two percent above the optimum moisture content. Placed backfill should be compacted to a relative compaction of 95 or more percent of the maximum dry density as evaluated by ASTM D 698. The backfill in the upper 2 foot zone below pavement sections should, however, be placed to 100 percent relative density. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in uniform lifts not exceeding 8 inches in loose thickness. Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill.

10.5.4. Pipeline Frictional Resistance

For frictional resistance of an un-coated pipe, we recommend a coefficient of friction of 0.4. If the pipe is wrapped in a corrosion resistant tape or enamel, we recommend a coefficient of friction of 0.2.

10.6. Retaining Walls

Retaining wall foundations should be founded in the manner described in Section 10.6.2. Retaining walls that are not restrained from movement at the top and have a level backfill

behind the wall may be designed using an "active" equivalent fluid unit weight of 35 pounds per cubic foot (pcf). This value assumes compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment and that very low to low expansive backfill will be placed behind the wall. This value also assumes that the retaining walls will have a height less than 12 feet. Retaining walls should also be designed to resist a surcharge pressure of 0.35q. The value for "q" represents the pressure induced by adjacent light loads, uniform slab, or traffic loads plus any adjacent footing loads.

Measures should be taken so that moisture does not build up behind retaining walls. Retaining walls should be provided with a drain, as shown on Figure 6. Back drainage measures should include free-draining backfill material and perforated drainpipes. Drainpipes should outlet away from structures, and retaining walls should be waterproofed in accordance with the recommendations of the project civil engineer or architect. To reduce the potential for water- and sulfate/salt-related damage to the retaining walls, particular care should be taken in selection of the appropriate type of waterproofing material to be utilized and in the application of this material.

For passive resistance to lateral loads, we recommend that an equivalent fluid weight of 250 pcf be used up to a value of 3,000 psf. This value assumes that the ground is horizontal for a distance of 10 feet or more behind the wall or three times the height generating the passive pressure, whichever is greater. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. For frictional resistance to lateral loads, we recommend that a coefficient of friction of 0.4 be used between soil and concrete. If passive and frictional resistances are to be used in combination, we recommend that the friction coefficient be reduced by two-thirds. The passive resistance values may be increased by one-third when considering loads of short duration such as wind or seismic forces.

10.6.1. Retaining Wall Horizontal Pressures

We understand that SRP will occasionally use a crane near the new retaining walls. Moreover, an outrigger pad from the crane will be situated as close as 2.5 feet from the

back of the retaining wall. The outrigger pad will be 2 feet by 2 feet in size and it will apply 220,000 pounds when in use. We were asked to analyze the horizontal pressures imposed on the retaining wall as a result of this outrigger load. This analysis was performed using an equation developed by Boussinesq, for a point load at the surface and the associated horizontal pressure at various depths. Boussinesq's equation was chosen because it approximates this load condition and is somewhat conservative; however, less conservative than the tri-wedge method. The equation we used is as follows:

$$\sigma_r = P/2\pi \times [3r^2Z/R^5 - (1-2\mu)(R-Z/Rr^2)]$$

where: σ_r = horizontal pressure at specified depth
P = point load
r = radial distance at surface
Z = depth
μ = Poisson's ratio

Based on the above equation and a Poisson's ratio equal to 0.35, we have developed resultant horizontal forces for a 1 foot wide segment of wall, a 2 foot wide segment of wall, and a 4 foot wide segment of wall that are centered along to the point load. An average Poisson's ratio equal to 0.35 was assumed based on the consistency of the soil encountered in our borings. The resultant force from these various segment widths along with the depth from the surface to the resultant force is given in Table 7.

Table 7 – Summary of Resultant Retaining Wall Forces

	Resultant Force (kips)	**Depth from Surface to Resultant Force (feet)**
1 Foot Wide Segment	10.5	1.8
2 Foot Wide Segment	20.6	1.9
4 Foot Wide Segment	38.6	2.0

The hand calculations used to develop the values present above are given in Appendix E.

10.6.2. Retaining Wall Foundations

We also understand that there will be continuos footings constructed as part of this project. These foundations will be used to support the new retaining walls that will be located adjacent to the SRP power poles, and could extend 12 to 18 feet bgs.

We recommend utilizing continuous footings for this project, with a width of 12 or more inches. Continuous footings should be reinforced with two or more No. 4 reinforcement bars, one placed near the top and one placed near the bottom of the footings, and further detailed in accordance with the recommendations of the structural engineer. Footings may be designed using an allowable bearing capacity of up to 3,000 pounds psf for static conditions.

Total and differential settlement of up to about one inch and one-half inch, respectively, may occur. Distortions of no more than about 1 inch (vertical) over 20 feet (horizontal) are possible.

Foundations that are subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.4 (total frictional resistance equals the coefficient of friction multiplied by the dead load). An ultimate passive resistance value of 250 pounds psf per foot of depth can be used. The ultimate lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces. The foundations should preferably be proportioned such that the resultant force from lateral loadings falls within the kern (i.e., middle one-third).

10.7. Corrosion Potential

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the foundations and structures. Corrosion potential was evaluated using the results of laboratory testing of samples obtained during our subsurface evaluation that were considered representative of soils at the subject site.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236b, while sulfate and chloride tests were performed in accordance with Arizona Test 733 and 722, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH value of the samples tested ranged from 7.1 to 8.1, which is considered to be alkaline. The minimum electrical resistivity measured in the laboratory ranged from 107 to 671 ohm-cm, which is considered to be corrosive to ferrous materials. The chloride content of the sample tested was measured to range from 104 to 1,900 ppm, which is also considered to be corrosive to ferrous materials. The soluble sulfate content of the soil sample was measured to range from .008 to 0.230 percent. Water-soluble sulfate contents between 0.20 and 2.00 percent represent a "severe" sulfate exposure. Additional tests are currently underway to evaluate the higher chloride and sulfate contents measured.

The results of the laboratory testing indicate that the on-site materials could be corrosive to ferrous metals. Therefore, special consideration should be given to the use of heavy gauge, corrosion protected, underground steel pipe or culverts, if any are planned. As an alternative, plastic pipe or reinforced concrete pipe could be considered. A corrosion specialist should be consulted for further recommendations.

10.8. Concrete

Concrete in contact with soil or water that contains high concentrations of soluble sulfates can be subject to chemical and/or physical deterioration. Based on the UBC criteria (ICBO, 1997), the potential for sulfate attack is negligible for water-soluble sulfate contents in soil ranging from 0.00 to 0.10 percent by weight (0 to 1,000 ppm), and moderate for water-soluble sulfate contents ranging from 0.10 to 0.20 percent by weight (1,000 to 2,000 ppm). The potential for sulfate attack is severe for water-soluble sulfate contents ranging from 0.20 to 2.00 percent by weight (2,000 to 20,000 ppm), and very severe for water-soluble sulfate contents over 2.00 percent by weight (20,000 ppm).

The results of our sulfate content laboratory tests indicate that the site soils present a severe sulfate exposure to concrete. According to Table 19-A-3 of the 1994 UBC, Type V cement should be used for the construction of concrete structures at this site. However, we understand that Type V cement is not readily available in Arizona. The ready-mix and concrete pipe suppliers should be consulted with respect to sulfate-resistant concrete.

The concrete should have a water-cementitious materials ratio no greater than 0.45 by weight for normal weight aggregate concrete. From a quality standpoint, a 28-day compressive strength of 4,000 psi or higher is desirable because it will improve concrete durability and resistance to sulfate attack.

10.9. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, the civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

10.10. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of proposed borrow materials for use as fill and to observe placement and test compaction of fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

11. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only and may not provide sufficient data to prepare an accurate bid by some contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government ac-

tion or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

12. SELECTED REFERENCES

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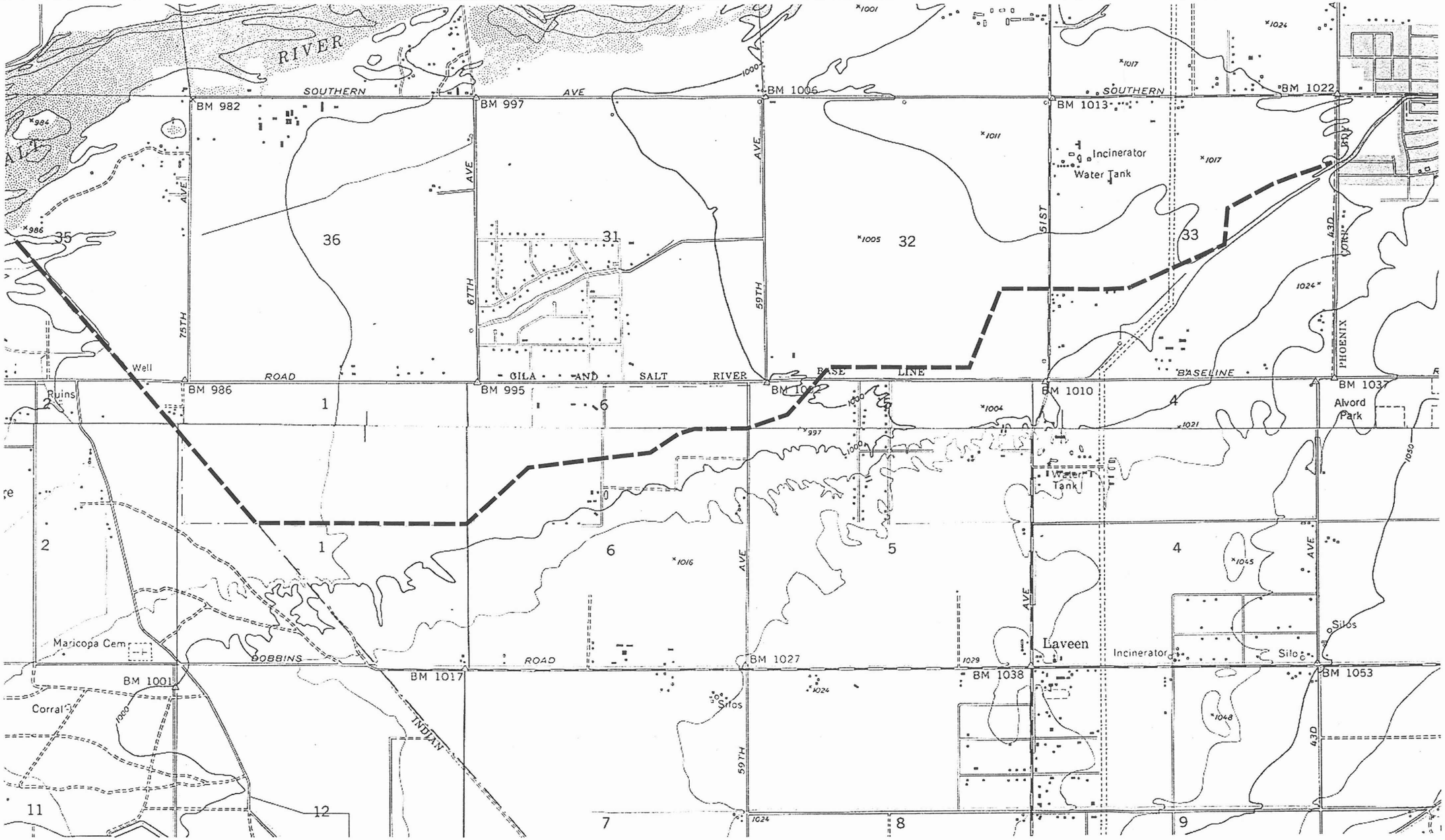


LEGEND

--- Approximate Location of Conveyance Channel

N

0 0.5 1.0

Approximate Scale in Miles

NOTE: ALL DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

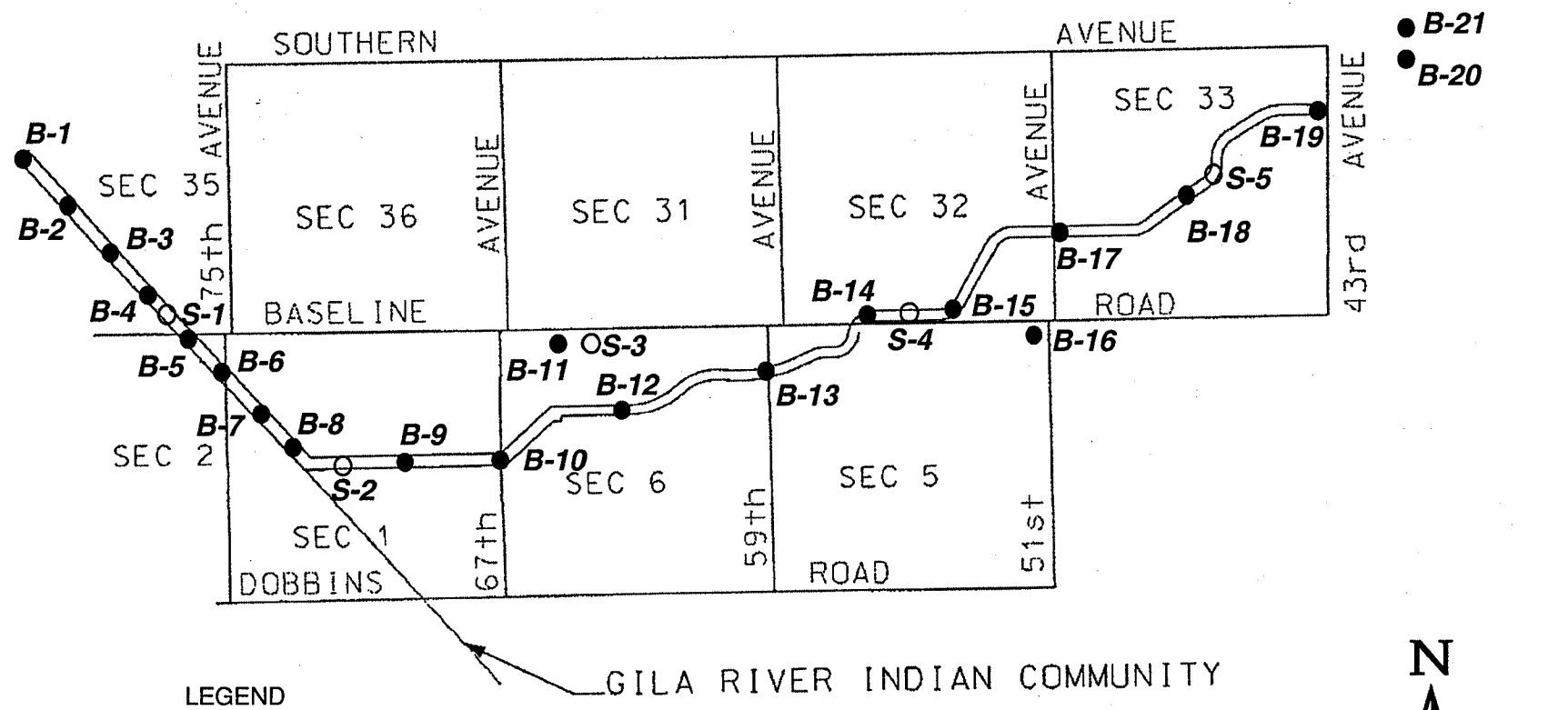
Ninyo & Moore

SITE VICINITY MAP

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	1

G:\600108-01SITE

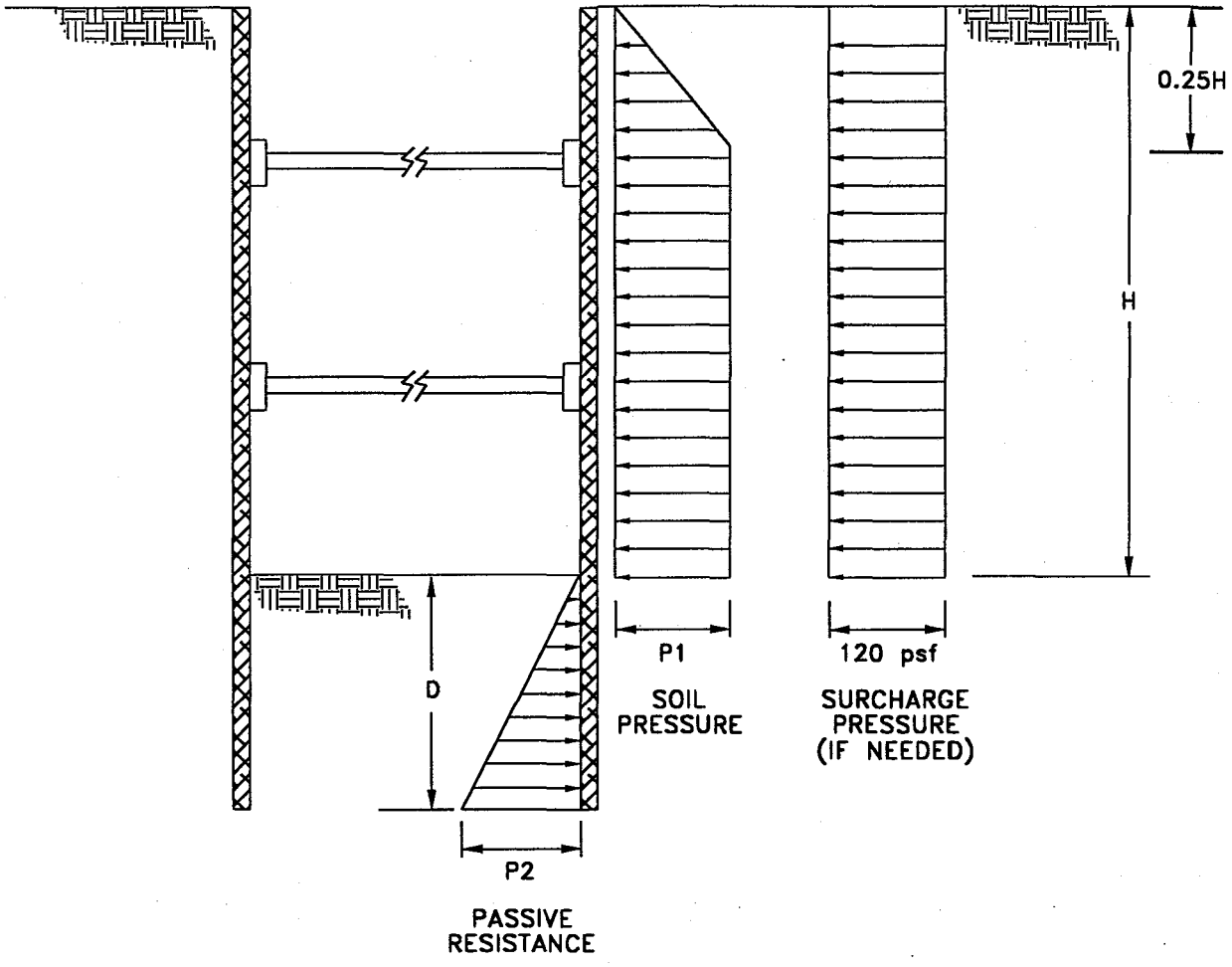


Ninyo & Moore

BORING LOCATION MAP

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	2



ASSUMPTIONS AND NOTES

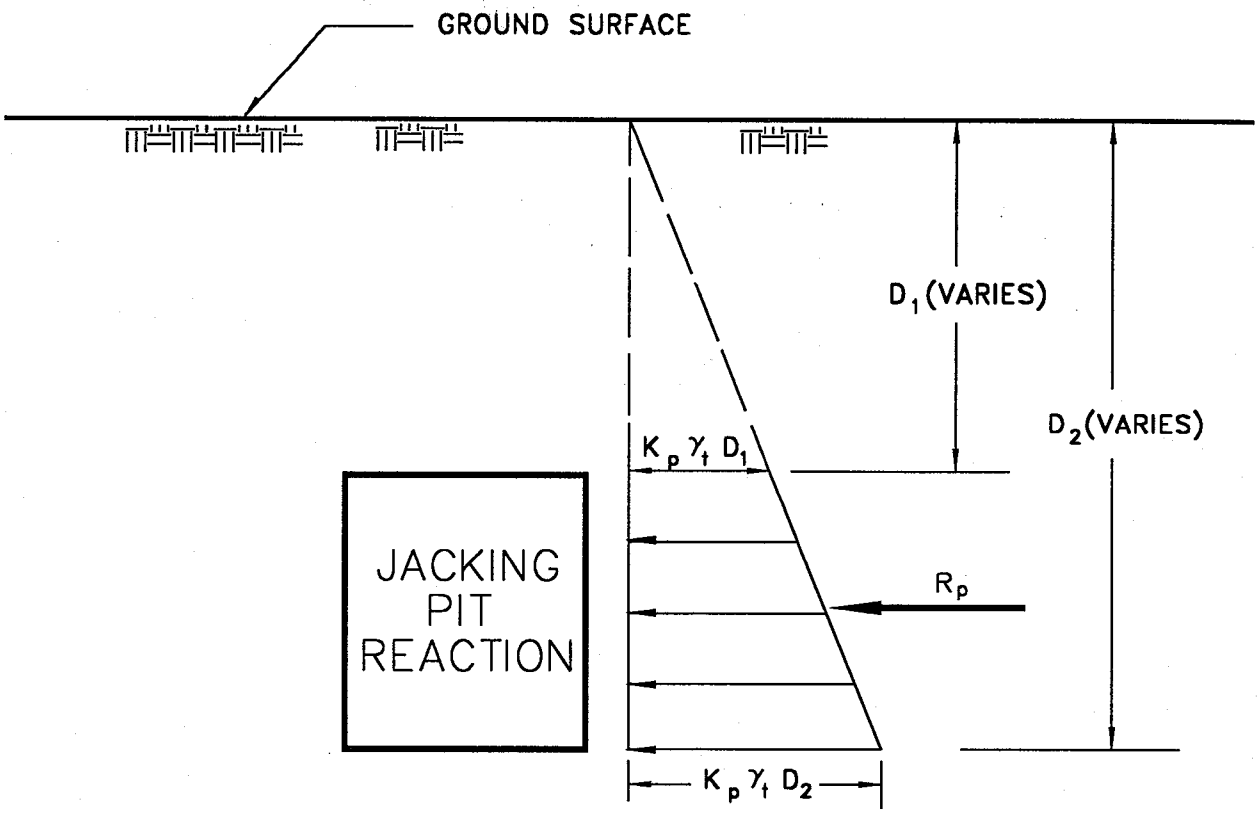
1. P1 = 48 x H psf
2. P2 = 360 x D psf
3. No groundwater encountered during construction.
4. Surcharge pressure consists of normal construction traffic. Roadway traffic from McDowell Road was not considered.
5. psf = pounds per square foot

NOT TO SCALE

Ninyo & Moore

LATERAL EARTH PRESSURES
FOR BRACED EXCAVATIONS
FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	3



$$R_p = [(1/2) K_p \gamma_t (D_2^2 - D_1^2)] \ / \ F.S.$$

ASSUMPTIONS AND NOTES

1. $\Phi = 30^0$
2. $K_p = 3.00$
3. $\gamma_t = 120$ pcf
4. No groundwater encountered during construction.
5. F.S. = 1.5

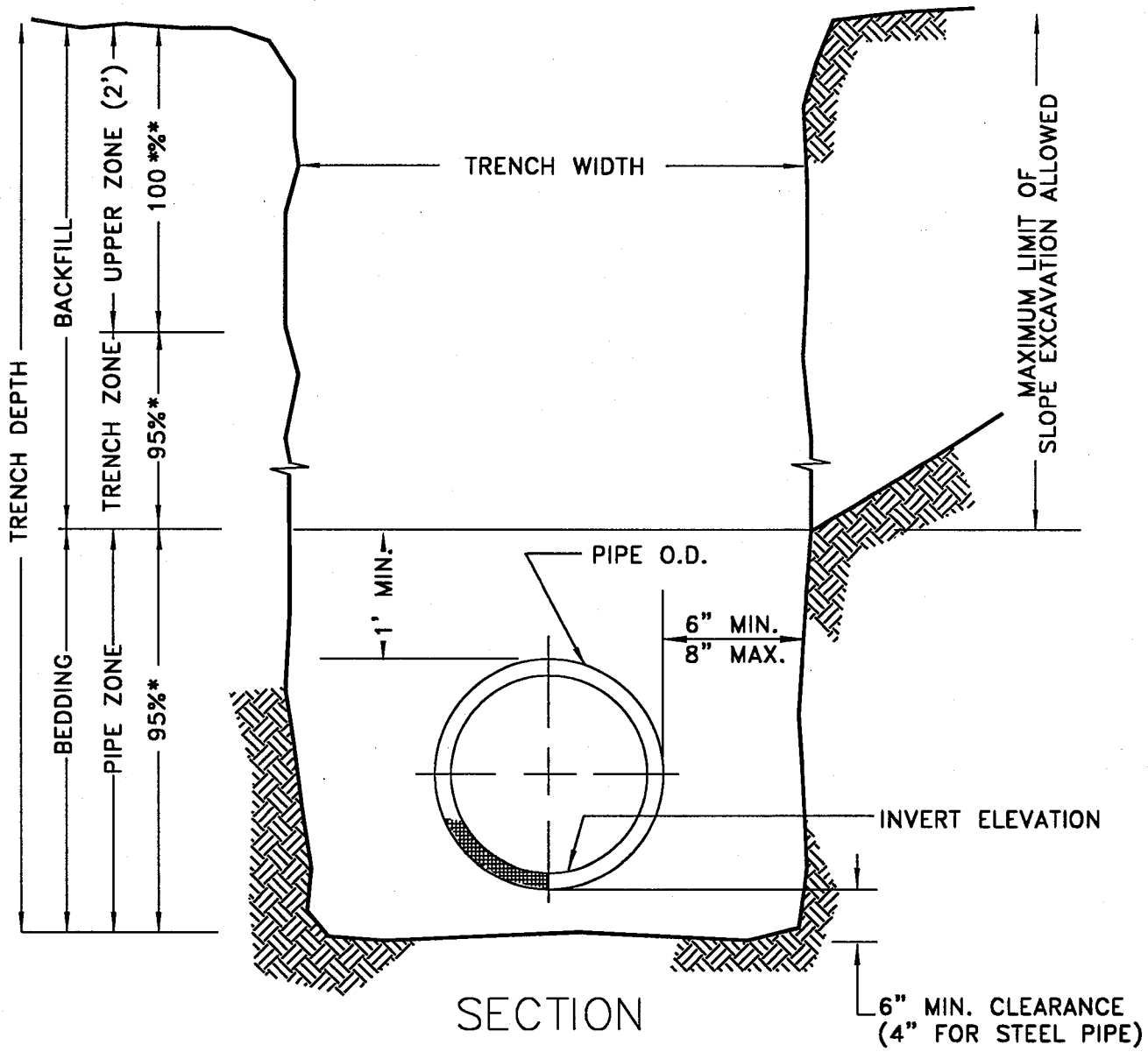
NOT TO SCALE

Ninyo & Moore

JACK PIT REACTION
LATERAL EARTH PRESSURE DIAGRAM

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	4



SECTION

NOTE

* Indicates minimum relative compaction (see report for details).

Upper zone required for pavement areas only.

Diagram not drawn to scale.

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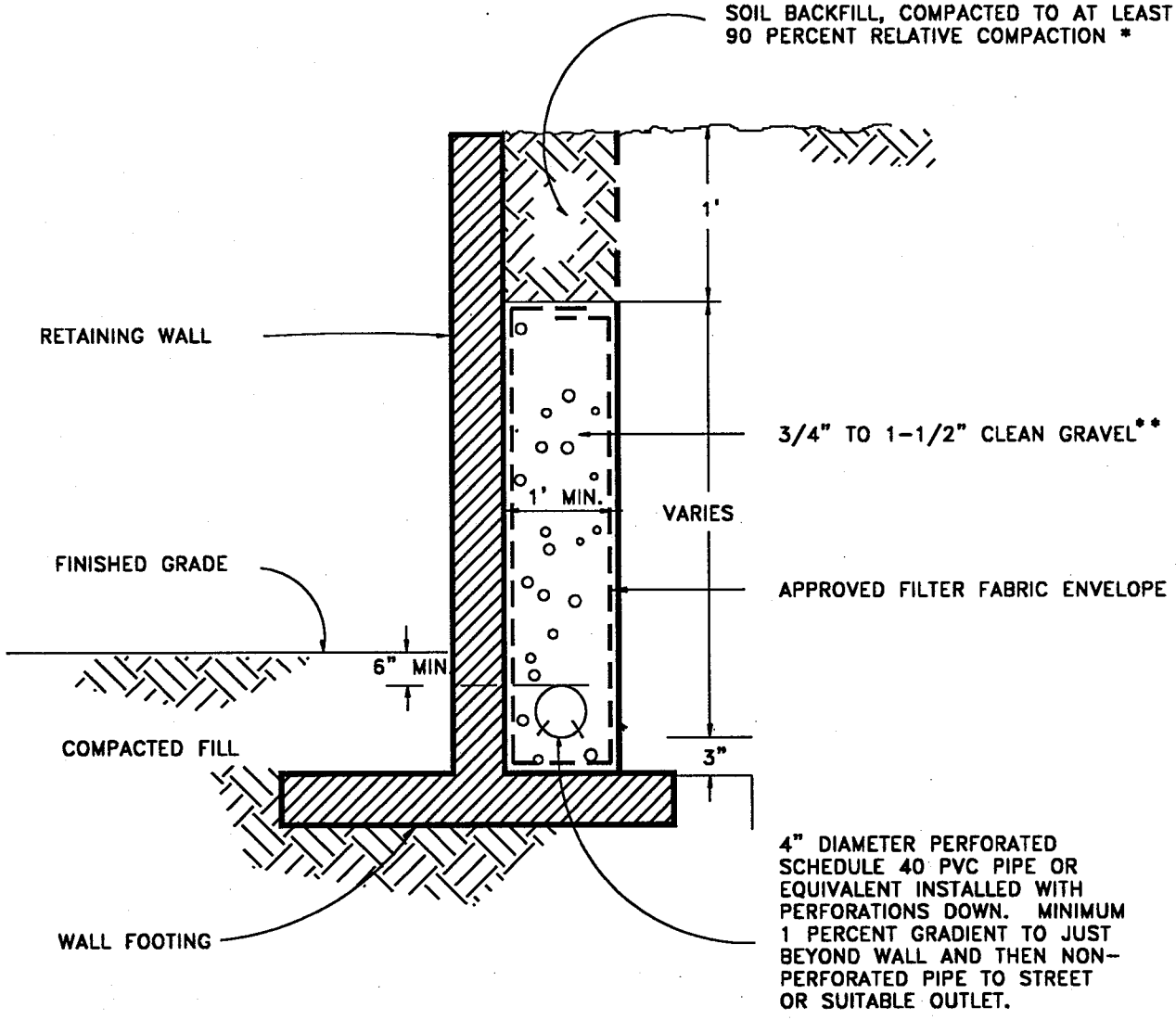
PIPE BEDDING AND TRENCH BACKFILL DETAIL

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	5

PERMEABLE MATERIAL

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90–100
3/8"	40–100
No.4	25–40
No.8	18–33
No.30	5–15
No.50	0–7
No.200	0–3



* BASED ON ASTM D698-91, WITH WALL LOCATED IN NON-STRUCTURAL AREA.

** IF PERMEABLE MATERIAL (SEE GRADATION ABOVE) IS USED IN PLACE OF 3/4" TO 1-1/2" GRAVEL, FILTER FABRIC MAY BE DELETED. PERMEABLE MATERIAL SHOULD BE COMPACTED TO 90 PERCENT OF RELATIVE COMPACTION IN NON-STRUCTURAL AREAS.

NOT TO SCALE

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TYPICAL
RETAINING WALL DRAIN DETAIL

FIGURE
6


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APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven up to 18 inches into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

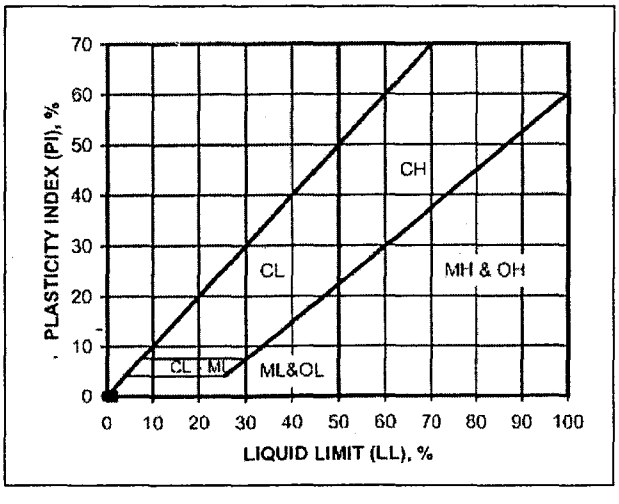
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	**GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)**	GW	Well graded gravels or gravel-sand mixtures little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	**SILTS & CLAYS Liquid Limit <50**	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

CLASSIFICATION CHART (Unified Soil Classification System)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No.4	76.2 to 4.76
Coarse	3" to 3/4"	76.2 to 19.1
Fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.420
Fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

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U.S.C.S. METHOD OF SOIL CLASSIFICATION

DATE DRILLED _____ BORING NO. PATTERNS

GROUND ELEVATION _____ SHEET 1 OF 2

METHOD OF DRILLING _____

DRIVE WEIGHT _____ DROP _____

SAMPLED BY _____ LOGGED BY _____ REVIEWED BY _____

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								SOILS
							GW	(GW:G3N) = well graded GRAVEL
							GP	(GP:G) = poorly graded GRAVEL, sandy gravel, aggregate base
							GM	(GM:GZ) = silty GRAVEL
							GC	(GC:OG) = clayey GRAVEL
							SW	(SW:D) = well graded SAND
							SP	(SP:S) = poorly graded SAND
5							SM	(NZ) = silty SAND
							SC	(NO) = clayey SAND
							CL	(O) = low plasticity CLAY or just CLAY
							ML	(Z) = silt
							OL	(4) = low plasticity organic SILT
							CH	(C) = high plasticity CLAY
							MH	(M) = plastic SILT
10							OH	(5) = high plasticity organic CLAY
							PT	(Q) = peat
								ROCKS AND CONCRETE
								(I) = SILTSTONE (clayey SILTSTONE, sandy SILTSTONE, etc.)
								(1) = SANDSTONE (silty SANDSTONE, clayey SANDSTONE, etc.)
								(H) = CLAYSTONE (sandy CLAYSTONE, silty CLAYSTONE, etc.)
								(O12) = BRECCIA rock with angular and/or gravel- or cobble-sized clasts
15								(B) + (1) = CONGLOMERATE
								(>) = SHALE or SLATE
								(/) = GRANITIC ROCK or BONSALL TONALITE
								(2) = METAVOLCANIC (or VOLCANIC) ROCK
								(2+I) = VOLCANIC TUFF
								(V) = GABBROIC ROCK or other intrusive igneous rock
								(P) = ASPHALT CONCRETE
20								(9) = CONCRETE

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BORING LOG

LEGEND FOR BORING LOGS

PROJECT NO.	DATE	FIGURE
PATTERNS	REV. 5/99	Legend-1

DATE DRILLED _____ BORING NO. PATTERNS

GROUND ELEVATION _____ SHEET 2 OF 2

METHOD OF DRILLING _____

DRIVE WEIGHT _____ DROP _____

SAMPLED BY _____ LOGGED BY _____ REVIEWED BY _____

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20				▽				(WATER) Water table during drilling.
				▼				(FWATER) Water table at boring completion.
								(%) = CALICHE
								(.) = GYPSUM
								($) = SCHIST
								(7) = Mudstone
25								(() Dolomite
30								
35								
40								

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BORING LOG

LEGEND FOR BORING LOGS

PROJECT NO.	DATE	FIGURE
PATTERNS	REV. 5/99	Legend-2

DATE DRILLED _____ BORING NO. SYMBOL SAMPLES

GROUND ELEVATION _____ SHEET 1 OF 1

METHOD OF DRILLING _____

DRIVE WEIGHT _____ DROP _____

SAMPLED BY _____ LOGGED BY _____ REVIEWED BY _____

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								Solid line denotes unit change.
								Dashed line denotes material change.
		■						Modified split-barrel drive sampler.
		☒						No recovery with modified split-barrel drive sampler.
5				♀				Seepage.
				▽				Groundwater encountered during drilling.
				▼				Groundwater measured after drilling.
10		◢						Standard Penetration Test (SPT).
		◢						No recovery with a SPT.
		▯	XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
		◢						No recovery with Shelby tube sampler.
15	■							Bulk sample.
		▯						Continuous Push Sample.
20								The total depth line is a solid line that is drawn at the bottom of the boring.

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BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.	DATE	FIGURE
SYMSAMP	Rev. 5/99	Legend-3

DATE DRILLED 6/13/01 BORING NO. B-1

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 19+20 LATERAL OFFSET = 150' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GM	ALLUVIUM: Brown, damp, medium dense, silty GRAVEL; little fine to coarse sand and rounded cobbles.
		29	0.5				
5		22					
		29	1.1	125.6		SP	Brown, damp, medium dense, gravelly fine to coarse SAND; few rounded cobbles.
10		29	1.5				
							Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/13/01.
15							
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-1

DATE DRILLED 6/13/01 BORING NO. B-2

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 29+70 LATERAL OFFSET = 130' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SP	ALLUVIUM: Brown, damp, medium dense, fine SAND.
	Driven	15	10.5				
5	Driven	17	4.0	112.0		GP-GM	Brown, damp, loose, sandy GRAVEL with silt.
	Driven	23	4.5			SP	Brown, moist, medium dense, fine to coarse SAND; little gravel.
10	Driven	20	3.0	103.2			Loose.
15	Driven	10	7.2				
							Total Depth = 16.5' Groundwater not encountered, backfilled on 6/13/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-2

DATE DRILLED 6/13/01 BORING NO. B-3

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 40+00 LATERAL OFFSET = 145' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						ML	ALLUVIUM: Brown, damp, loose, fine sandy SILT.
		7	10.0				
5		4	14.5	82.2			Very loose.
		3	10.2				
10		9	17.0	91.3		CL/SC	Brown, moist, firm, fine sandy CLAY to loose, clayey fine SAND.
		8	15.5			SC	Brown, moist, loose, clayey fine to medium SAND.
15							Total Depth = 13.0' Groundwater not encountered. Backfilled on 6/13/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-3

DATE DRILLED 6/13/01 BORING NO. B-4

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 50+80 LATERAL OFFSET = 145' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Brown, damp, firm, silty CLAY; little fine sand.
		13	14.0	92.0			
5		4	16.8				
		14	7.7	94.4		SM	Brown, moist, loose, silty fine SAND.
10		14	15.4	92.7			
		13	2.6			SP	Brown, moist, medium dense, fine to medium SAND.
15							Total Depth = 13.0' Groundwater not encountered. Backfilled on 6/13/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-4

DATE DRILLED 6/13/01 BORING NO. B-5

GROUND ELEVATION -- SHEET 1 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 60+00 LATERAL OFFSET = 145' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Brown, damp, firm, silty CLAY; few fine to coarse sand.
		6	12.8	95.2			
5		6	12.1	90.6			Some fine sand; few gravel.
						ML	Brown, damp, sitff, clayey SILT; some fine sand; few gravel.
		12	11.2	88.9			
10		21	14.5	90.9			Very stiff.
							Few rounded cobbles.
15		20					
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-5

DATE DRILLED 6/13/01 BORING NO. B-5

GROUND ELEVATION -- SHEET 2 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 60+00 LATERAL OFFSET = 145' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	64	2.5	111.3		SP	ALLUVIUM: Brown, moist, dense, gravelly fine to coarse SAND; few rounded cobbles.
								Total Depth = 22.0' (Refusal on sand, gravel, and cobbles) Groundwater not encountered. Backfilled on 6/13/01.
25								
30								
35								
40								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-6

DATE DRILLED 6/13/01 BORING NO. B-6

GROUND ELEVATION -- SHEET 1 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 70+70 LATERAL OFFSET = 140' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Brown, damp, very stiff, fine sandy CLAY.
		26	17.3	97.5			
5		7	10.9	92.7			Firm; silty; few fine sand.
		10	8.0	89.9		SM	Brown, damp, loose, silty fine SAND.
10		18	2.2	101.3		SP	Brown, damp, loose, fine SAND; trace silt. Few gravel.
15		61/10"	2.5			SP-SM	Brown, damp, dense, gravelly fine to coarse SAND with silt; few rounded cobbles.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-7

DATE DRILLED 6/13/01 BORING NO. B-6

GROUND ELEVATION -- SHEET 2 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 70+70 LATERAL OFFSET = 140' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	28	2.6	99.5		SP	ALLUVIUM: (continued) Brown, moist, medium dense, fine to medium SAND; trace silt.
25		■	96/9"	19.7			SC	Brown, moist to wet, very dense, clayey fine to coarse SAND; few gravel.
30		■	54	▼			GP	Brown, wet, medium dense, sandy GRAVEL; trace clay.
35								Total Depth = 31.5' Groundwater encountered at 30'. Backfilled on 6/13/01.
40								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-8

DATE DRILLED _____ BORING NO. B-7

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = _____ LATERAL OFFSET = _____

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								Boring was eliminated from scope.
5								
10								
15								
20								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-9

DATE DRILLED 6/21/01 BORING NO. B-8

GROUND ELEVATION -- SHEET 1 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 93+00 LATERAL OFFSET = 130' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		24	8.0	97.7		ML	ALLUVIUM: Brown, dry, medium dense, fine sandy SILT; scattered caliche nodules.
5		13	18.9			CL	Brown, moist, stiff, silty CLAY; scattered caliche nodules.
		20	19.1	94.4		SC	Brown, moist, loose, clayey SAND; scattered caliche nodules.
10		13	16.4			SM	Dark brown, moist, medium dense, silty fine SAND; trace clay.
						SP	Dark brown, moist to wet; medium dense; fine to medium SAND; little gravel.
15		39	22.5				
						GP	Brown, moist, medium dense, sandy GRAVEL.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-10

DATE DRILLED 6/21/01 BORING NO. B-8

GROUND ELEVATION -- SHEET 2 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 93+00 LATERAL OFFSET = 130' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		60	2.5			GP-GM	ALLUVIUM: (continued) Brown, moist, medium dense, sandy GRAVEL with silt.
25		50/0"					Very dense.
							Total Depth = 25' (Refusal on sand, gravel, and cobbles) Groundwater not encountered. Backfilled on 6/21/01.
30							
35							
40							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-11

DATE DRILLED 6/13/01 BORING NO. B-9

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 114+00 LATERAL OFFSET = 70' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Brown, damp, firm, silty CLAY.
		7	20.3				
5		13	19.4	99.9			Stiff; few fine sand.
		15	24.1				
10		18	19.6	100.9			
		22	17.4				Very stiff; sandy.
							Total Depth = 13.0' Groundwater not encountered. Backfilled on 6/13/01.
15							
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-12

DATE DRILLED 6/21/01 BORING NO. B-10

GROUND ELEVATION -- SHEET 1 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 131+50 LATERAL OFFSET = 64' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						ML	ALLUVIUM: Dark brown, moist, loose, sandy SILT; scattered caliche nodules.
		17					
5		13	14.4	98.3			
		9	12.7				No caliche.
10		21	19.0	103.6			
						GP-GC	Brown, moist, medium dense, sandy GRAVEL with clay.
15		26	3.2				
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-13

DATE DRILLED 6/21/01 BORING NO. B-10

GROUND ELEVATION -- SHEET 2 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 131+50 LATERAL OFFSET = 64' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		61				GP	ALLUVIUM: (continued) Brown, moist, very dense, sandy GRAVEL; trace clay.
							Total Depth = 21.5' Groundwater not encountered. Backfilled on 6/21/01.
25							
30							
35							
40							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-14

DATE DRILLED 6/28/01 BORING NO. B-11

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 148+00 LATERAL OFFSET = 1,320' Lt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		19	15.1	96.6		CL	ALLUVIUM: Brown, damp, stiff, silty CLAY; little fine sand.
5		6	16.4			SM	Brown, moist, loose, silty fine SAND.
		35	19.7	104.5		CL	Brown, moist, very stiff, silty CLAY; little fine sand.
10		16	16.3			SM	Brown, moist, medium dense, silty fine SAND.
15							Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/28/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-15

DATE DRILLED 6/21/01 BORING NO. B-12

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 159+00 LATERAL OFFSET = 197'Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	ALLUVIUM: Brown, damp, loose, clayey fine to coarse SAND; little gravel.
		■	19	5.7	100.9			
5		◢	7	9.6			SC	Reddish brown, damp, loose, clayey fine SAND.
		■	18	13.2	99.4		CL	Reddish brown, damp, stiff, fine sandy CLAY.
10		◢	30	19.2				Very stiff.
								Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/21/01.
15								
20								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-16

DATE DRILLED 6/21/01 BORING NO. B-13

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 188+50 LATERAL OFFSET = 80' Lt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		17	20.4	98.4		ML	ALLUVIUM: Yellow brown, damp, loose, SILT; few fine sand.
5		25	18.1	106.8		ML	Yellow brown, damp, very stiff, clayey SILT; few fine sand.
		70	6.7			GC	Brown, moist, dense, clayey GRAVEL; little fine to coarse sand.
10							Total Depth = 9.0' (Refusal on sand, gravel, and cobbles) Groundwater not encountered. Backfilled on 6/21/01.
15							
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-17

DATE DRILLED 6/22/01 BORING NO. B-14

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 210+00 LATERAL OFFSET = 45' Lt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		19	12.6	93.8		ML	ALLUVIUM: Brown, damp, loose, fine sandy SILT.
5		24	17.5	102.0		CL	Brown, damp, very stiff, silty CLAY; scattered caliche nodules.
		13	12.7			SC	Dark brown, moist, medium dense, clayey fine SAND; few fine to coarse sand; scattered caliche nodules.
10						CL	Dark brown, moist, stiff, silty CLAY; few fine to coarse sand; scattered caliche nodules.
		16				SM	Yellowish brown, damp, loose, silty fine SAND.
						GP	Brown, damp, dense, sandy GRAVEL.
15		85					
							Total Depth = 16.0' (Refusal on sand, gravel, and cobbles) Groundwater not encountered. Backfilled on 6/22/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-18

DATE DRILLED 6/22/01 BORING NO. B-15

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 226+50 LATERAL OFFSET = 93' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		20	13.9			ML	ALLUVIUM: Light brown, damp, loose, sandy SILT.
5		12	14.6			CL	Dark brown, damp to moist, stiff, silty CLAY; few fine sand.
		19	15.2	107.6		ML	Dark brown, moist, loose, fine sandy SILT; trace clay; scattered caliche nodules.
10		9	21.3				
							Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/21/01.
15							
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-19

DATE DRILLED 6/22/01 BORING NO. B-16

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 251+50 LATERAL OFFSET = 1,850' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							CL	ALLUVIUM: Dark brown, moist, stiff to very stiff, silty CLAY.
			20	20.8	96.4			
5			20	14.9				Very stiff.
			24	13.7	107.5			Scattered caliche nodules.
10			10	20.6				Few fine to coarse sand.
								Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/22/01.
15								
20								

Ninyo & Moore

BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-20

DATE DRILLED 6/22/01 BORING NO. B-17

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 256+50 LATERAL OFFSET = 40' Lt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		19				SM	ALLUVIUM: Brown, damp, loose, silty fine to coarse SAND; little gravel.
5		15	17.4	102.7		CL	Dark brown, moist, stiff, silty CLAY; little fine sand.
		10	25.4				
10		18	20.2	103.3		ML	Dark brown, moist, loose, fine sandy SILT; scattered caliche nodules.
15							Total Depth = 13.0' (Refusal on sand, gravel, and cobbles) Groundwater not encountered. Backfilled on 6/22/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-21

DATE DRILLED 6/28/01 BORING NO. B-18

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 284+00 LATERAL OFFSET = 30' Lt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ML	ALLUVIUM: Brown, damp, loose, fine sandy SILT.
		■	13	16.9	93.5			
5		■	9	19.6				Scattered caliche nodules.
		■	19	17.5	102.7			Few gravel; no caliche.
10		■	10	17.5				Moist.
								Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/28/01.
15								
20								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-22

DATE DRILLED 6/22/01 BORING NO. B-19

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = 314+50 LATERAL OFFSET = 40' Rt.

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ML	ALLUVIUM: Brown, damp, loose SILT; little fine sand.
			13	9.2	93.7			
5			16	15.3				Medium dense.
							SM	Brown, damp, loose, silty fine SAND.
			16	13.8	101.6			
10			14	7.5				Few coarse sand.
								Total Depth = 11.5' Groundwater not encountered. Backfilled on 6/22/01.
15								
20								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-23

DATE DRILLED 6/22/01 BORING NO. B-20

GROUND ELEVATION -- SHEET 1 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = NA LATERAL OFFSET = NA

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Dark brown, damp, stiff to very stiff, fine sandy CLAY.
	Driven	20	12.3	99.5			
5	Driven	13	17.1				Stiff; scattered caliche nodules.
						SM	Brown, damp, loose, silty fine SAND.
	Driven	19	12.3	96.6			
10	Driven	8	16.5				
						GW-GM	Brown, damp, medium dense, sandy GRAVEL with silt.
15	Driven	27	3.4				
20							

Ninyo & Moore

BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-24

DATE DRILLED 6/22/01 BORING NO. B-20

GROUND ELEVATION -- SHEET 2 OF 2

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = NA LATERAL OFFSET = NA

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			50/4"				GP	ALLUVIUM: (continued) Brown, damp, very dense, sandy GRAVEL.
								Total Depth = 20.3' (Refusal) Groundwater not encountered. Backfilled on 6/22/01.
25								
30								
35								
40								

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-25

DATE DRILLED 6/28/01 BORING NO. B-21

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME 75, 6.5" Hollow-Stem Auger

BASELINE STATION = NA LATERAL OFFSET = NA

SAMPLED BY EMS LOGGED BY EMS REVIEWED BY LLG

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Brown, damp, very stiff, silty CLAY; few fine to coarse sand.
		35	16.2	106.7			
5						SM	Brown, damp, loose to medium dense, silty fine SAND; few coarse sand.
		21	11.7	97.0			
		16	12.5				Medium dense.
10						ML	Brown, damp, medium dense, fine sandy SILT; few gravel.
		26	15.7	100.4			
						GC	Brown, damp, medium dense, clayey GRAVEL; little fine to coarse sand.
						GP	Brown, damp, dense, sandy GRAVEL; trace silt.
15		85/11"	2.0				
							Total Depth = 17.5' (Refusal) Groundwater not encountered. Backfilled on 6/28/01.
20							

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BORING LOG

Flood Control District of Maricopa County
Laveen Area Conveyance Channel

PROJECT NO.	DATE	FIGURE
600220001	10/2001	A-26


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APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-93. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

Moisture Content

The moisture content of samples obtained from the exploratory excavations was evaluated in accordance with ASTM D 2216-92. The test results are presented on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-94. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures B-1 through B-22. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

200 Wash

An evaluation of the percentage of minus-200 sieve material in selected soil samples was performed in general accordance with ASTM D 1140-97. The results of the tests are presented on Figures B-23 and B-24.

Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-98. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figures B-25 through B-27.

Direct Shear Tests

Direct shear tests were performed on undisturbed samples in general accordance with ASTM D 3080-90 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-28 through B-39.

Expansion Index Tests

The expansion index of selected materials was evaluated in general accordance with U.B.C. Standard No. 18-2. Specimens were molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these tests are presented on Figure B-40.

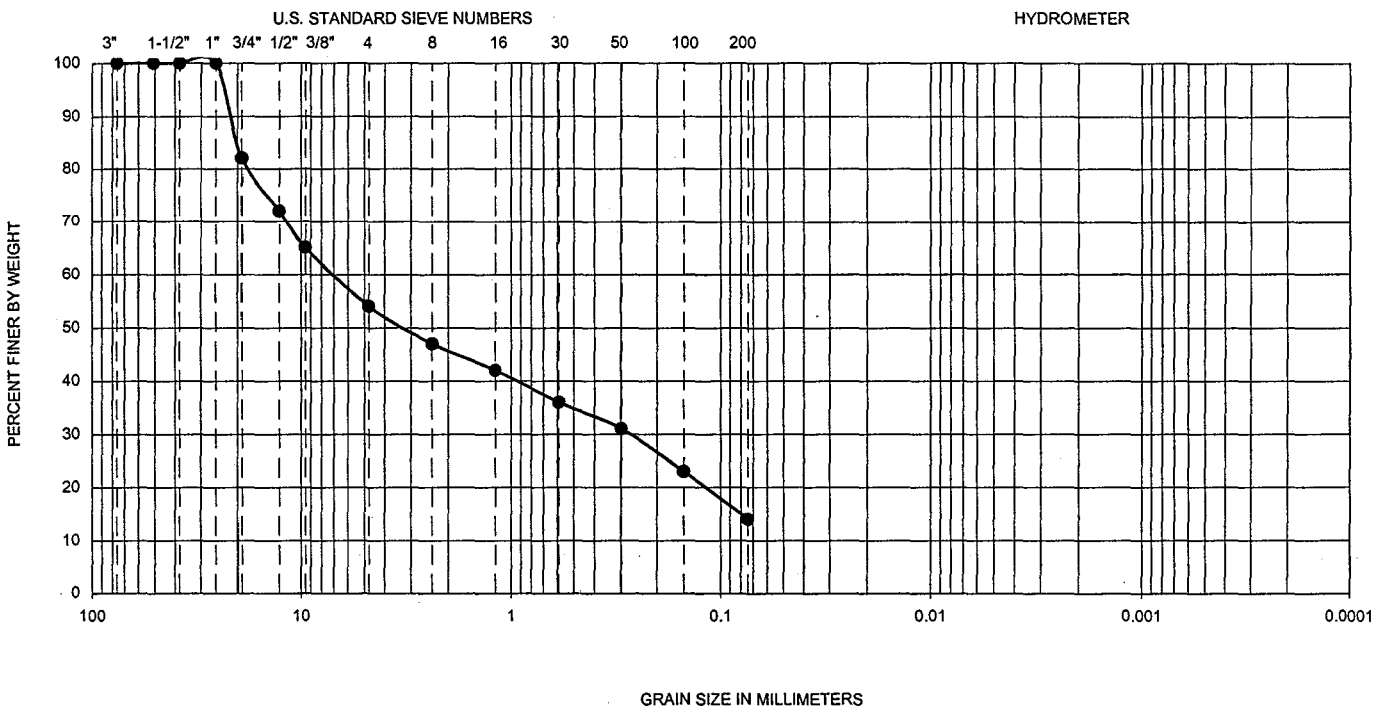
Maximum Dry Density and Optimum Moisture Content Tests

The maximum dry density and optimum moisture content of selected representative soil samples were evaluated in general accordance with ASTM D 1557-91. The results of these tests are summarized on Figures B-41 through B-45.

Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on representative samples in general accordance with Arizona Test 236b. The chloride content of selected samples was evaluated in general accordance with Arizona Test 722. The sulfate content of selected samples was evaluated in general accordance with Arizona Test 733. The test results are presented on Figure B-46.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	2.5-4	--	--	--	--	--	--	--	--	14	GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

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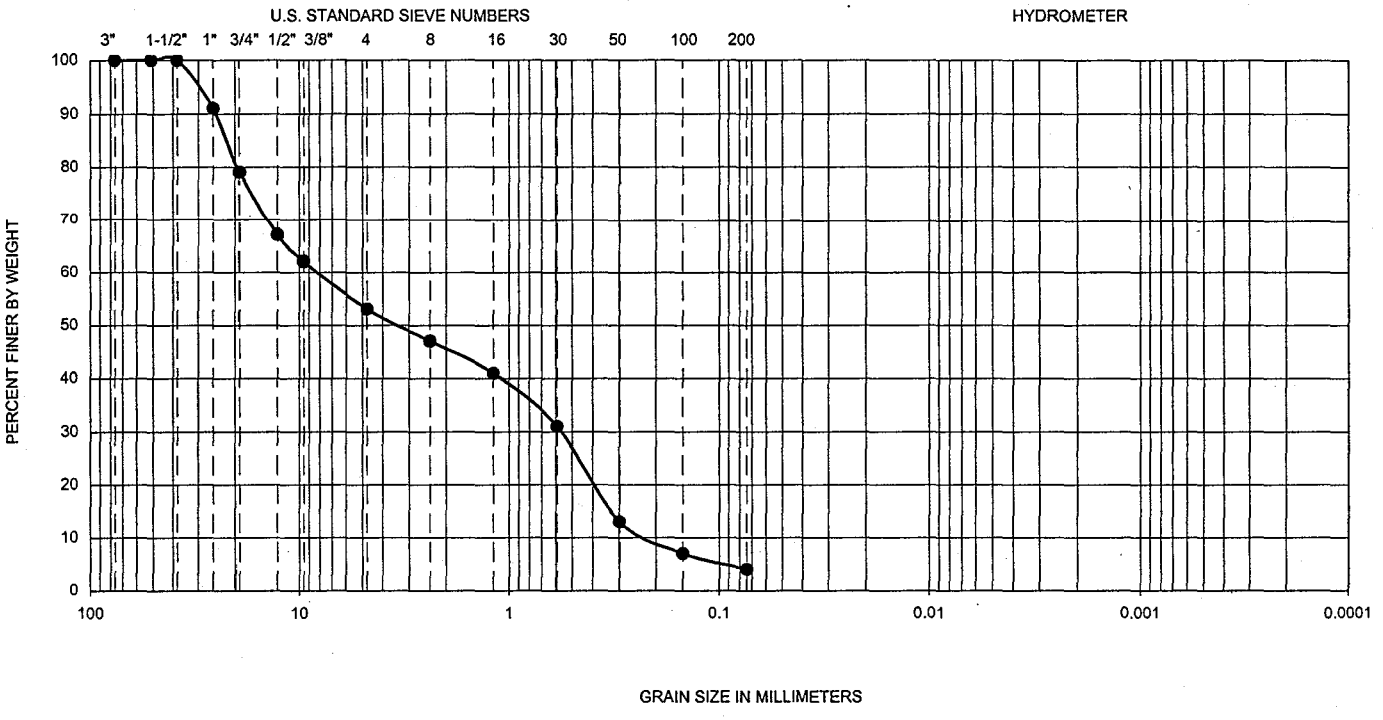
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-1

SIEVE B-1@2.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	10-11.5	--	--	--	--	--	--	--	--	4	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

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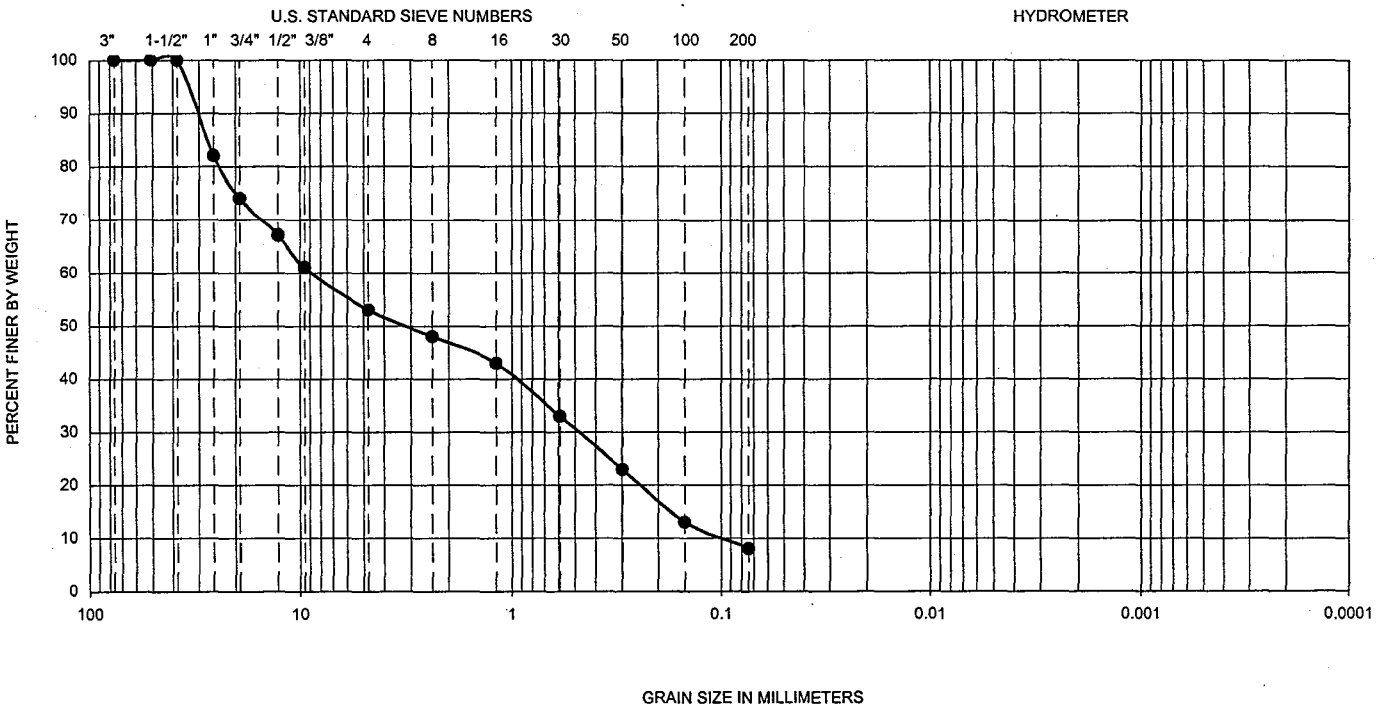
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-2

SIEVE B-1@10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-2	5-6.5	--	--	--	--	--	--	--	--	8	GP-GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

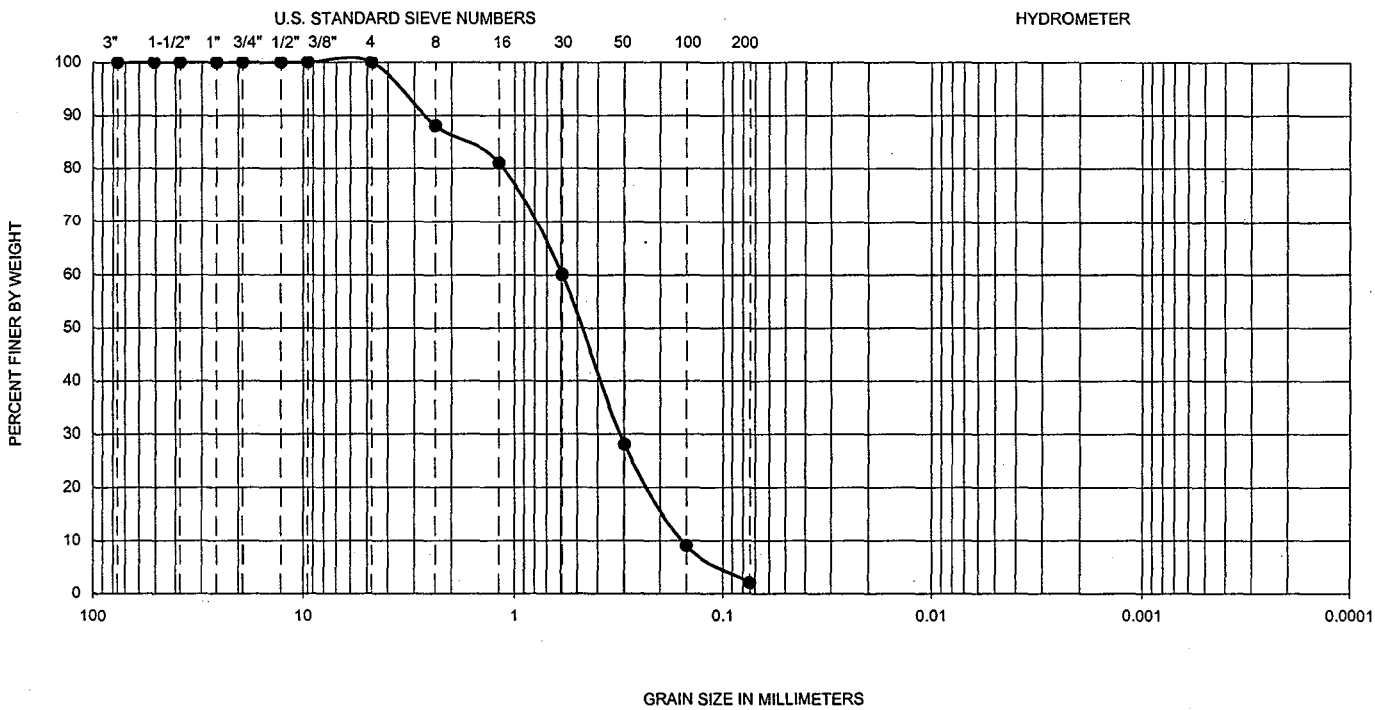
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-3

SIEVE B-2@5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-2	10-11.5	--	--	--	--	--	--	--	--	2	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

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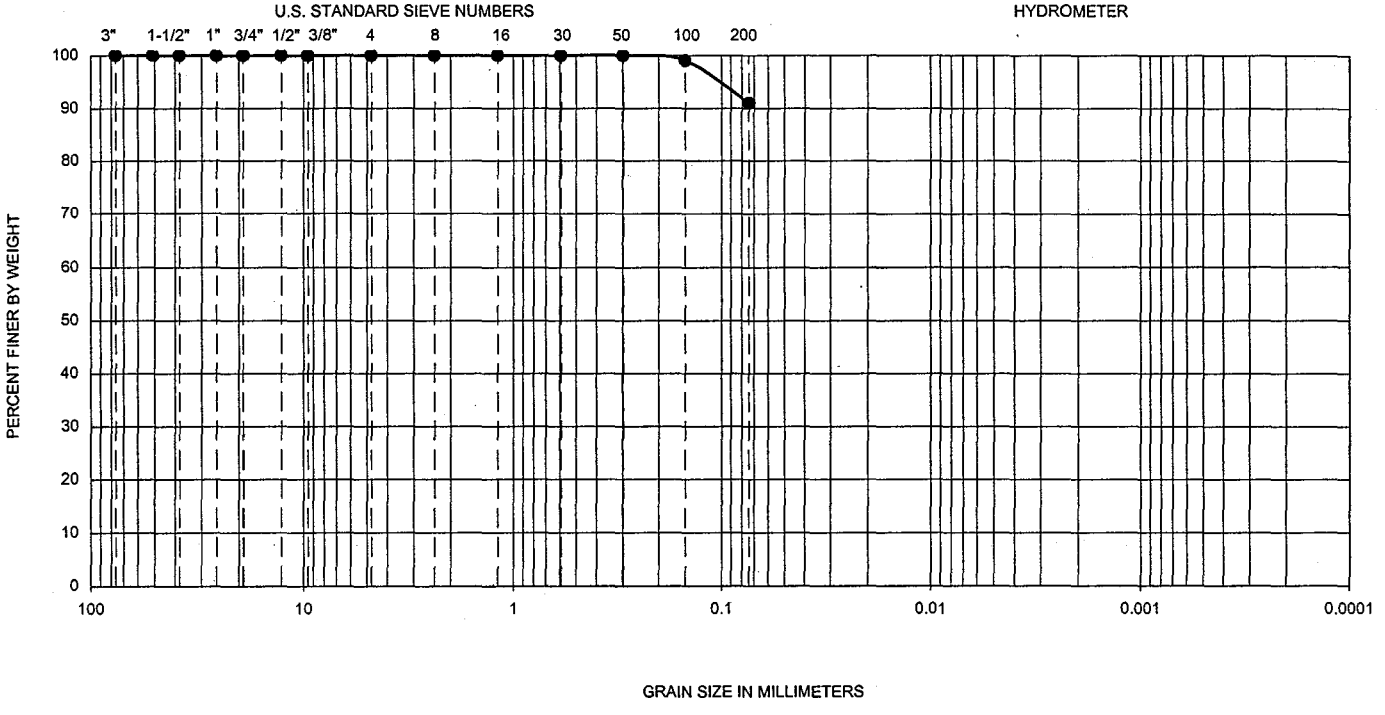
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-4

SIEVE B-2@10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-3	5-6.5	--	--	--	--	--	--	--	--	91	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

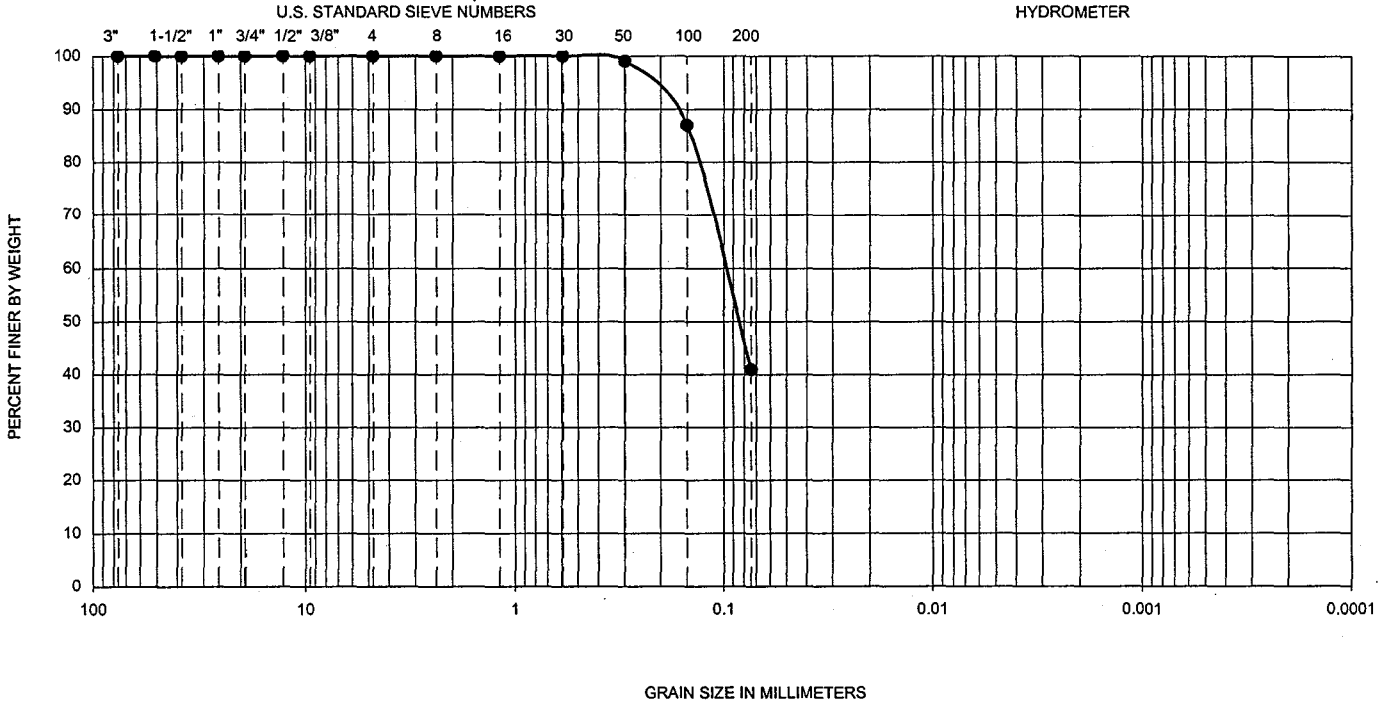
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-5

SIEVE B-3@5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-4	10-11.5	--	--	--	--	--	--	--	--	41	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

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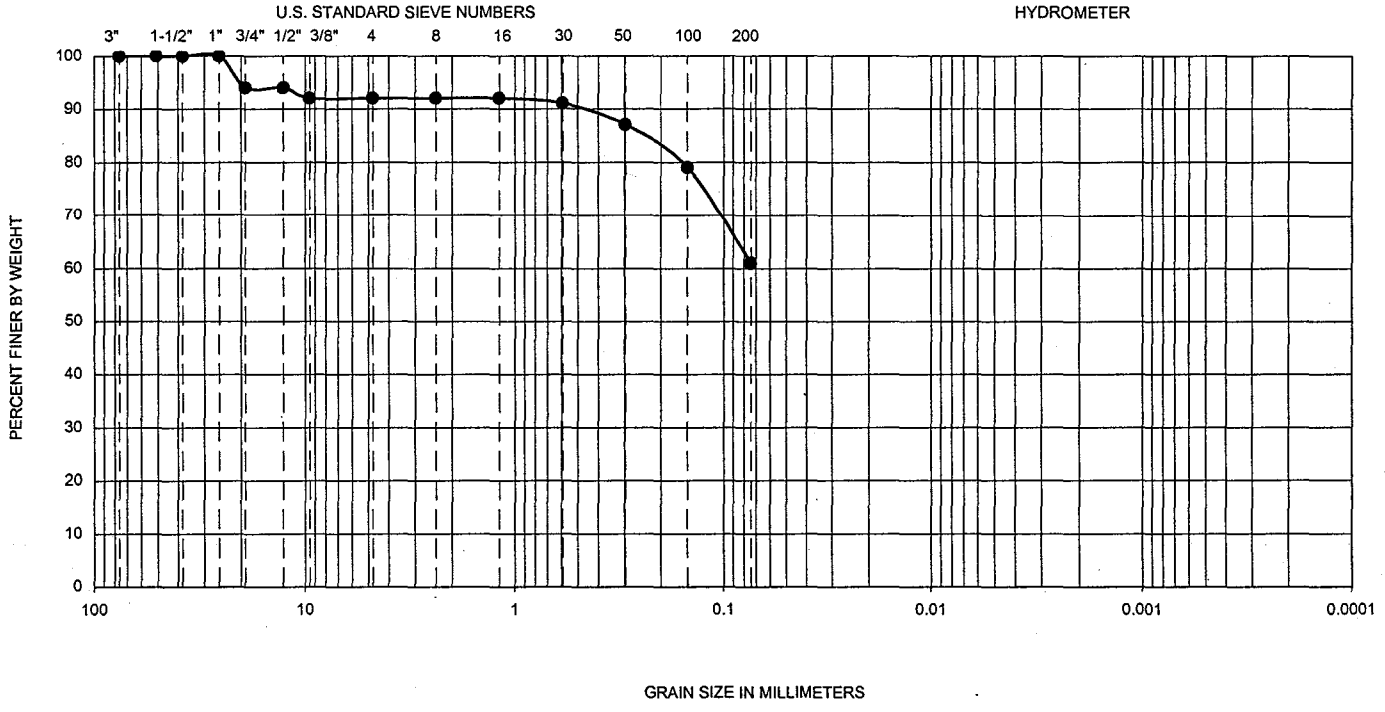
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-6

SIEVE B-4@10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-5	5-6.5	--	--	--	--	--	--	--	--	61	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

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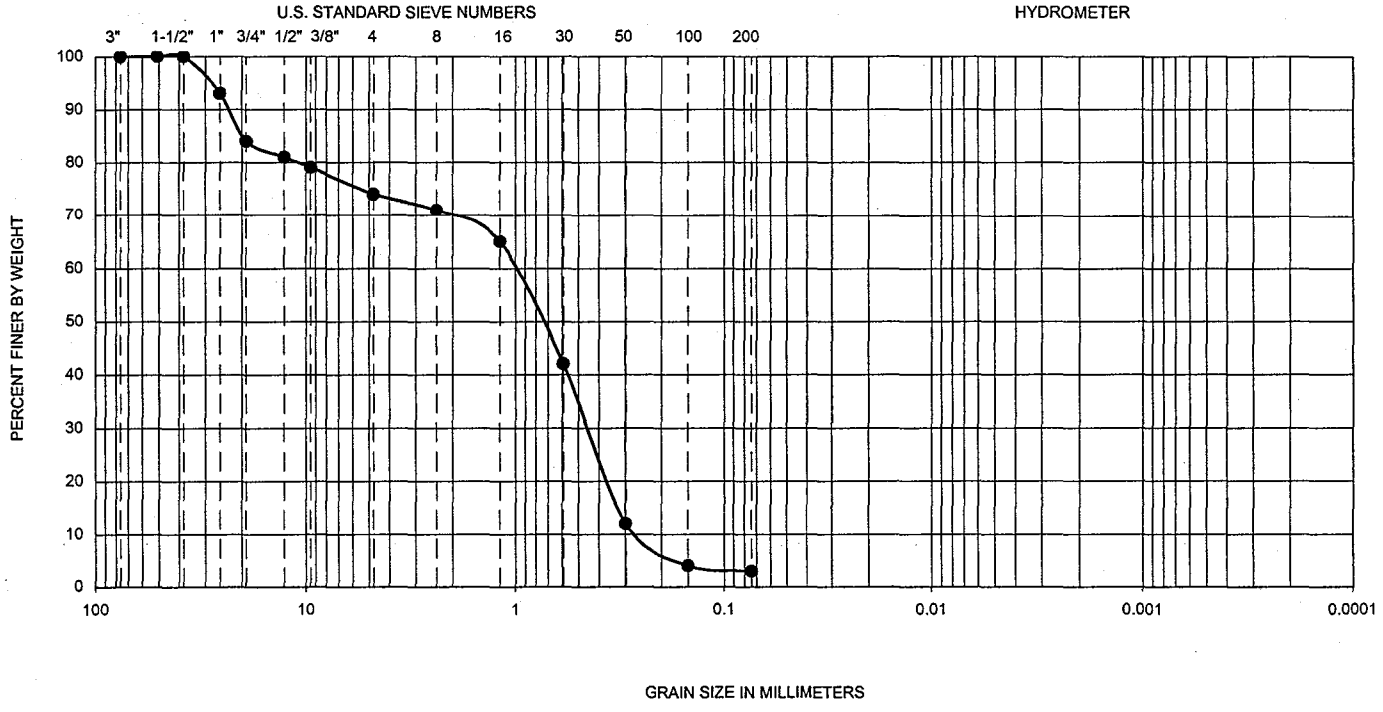
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-7

SIEVE B-5@5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-5	20-21	--	--	--	--	--	--	--	--	3	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

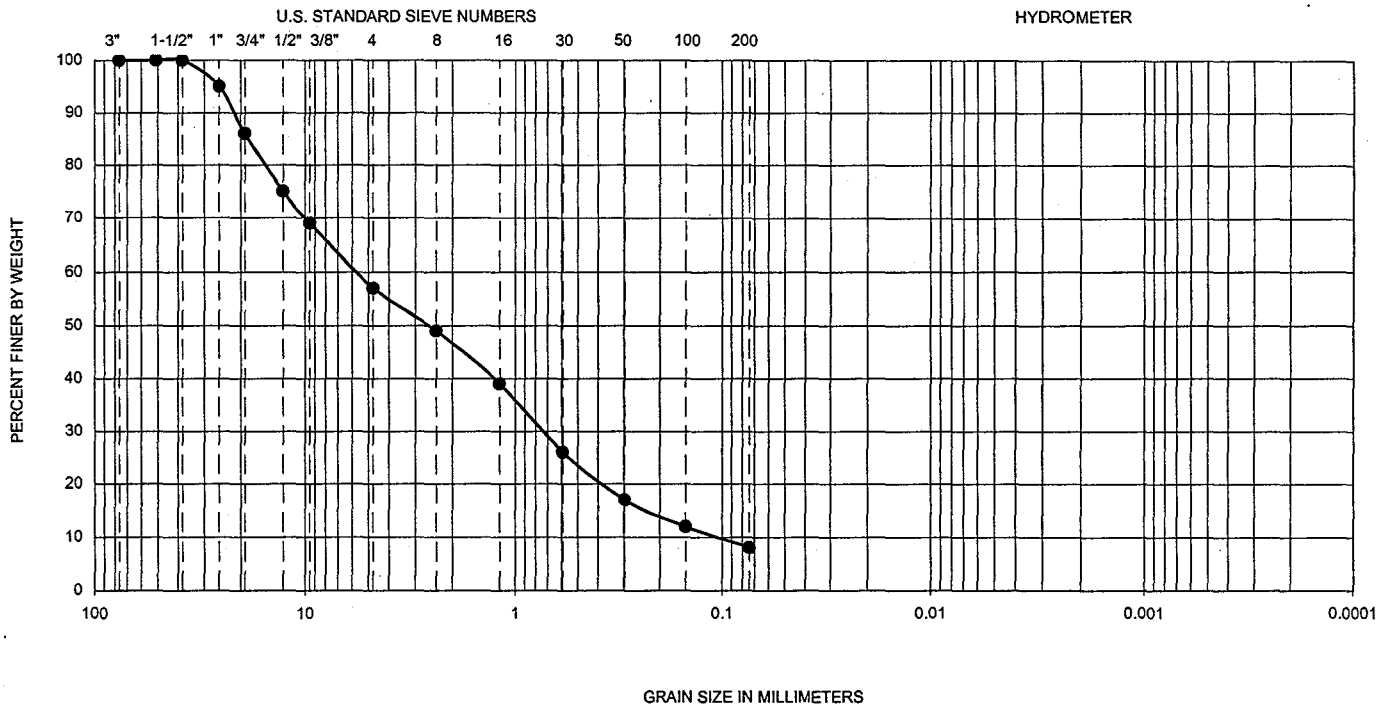
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-8

SIEVE B-5@20

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-6	15-15.8	--	--	--	--	--	--	--	--	8	SP-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

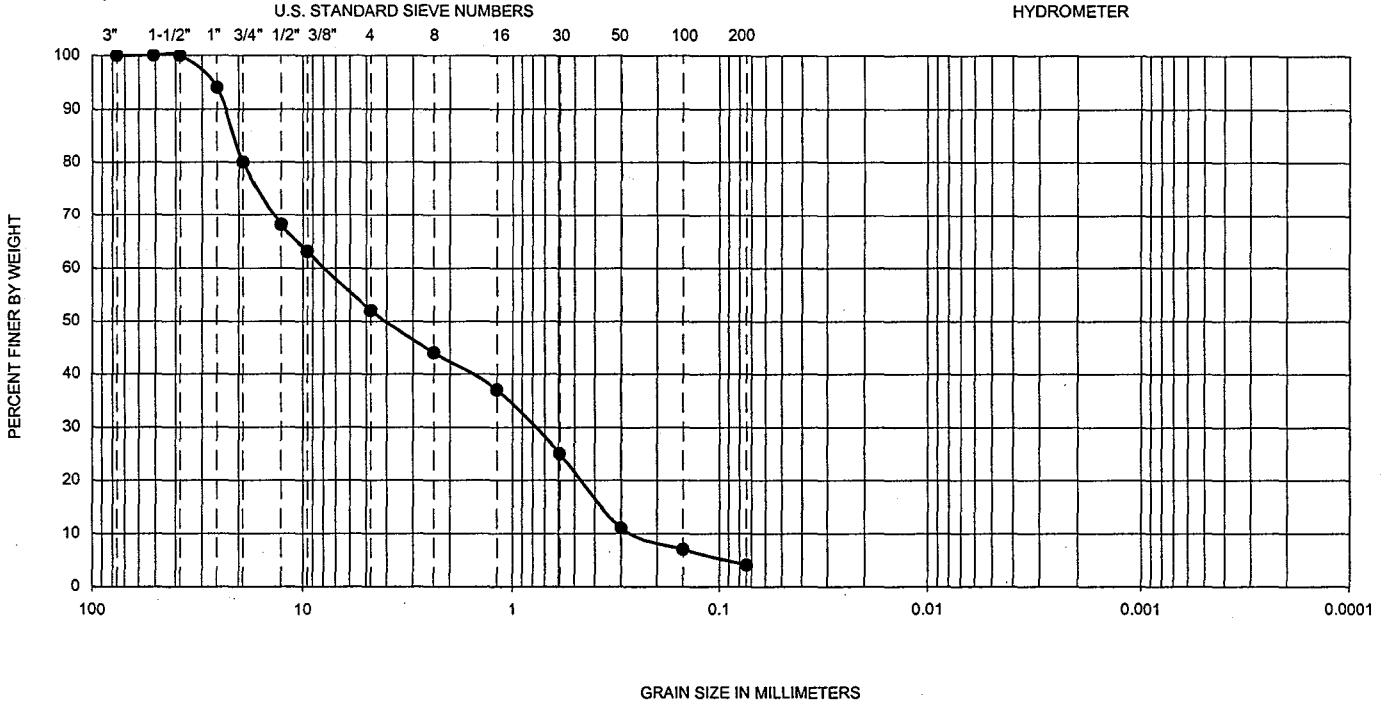
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-9

SIEVE B-6@15

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-6	30-31.5	--	--	--	--	--	--	--	--	4	GP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

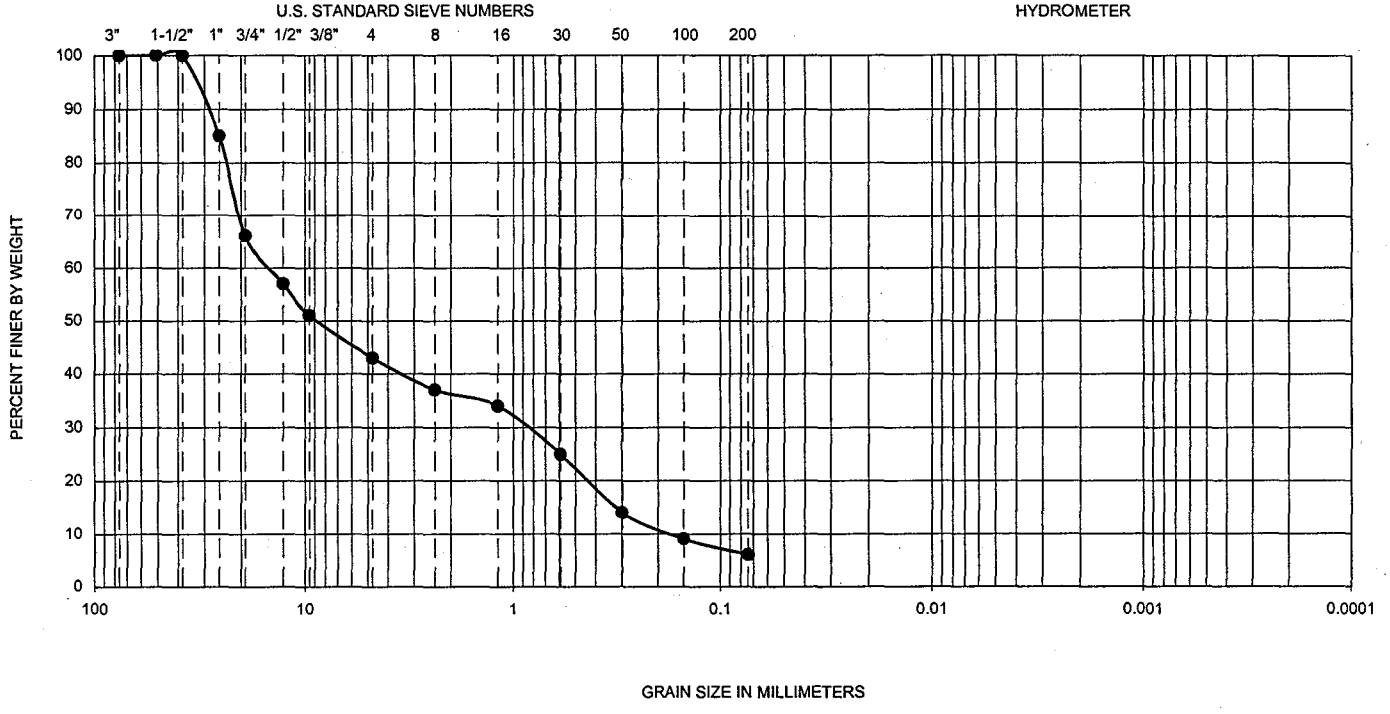
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-10

SIEVE B-6@30

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-8	20-21.5	--	--	--	--	--	--	--	--	6	GP-GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

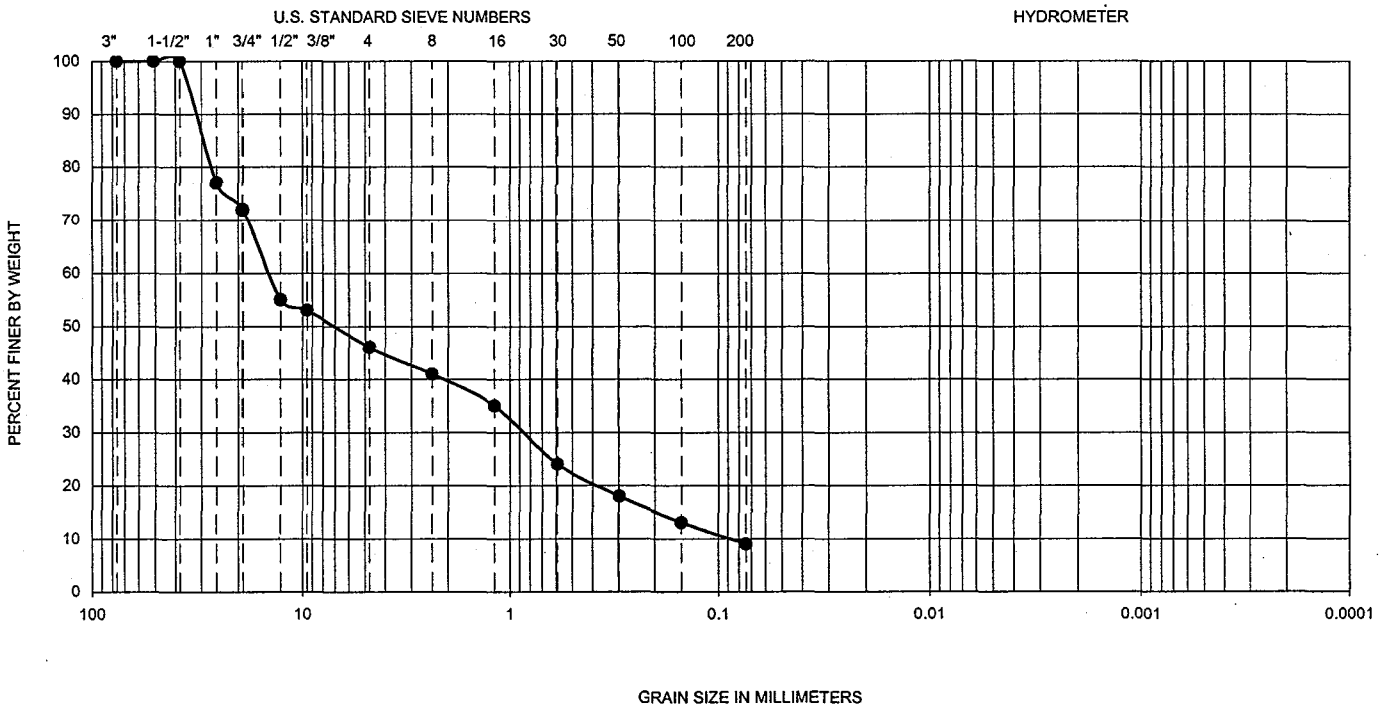
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-11

SIEVE B-8@20

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-10	15-16.5	--	--	--	--	--	--	--	--	9	GP-GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

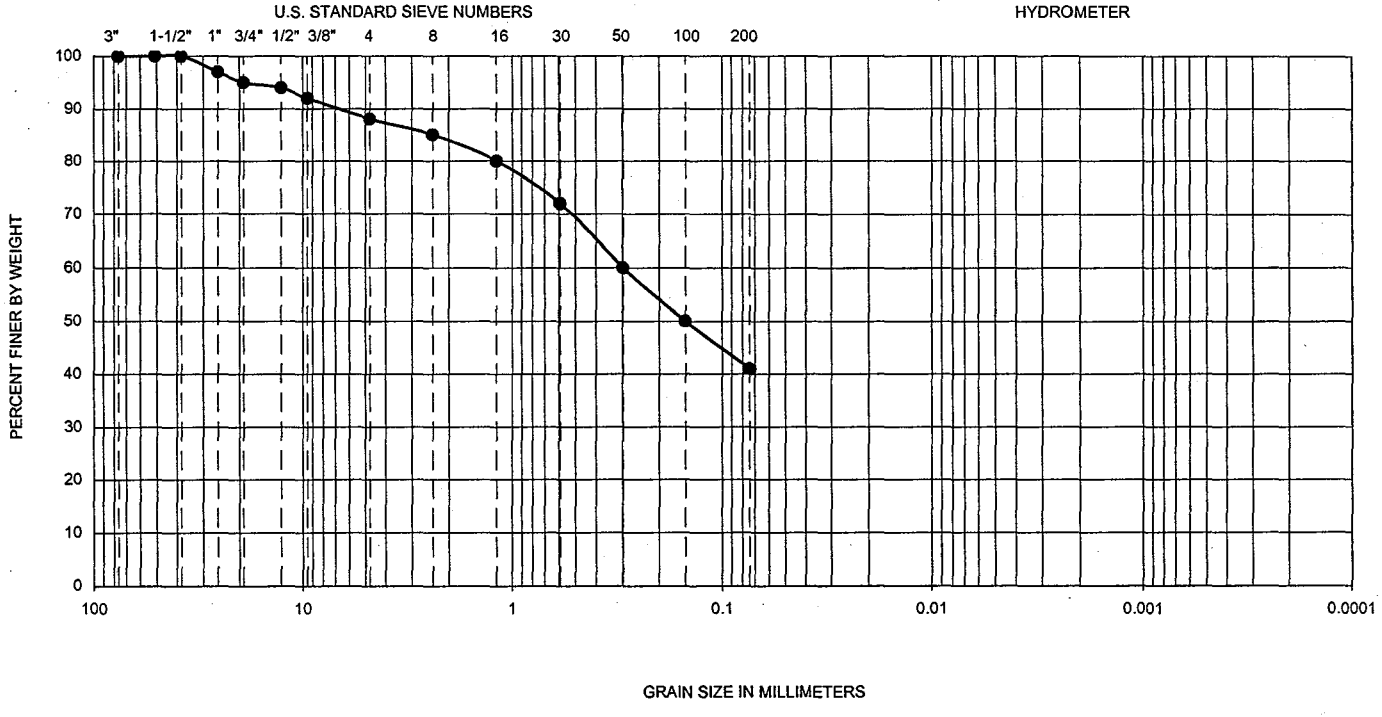
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-12

SIEVE B-10@15

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-12	2.5-4	--	--	--	--	--	--	--	--	41	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

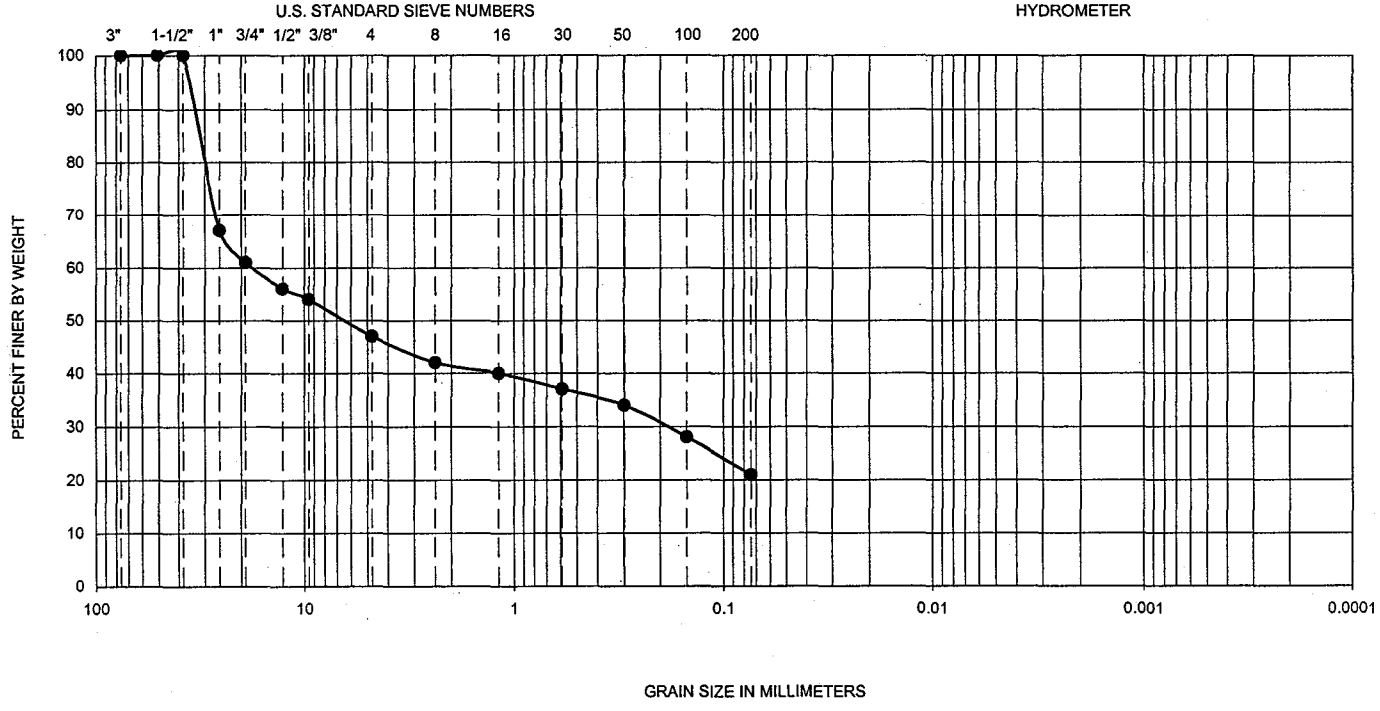
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-13

SIEVE B-12@2.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-13	7.5-8.5	--	--	--	--	--	--	--	--	21	GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

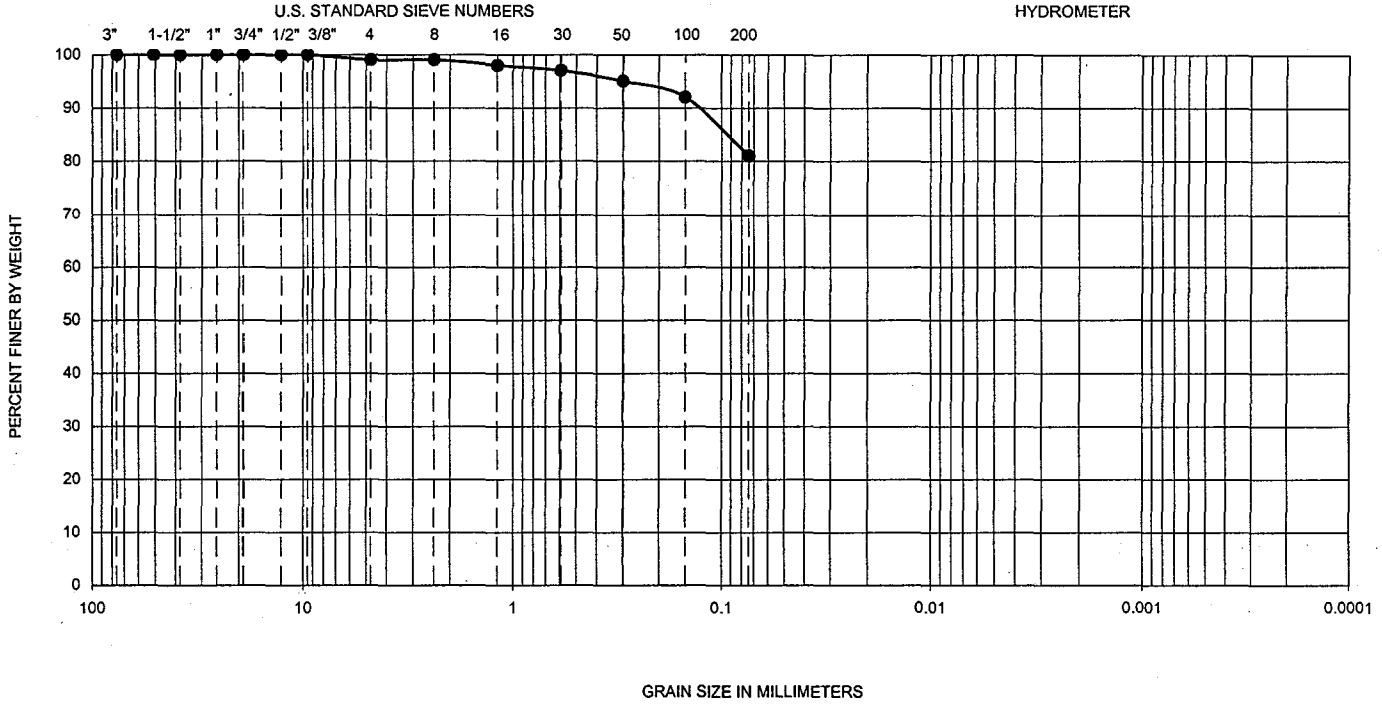
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-14

SIEVE B-13@7.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-15	2.5-4	--	--	--	--	--	--	--	--	81	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

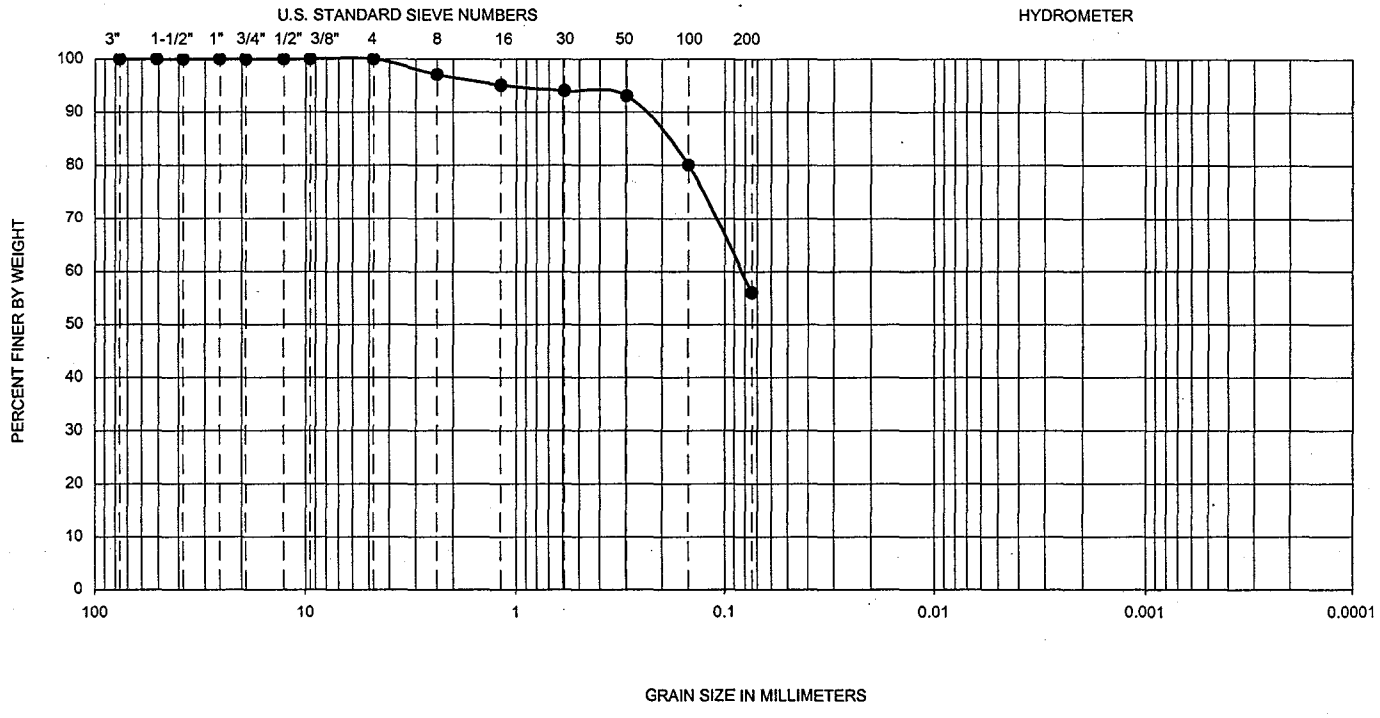
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-15

SIEVE B-15@2.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-15	7.5-9	--	--	--	--	--	--	--	--	56	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

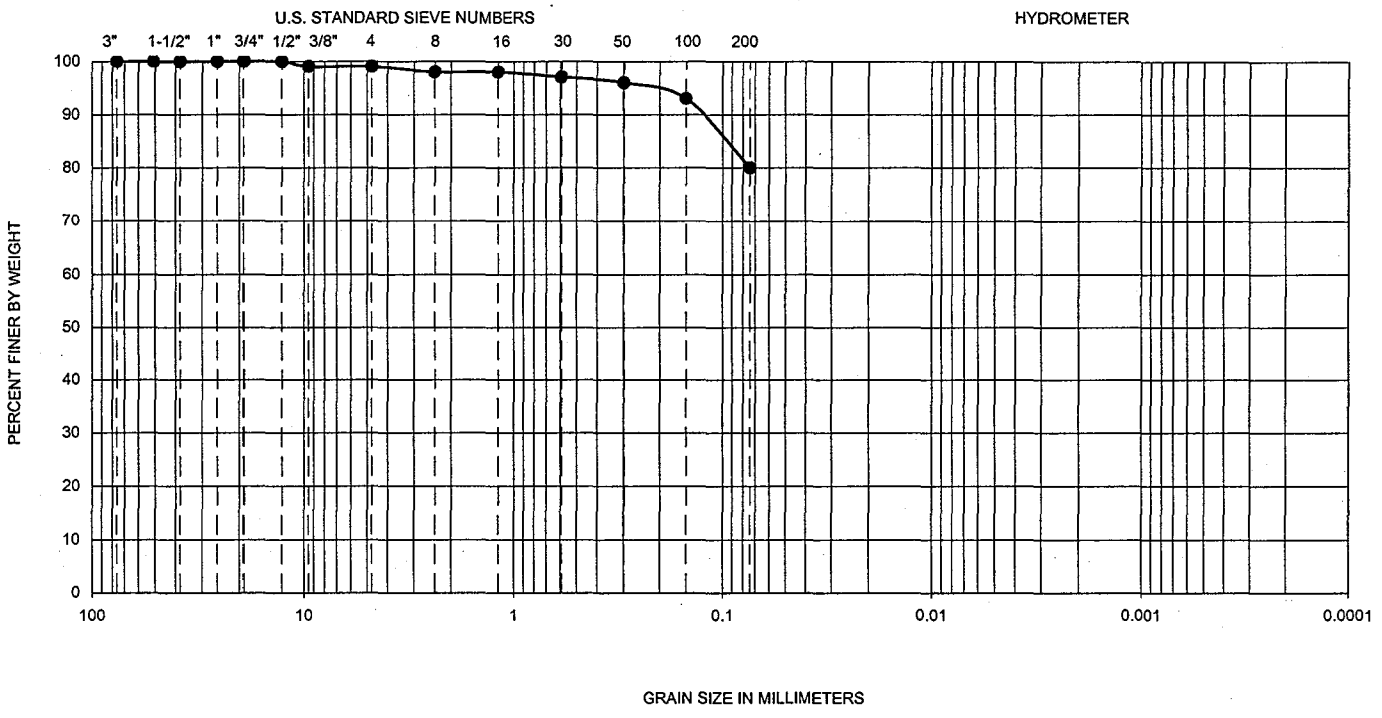
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-16

SIEVE B-15@7.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-18	2.5-4	--	--	--	--	--	--	--	--	80	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

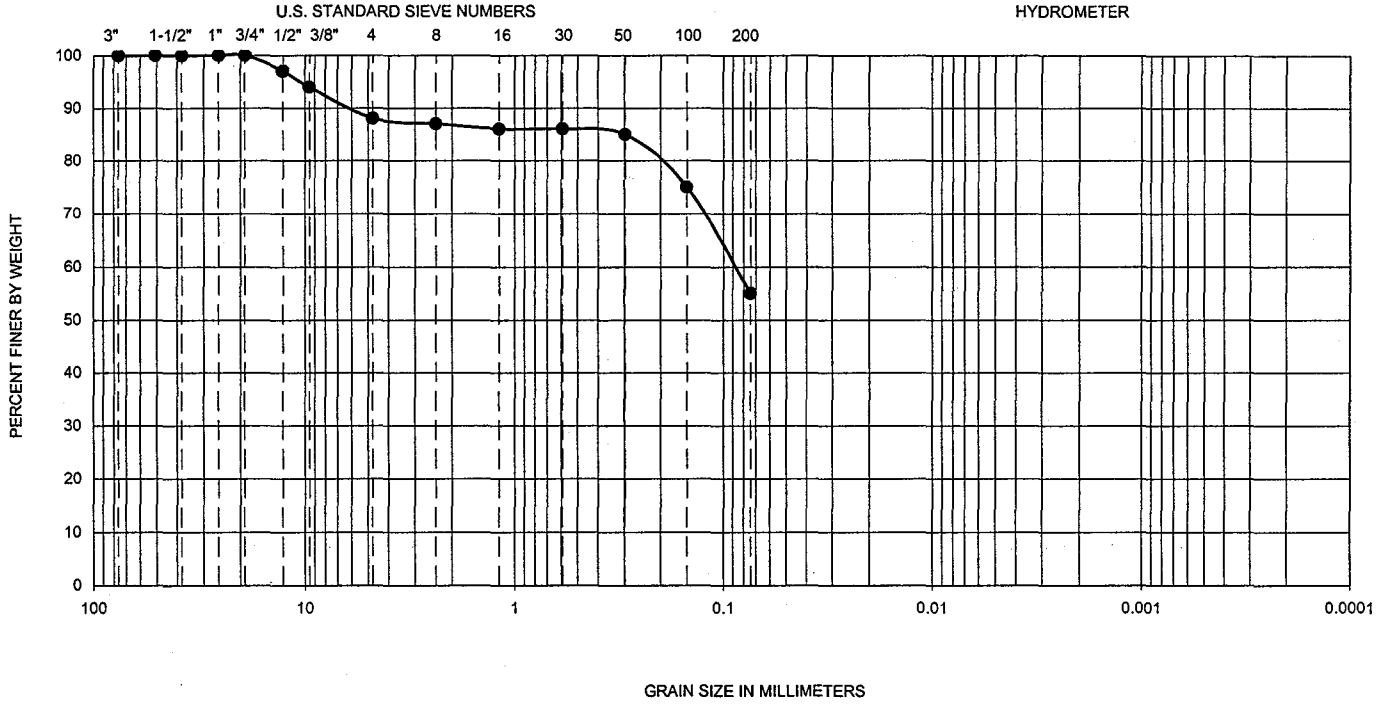
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-17

SIEVE B-18@2.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-18	7.5-9	--	--	--	--	--	--	--	--	55	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

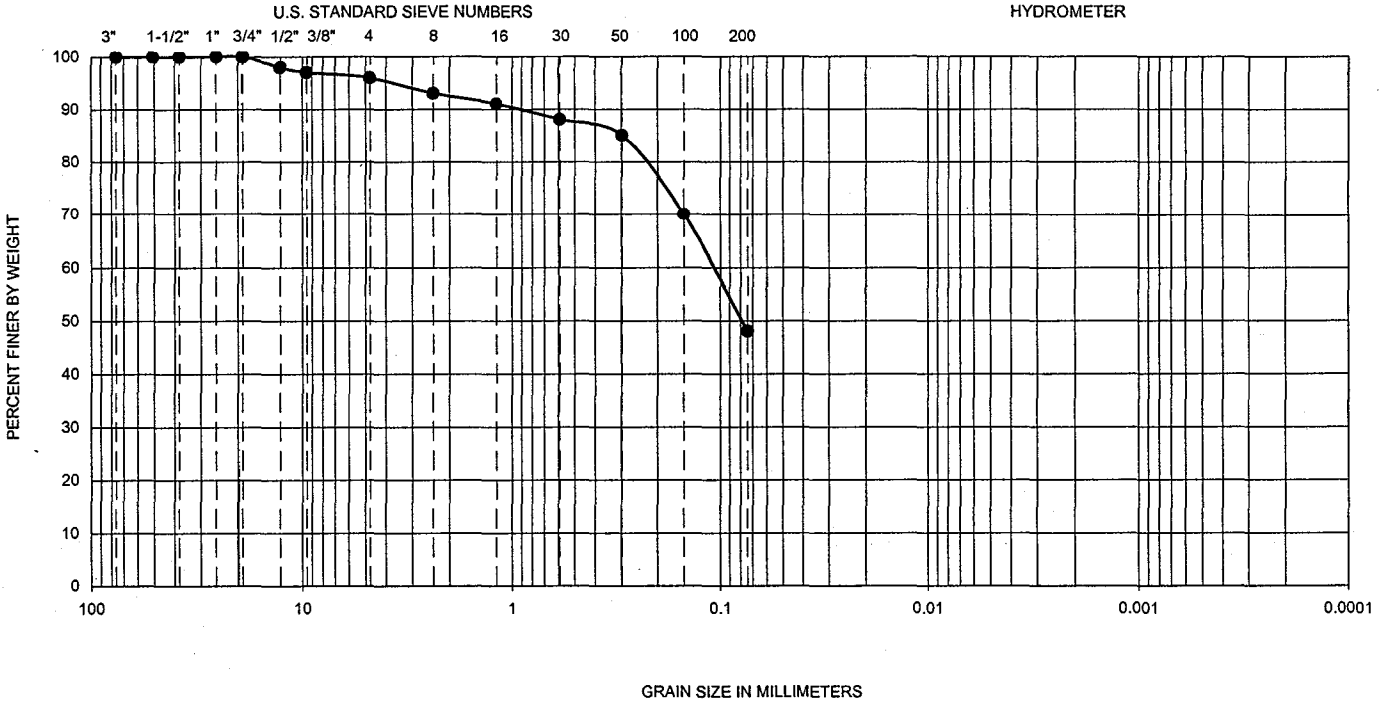
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-18

SIEVE B-18@7.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-19	7.5-9	--	--	--	--	--	--	--	--	48	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

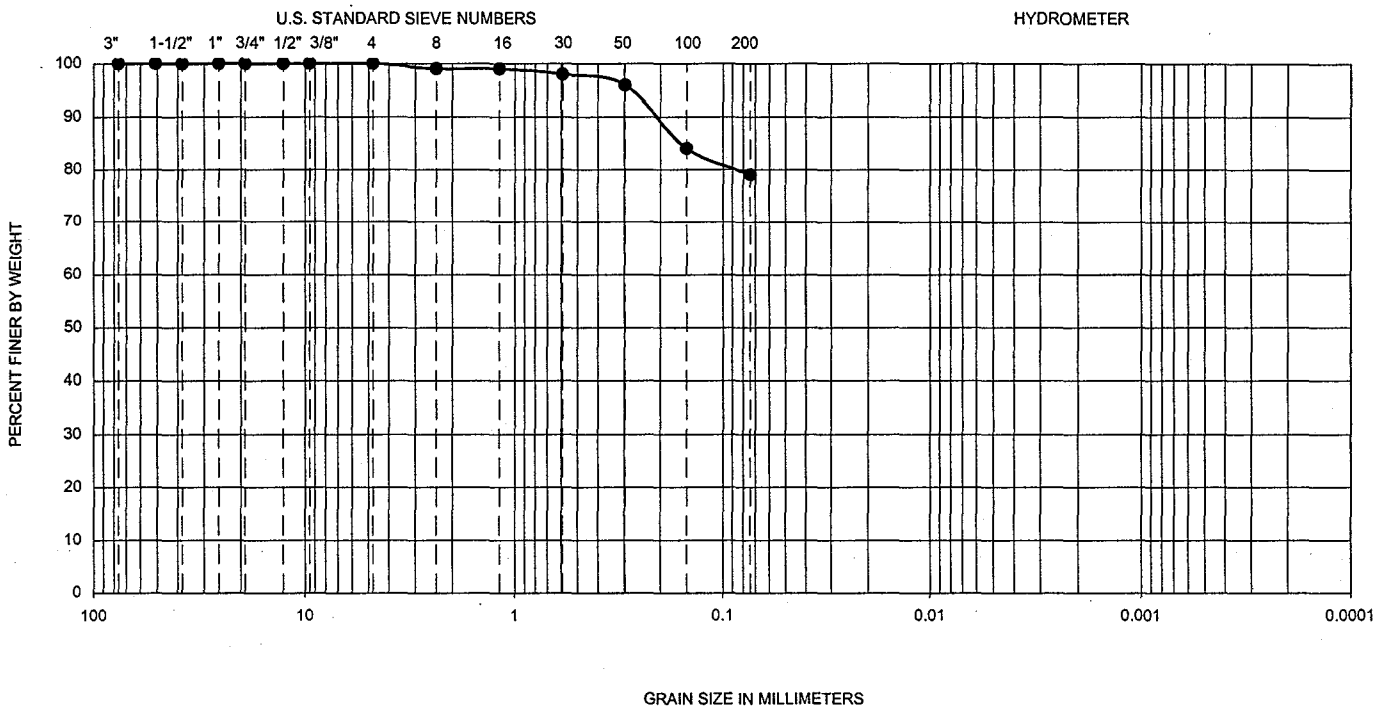
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-19

SIEVE1 B-19@7.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-20	2.5-4	--	--	--	--	--	--	--	--	79	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

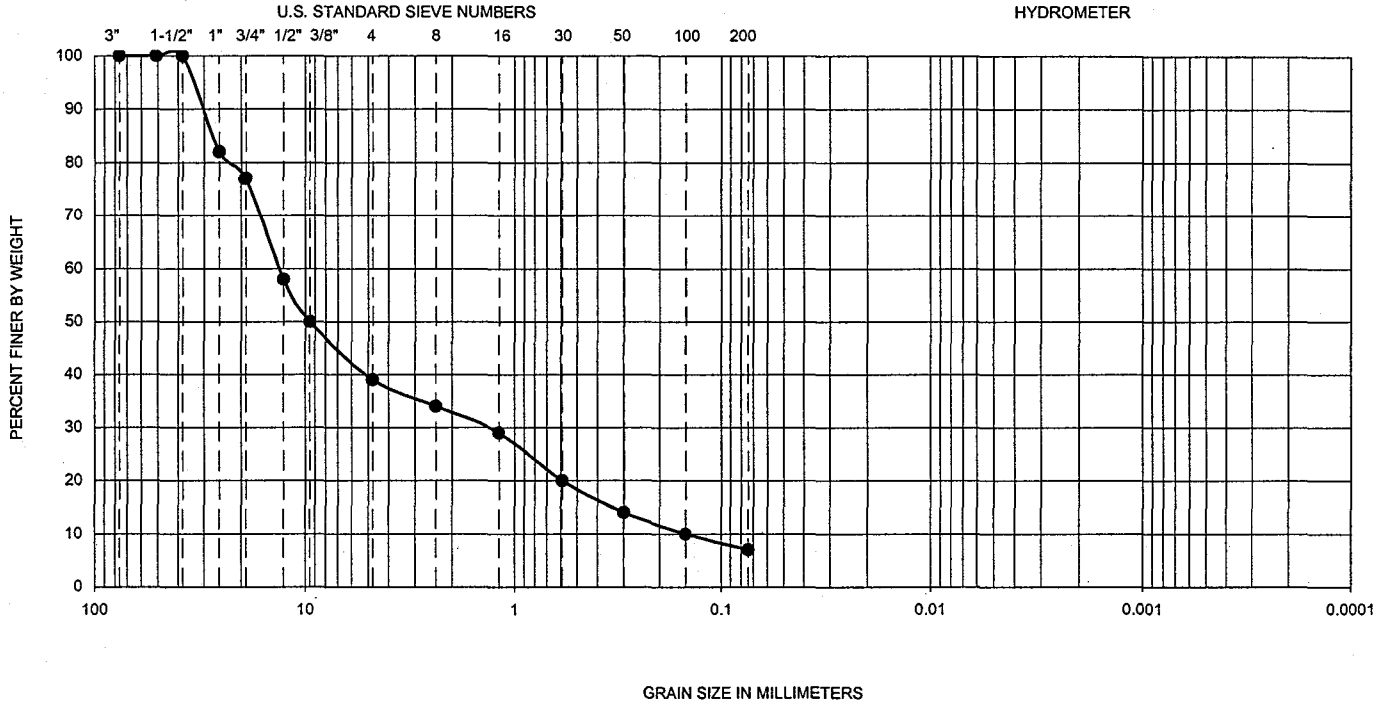
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-20

SIEVE B-20@2.5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-20	15-16.5	--	--	--	0.16	1.60	14.00	87.5	1.1	7	GW-GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

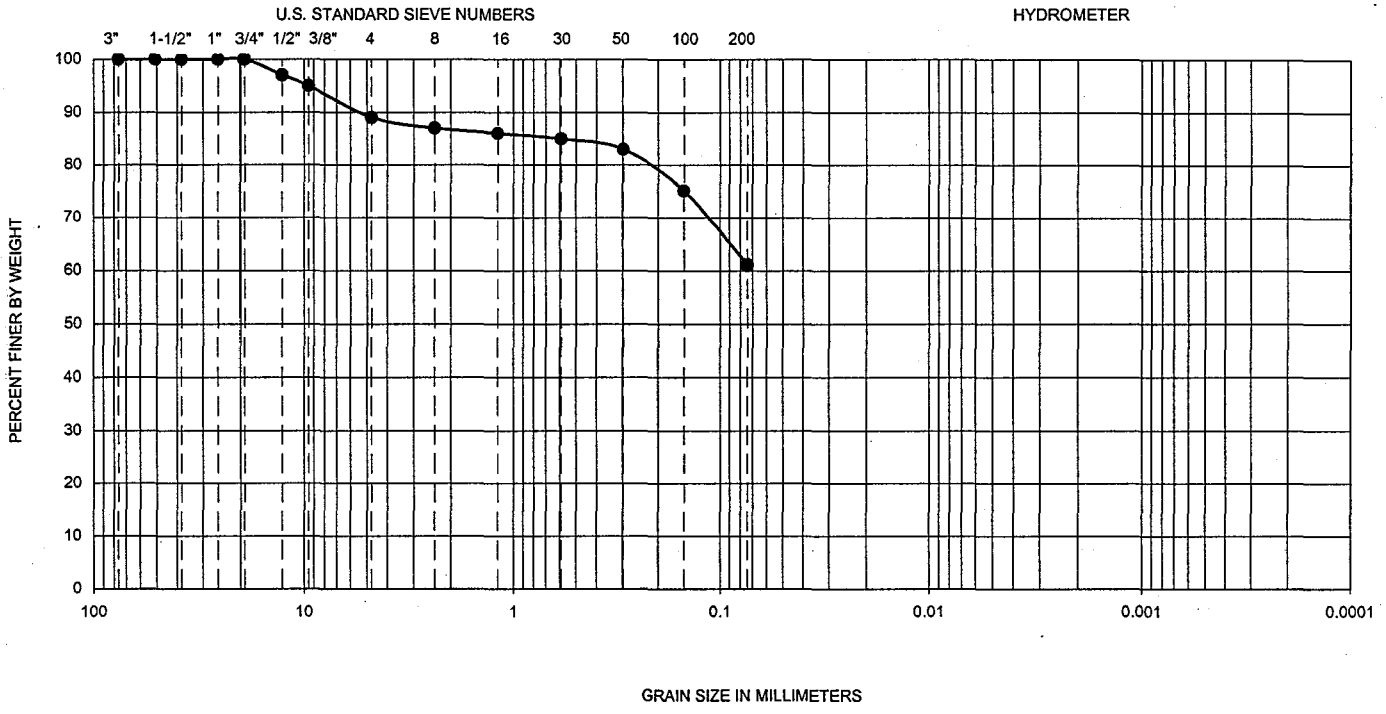
GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-21

SIEVE B-20@15

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-21	10-11.5	--	--	--	--	--	--	--	--	61	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

GRADATION TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-22

SIEVE B-21@10

NO. 200 SIEVE ANALYSIS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-3	10-11.5	Fine sandy CLAY to clayey fine SAND	100	50	CL/SC
B-4	2.5-4	Silty CLAY	100	77	CL
B-6	2.5-4	Fine sandy CLAY	100	62	CL
B-8	7.5-9	Clayey SAND	100	18	SC
B-9	5-6.5	Silty CLAY	100	83	CL
B-9	11.5-13	Sandy CLAY	100	60	CL
B-10	5-6.5	Sandy SILT	100	70	ML
B-11	2.5-4	Silty CLAY	100	82	CL
B-11	7.5-9	Silty CLAY	100	76	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140-97

Ninyo & Moore

200-WASH1

NO. 200 SIEVE ANALYSIS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-23

NO. 200 SIEVE ANALYSIS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-12	7.5-9	Fine sandy CLAY	100	68	CL
B-13	2.5-4	SILT	100	92	ML
B-14	5-6.5	Silty CLAY	100	76	CL
B-16	2.5-4	Silty CLAY	100	96	CL
B-16	7.5-9	Silty CLAY	100	55	CL
B-17	5-6.5	Silty CLAY	100	76	CL
B-17	10-11.5	Fine sandy SILT	100	60	ML
B-19	2.5-4	SILT	100	79	ML
B-21	2.5-4	Silty CLAY	100	86	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140-97

Ninyo & Moore

200-WASH2

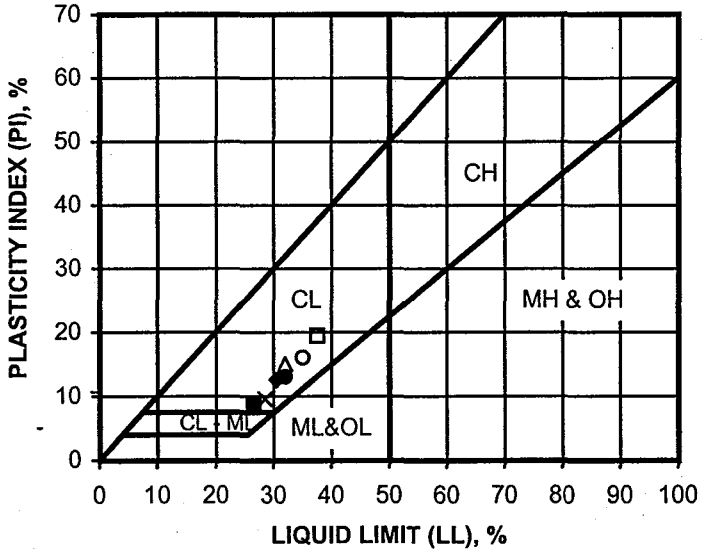
NO. 200 SIEVE ANALYSIS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-24

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-3	10-11.5	32	19	13	CL	CL/SC
■	B-4	2.5-4	27	18	9	CL	CL
◆	B-5	5-6.5	31	18	13	CL	CL
○	B-6	2.5-4	35	19	16	CL	CL
□	B-8	7.5-9	38	18	20	CL	SC
△	B-9	5-6.5	32	17	15	CL	CL
X	B-9	11.5-13	29	19	10	CL	CL
+	B-10	5-6.5				NP	ML

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-98

Ninyo & Moore

ATTERBERG1

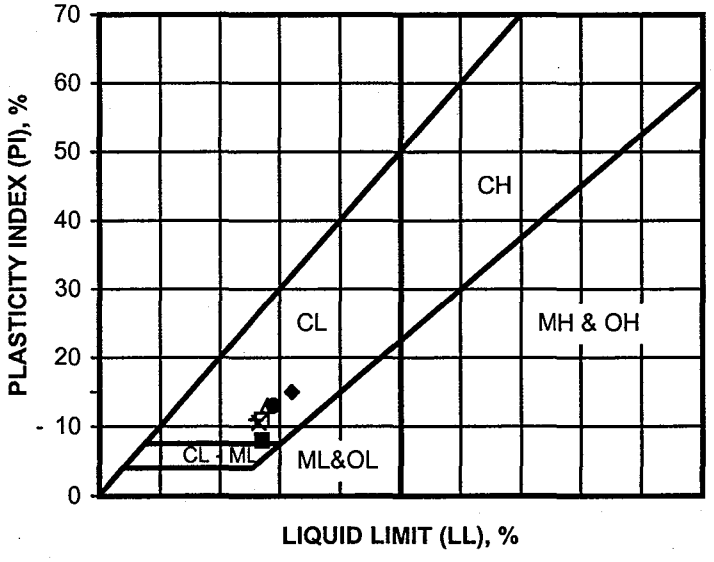
ATTERBERG LIMITS TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-25

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-11	2.5-4	29	16	13	CL	CL
■	B-11	7.5-9	27	19	8	CL	CL
◆	B-12	7.5-9	32	17	15	CL	CL
○	B-13	2.5-4				NP	ML
□	B-14	5-6.5	27	16	11	CL	CL
△	B-16	2.5-4	28	15	13	CL	CL
X	B-16	7.5-9	27	16	11	CL	CL
+	B-17	5-6.5	26	15	11	CL	CL

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-98

Ninyo & Moore

ATTERBERG2

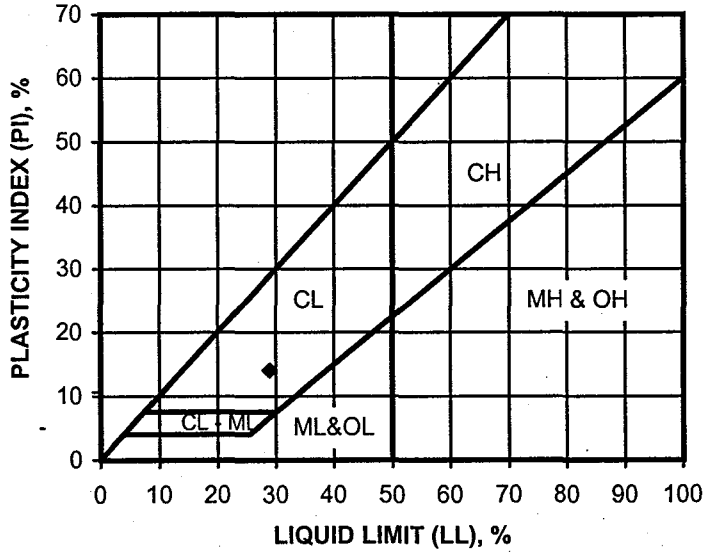
ATTERBERG LIMITS TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-26

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-17	10-11.5				NP	ML
■	B-19	2.5-4				NP	ML
◆	B-21	2.5-4	29	15	14	CL	CL

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-98

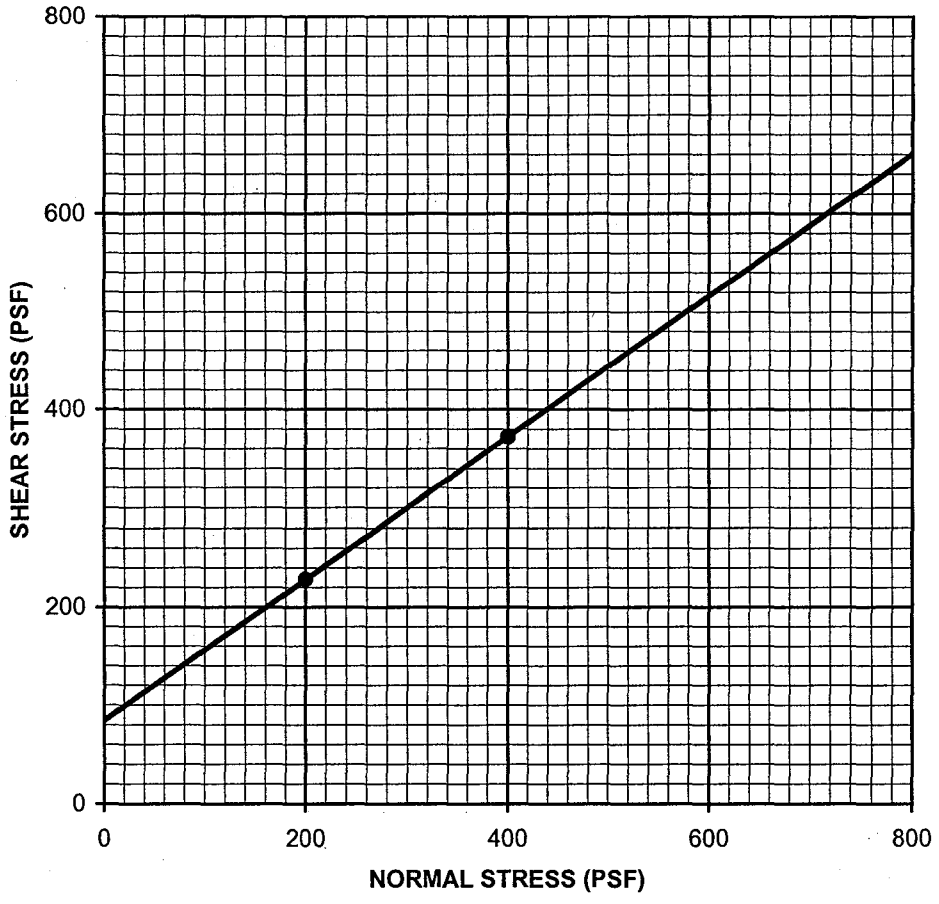
Ninyo & Moore

ATTERBERG3

ATTERBERG LIMITS TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-27



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-5	2.5-4	Peak	84	36	CL

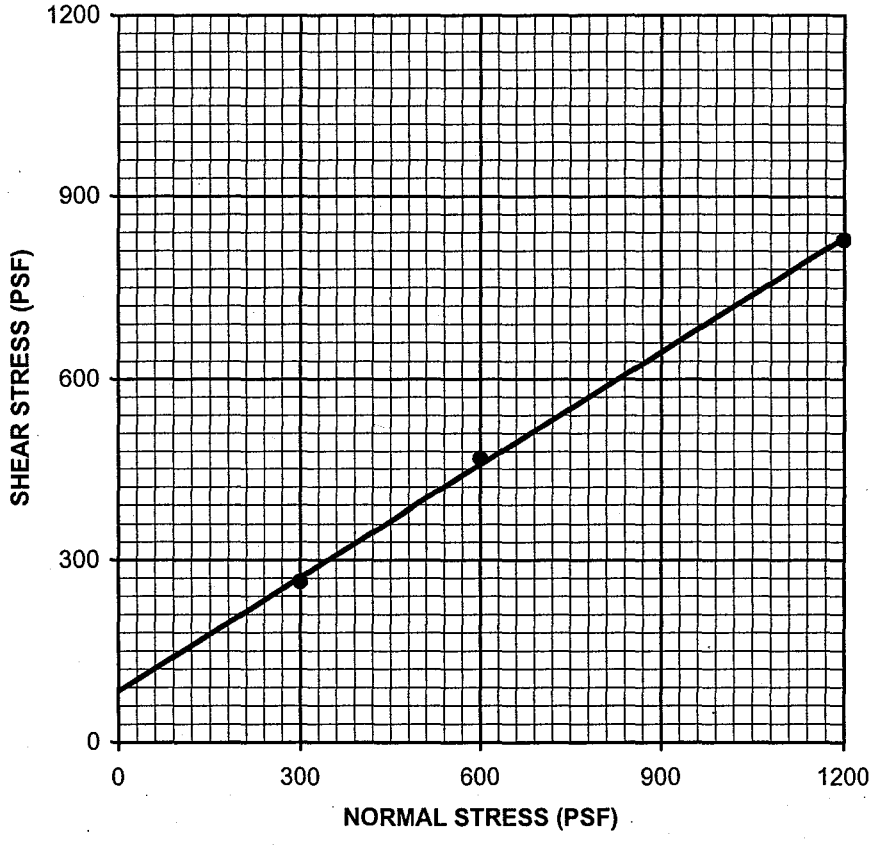
Ninyo & Moore

DSHEAR B-5@2.5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-28



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-5	5-6.5	Peak	84	32	CL

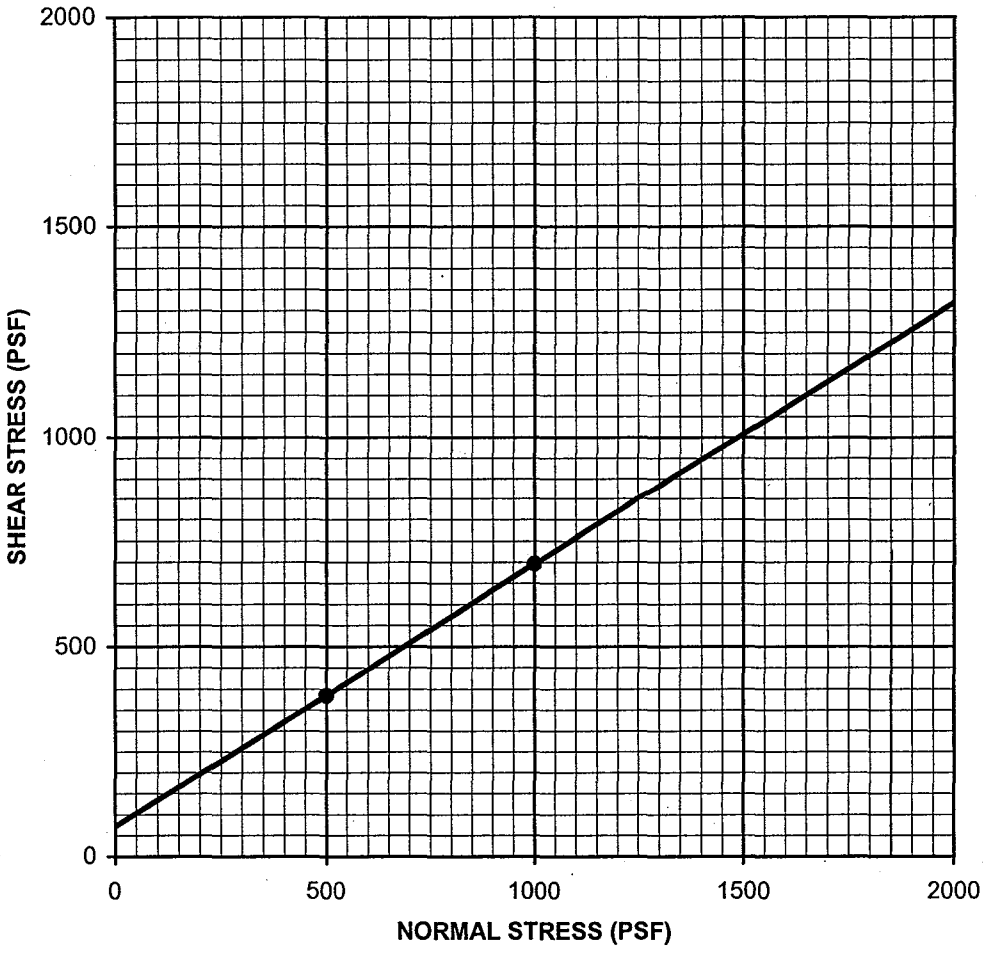
Ninyo & Moore

DSHEAR B-5@5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-29



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-5	7.5-9	Peak	72	32	ML

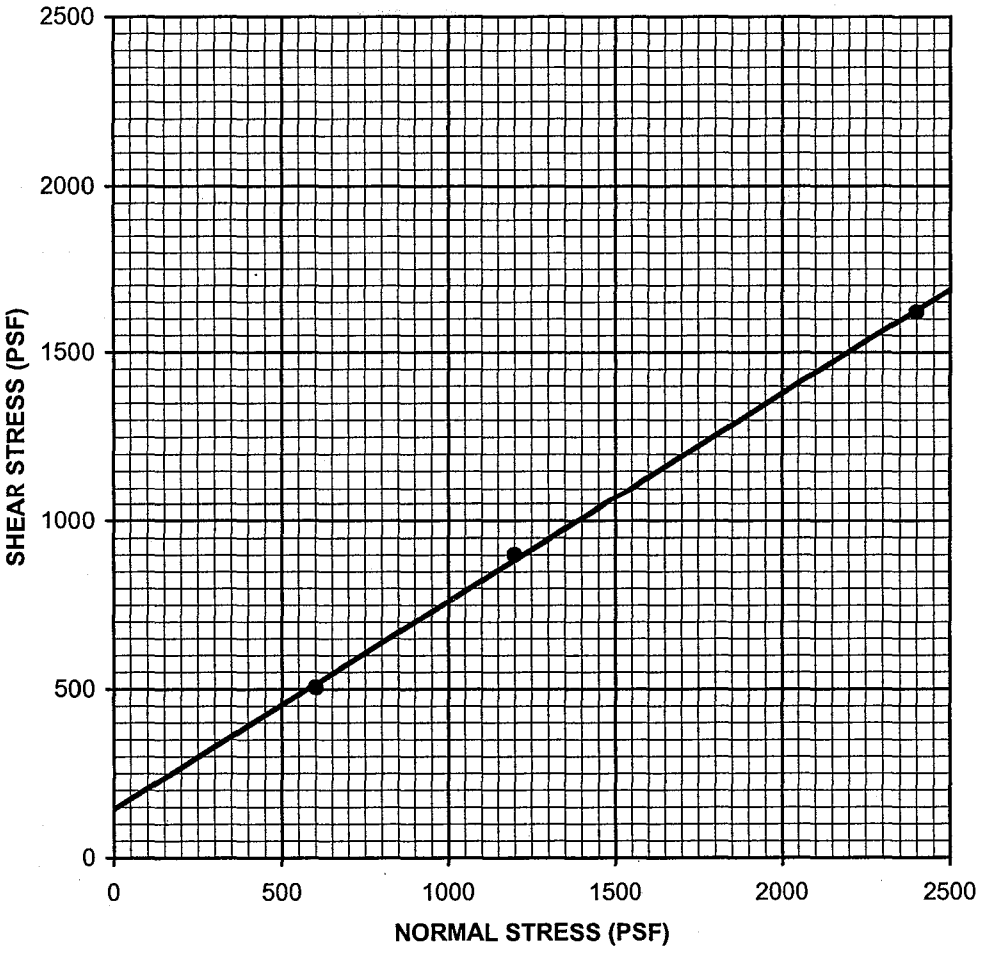
Ninyo & Moore

DSHEAR B-5@7.5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-30



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-5	10-11.5	Peak	144	32	ML

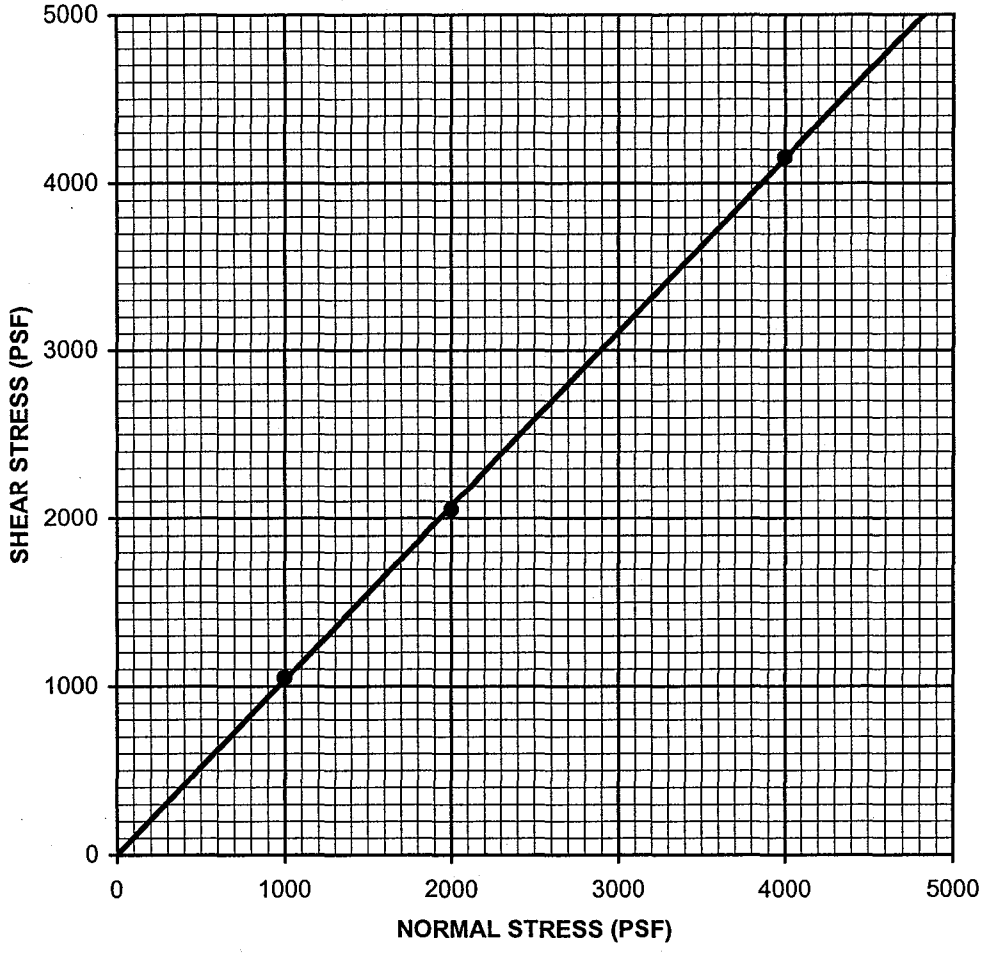
Ninyo & Moore

DSHEAR B-5@10

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-31



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-5	20-21	Peak	0	46	SP

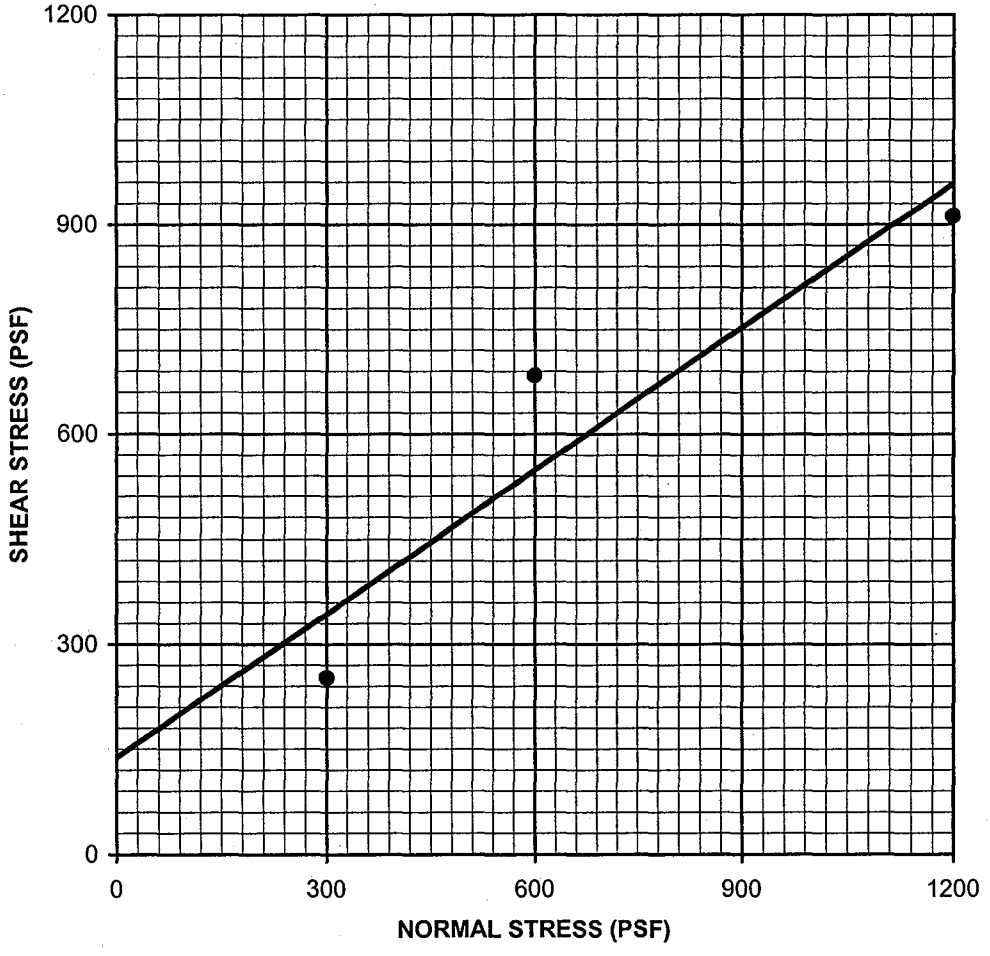
Ninyo & Moore

DSHEAR B-5@20

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-32



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-6	5-6.5	Peak	138	34	CL

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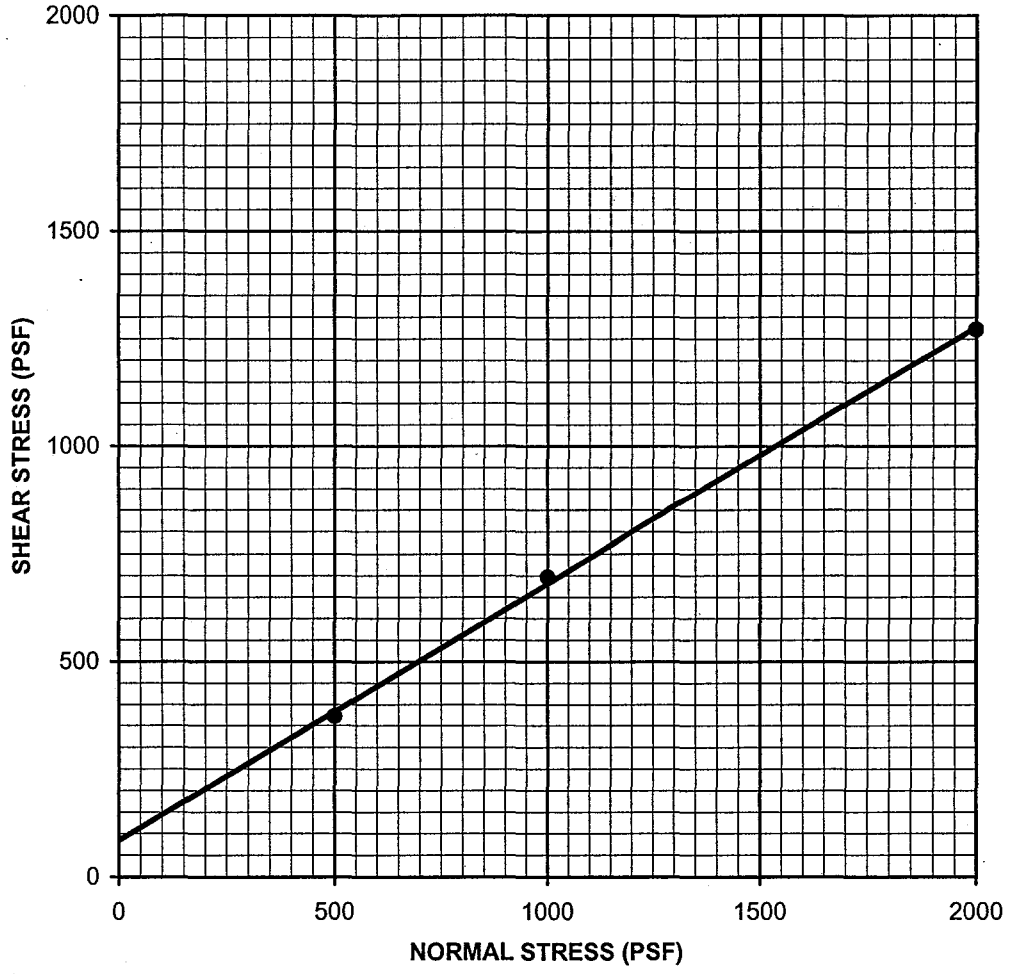
DSHEAR B-6@5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-33



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-6	7.5-9	Peak	84	31	SM

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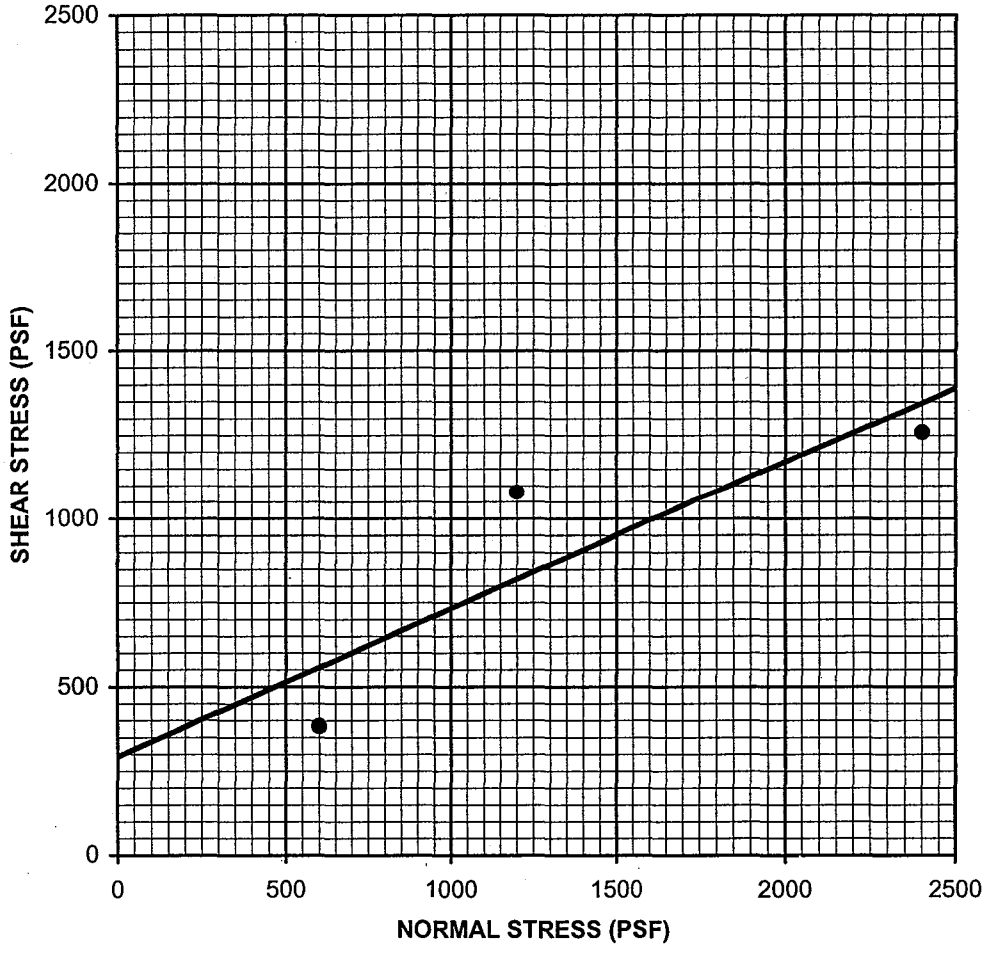
DSHEAR B-6@7.5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-34



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-6	10-11.5	Peak	294	24	SP

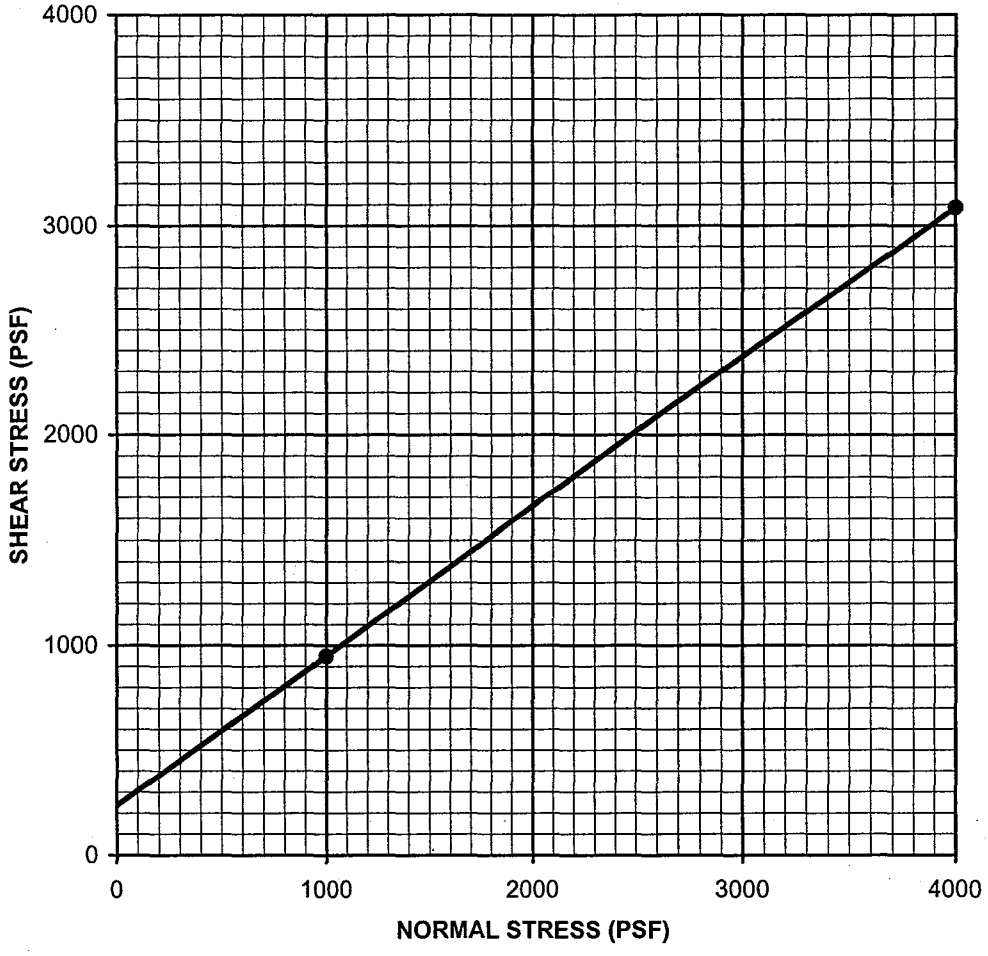
Ninyo & Moore

DSHEAR B-6@10

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-35



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-6	20-21.5	Peak	236	35	SP

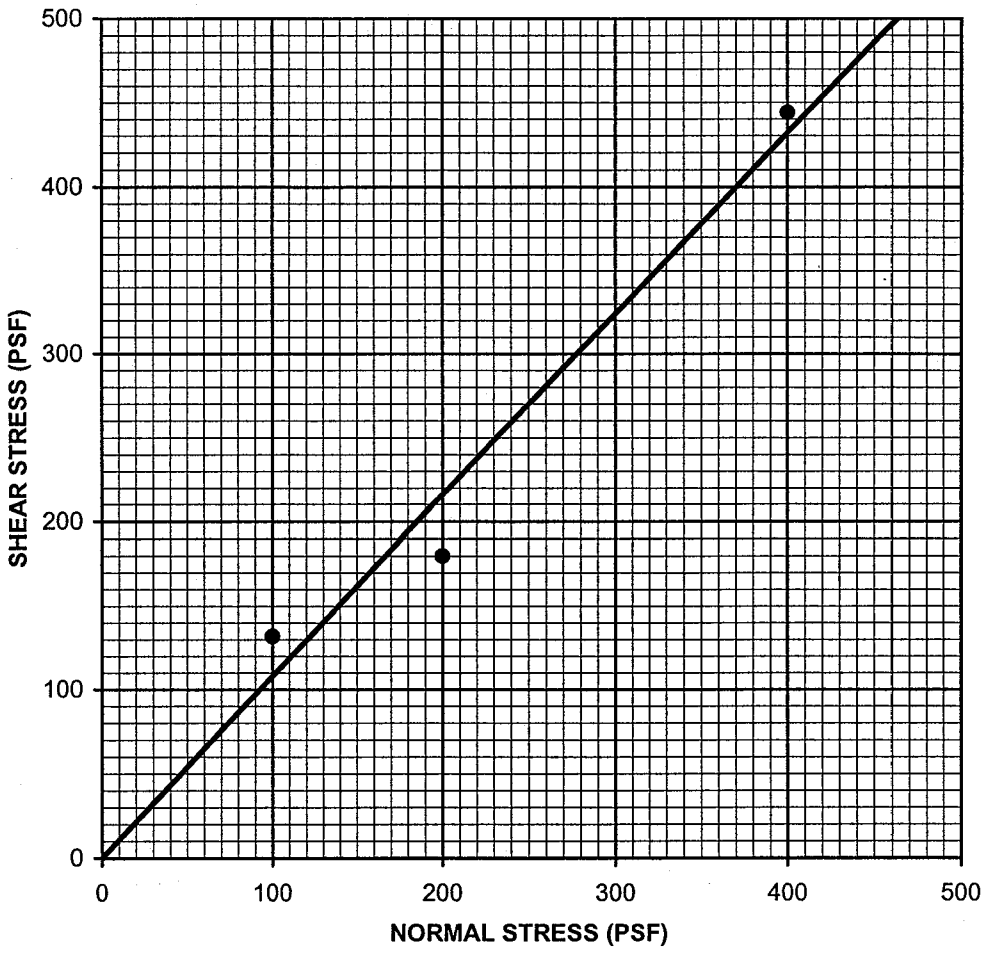
Ninyo & Moore

DSHEAR B-6@20

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-36



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-8	2.5-4	Peak	0	47	ML

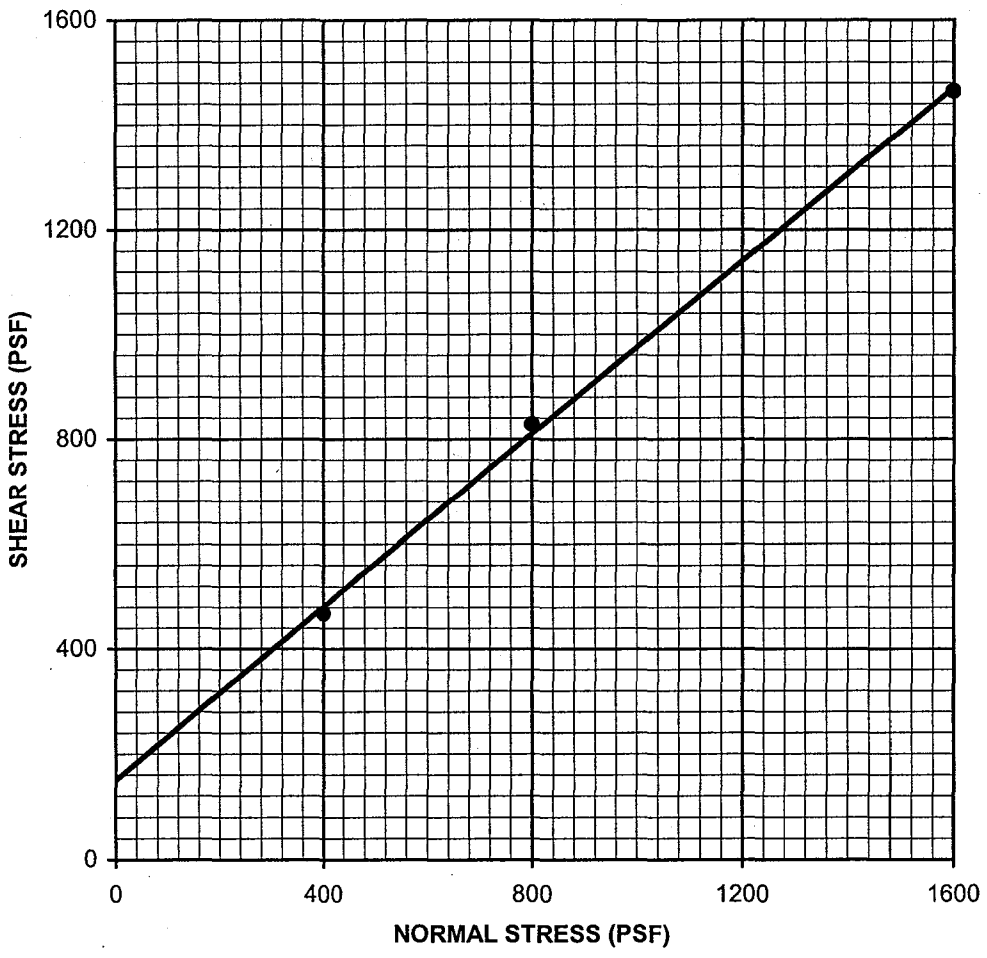
Ninyo & Moore

DSHEAR B-8@2.5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-37



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-8	7.5-9	Peak	150	40	SC

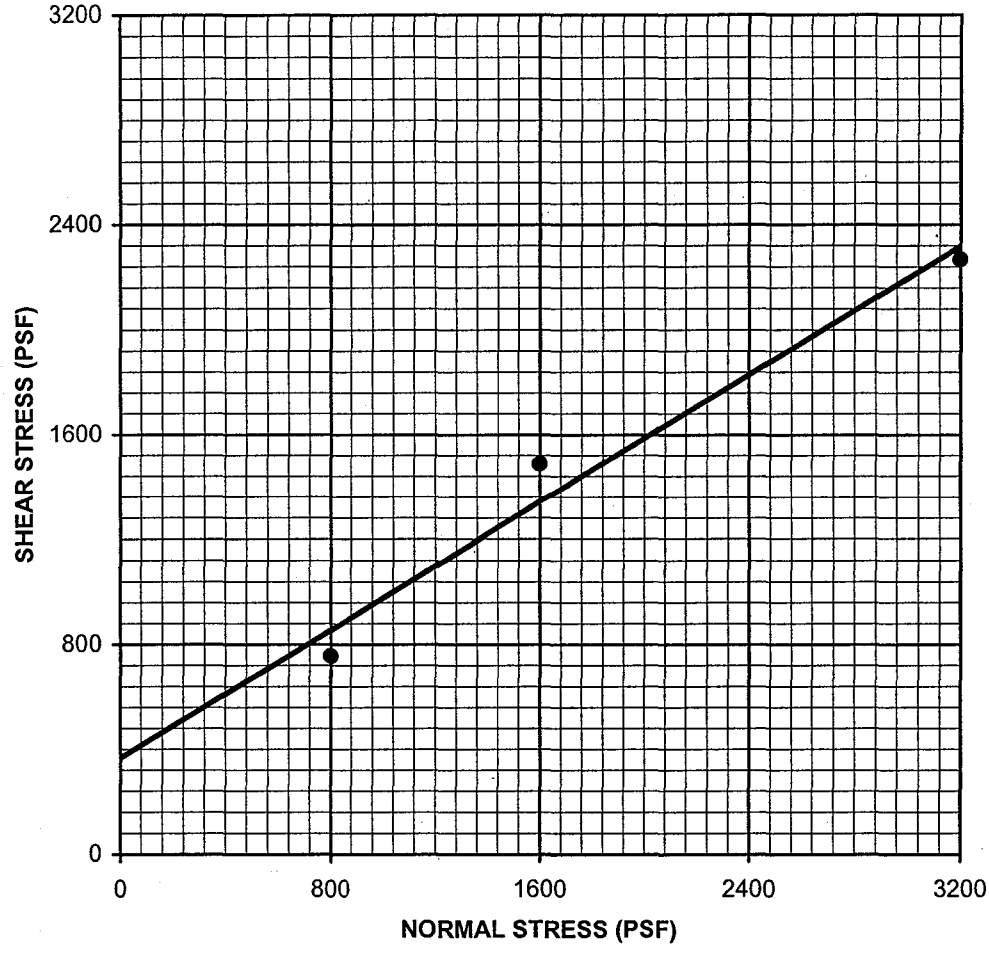
Ninyo & Moore

DSHEAR B-8@7.5

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-38



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
Undisturbed	—●—	B-8	15-16.5	Peak	366	31	SP

Ninyo & Moore

DSHEAR B-8@15

DIRECT SHEAR TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-39

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	EXPANSION POTENTIAL
B-4	0-5	9.7	101.5	24.3	0.0315	27	Low
B-6	0-5	10.2	102.9	25.3	0.043	40	Low
B-13	0-5	9.5	107.3	18.8	0.014	12	Very Low
B-19	0-5	10.0	103.7	21.3	0.0061	4	Very Low
B-21	0-5	9.5	106.6	20.9	0.0194	17	Very Low

PERFORMED IN GENERAL ACCORDANCE WITH UBC STANDARD 18-2

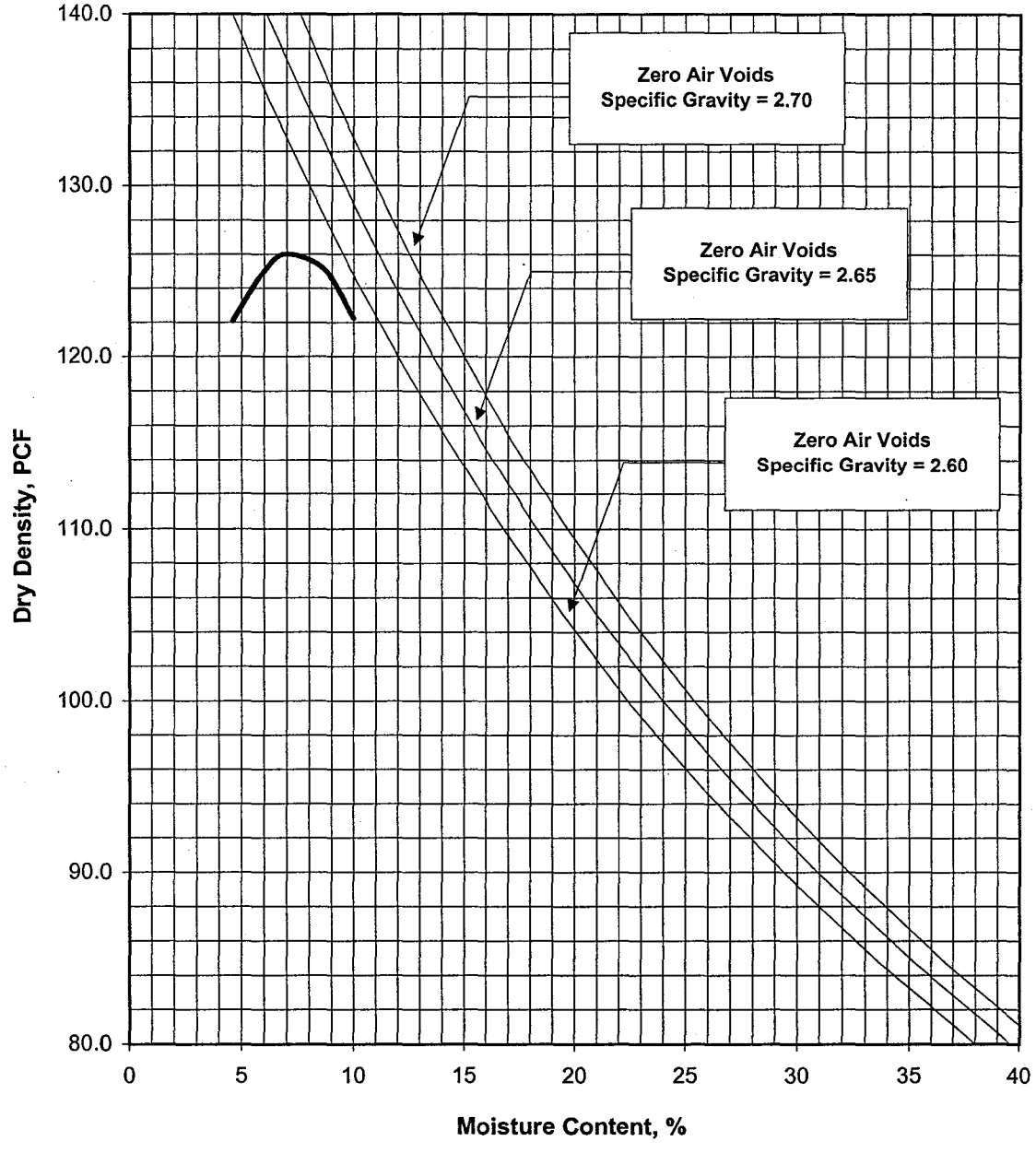
Ninyo & Moore

ASTM-EI1.xls

EXPANSION INDEX TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-40



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-1	0-5	Silty GRAVEL	126.0	7.0

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698-00a METHOD "C"

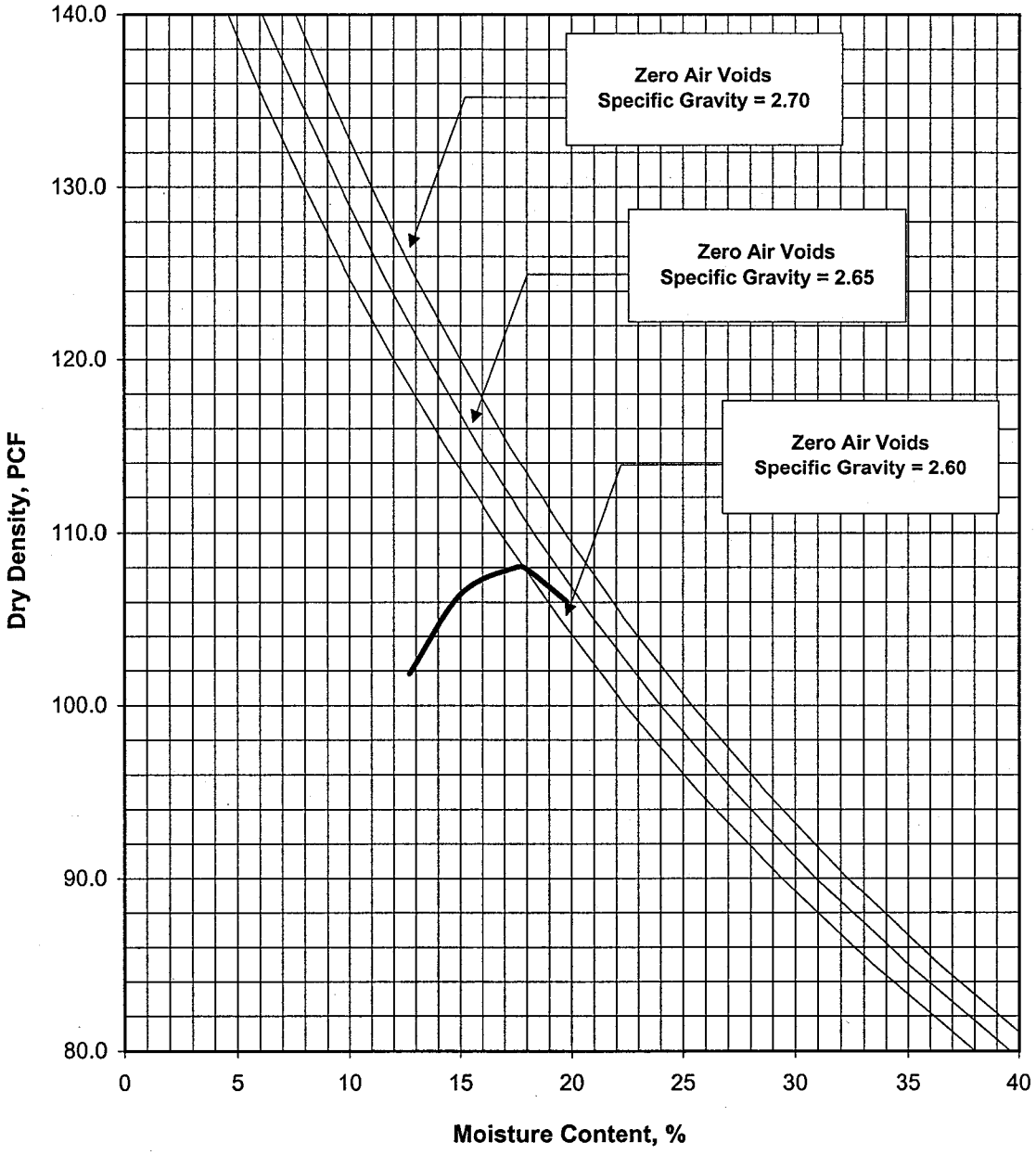
Ninyo & Moore

MAXDENSITY B-1(0-5)

MAXIMUM DENSITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-41



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-6	0-5	Fine sandy CLAY	108.0	17.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698-00a METHOD "A"

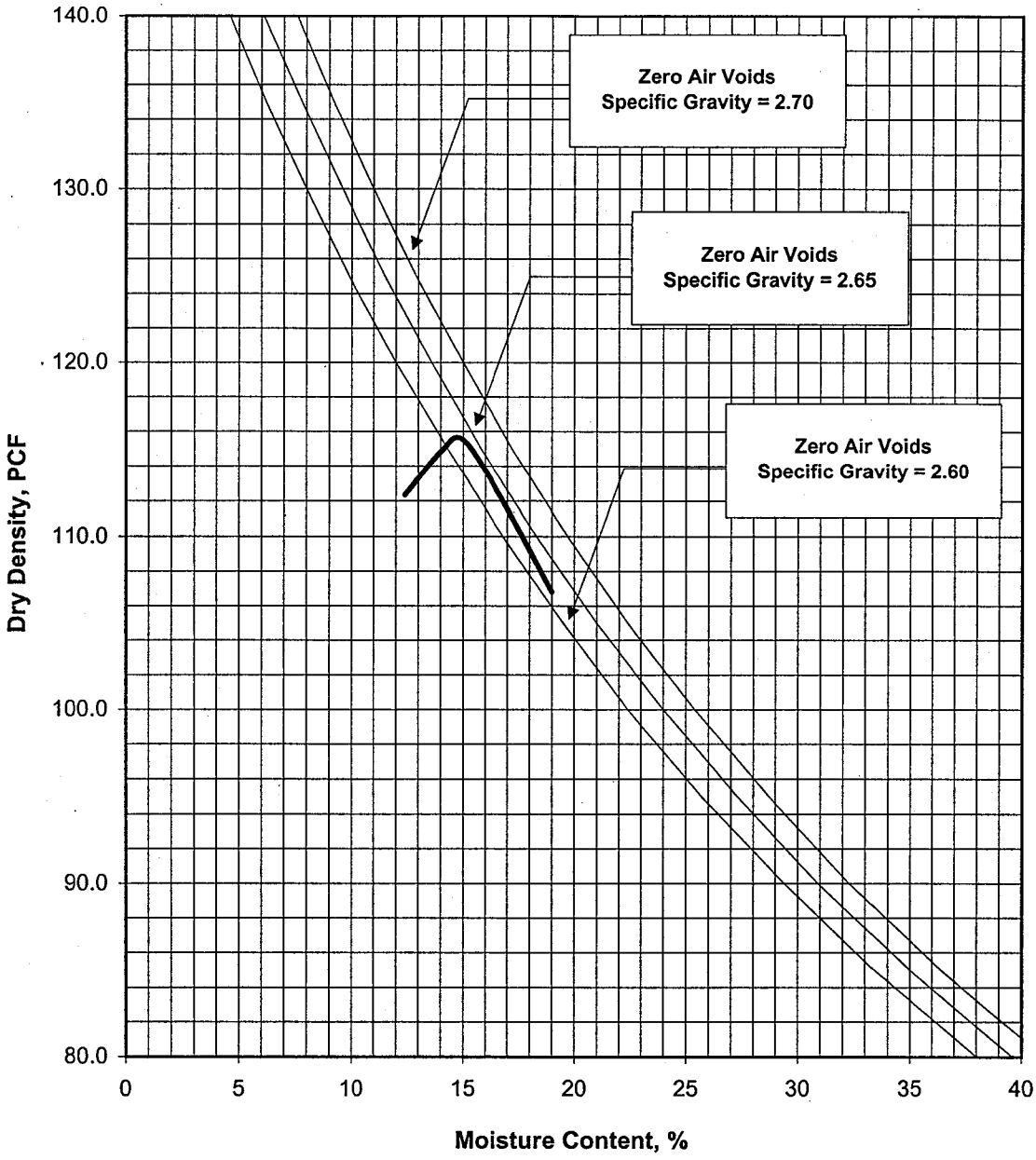
Ninyo & Moore

MAXDENSITY B-6(0-5).xls

MAXIMUM DENSITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-42



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-13	0-5	SILT	115.5	15.0

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 - 00a METHOD "A"

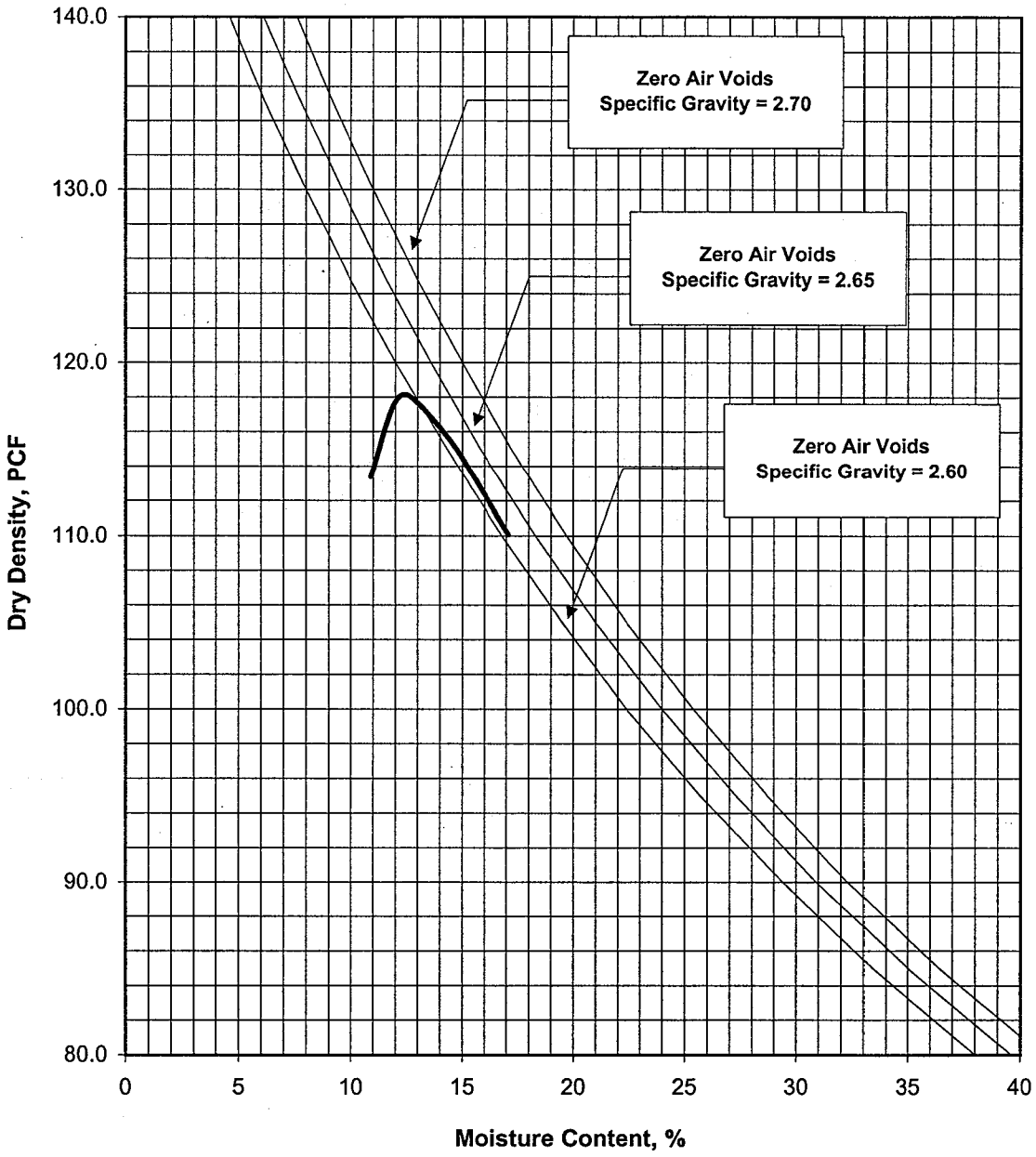
Ninyo & Moore

MAXDENSITY B-13(0-5).xls

MAXIMUM DENSITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-43



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-19	0-5	SILT	118.0	12.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 - 00a METHOD "A"

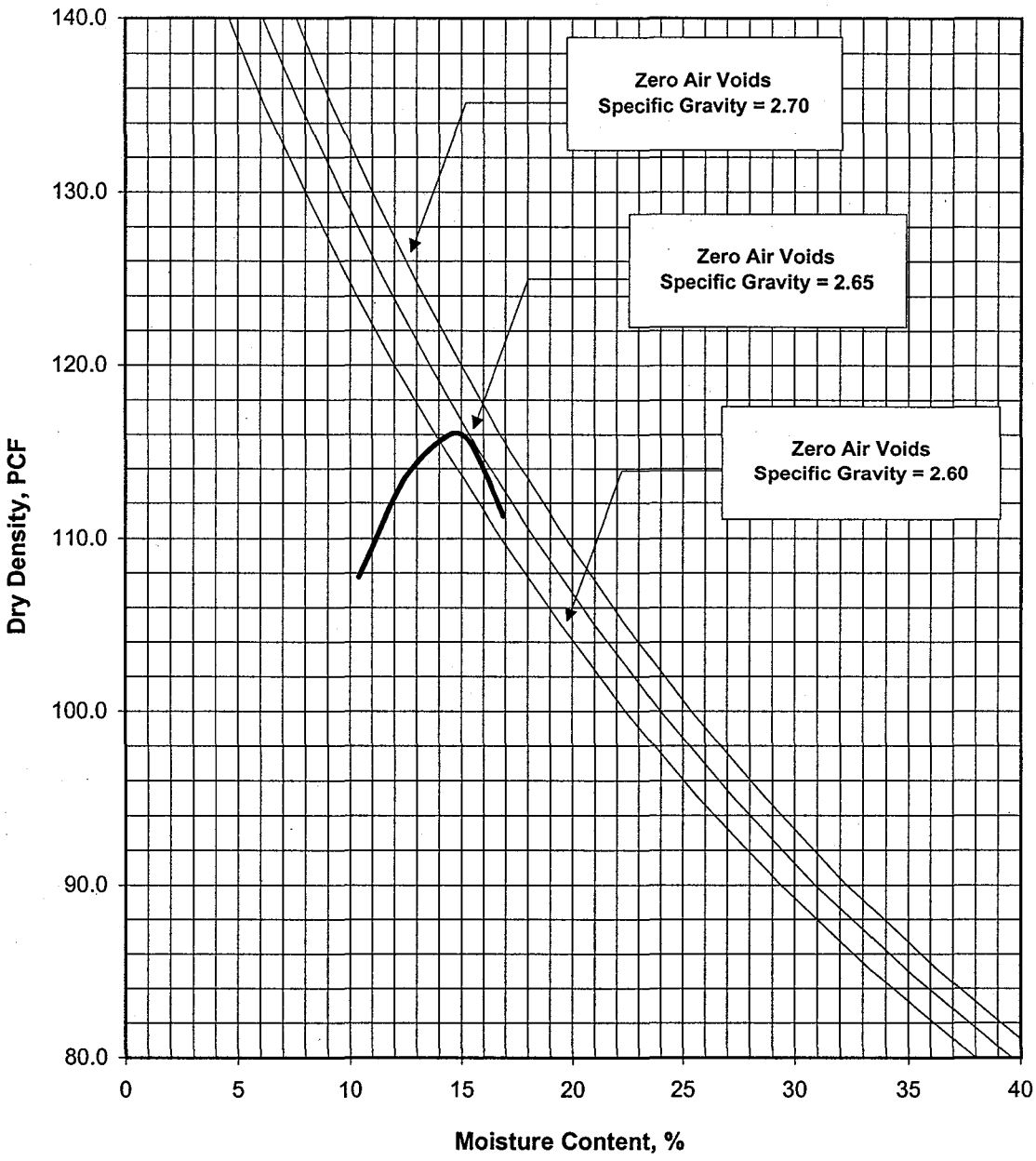
Ninyo & Moore

MAXDENSITY B-19(0-5)

MAXIMUM DENSITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-44



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-21	0-5	Silty CLAY	116.0	14.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 - 00a METHOD "A"

Ninyo & Moore

MAXDENSITY B-21(0-5)

MAXIMUM DENSITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-45

CORROSIVITY TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH *	RESISTIVITY * (ohm-cm)	WATER-SOLUBLE SULFATE CONTENT IN SOIL ** (%)	CHLORIDE CONTENT *** (ppm)
B-5	0-5	7.1	107	0.230	1900
B-19	0-5	8.1	671	0.008	104

* PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b
** PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
*** PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

Ninyo & Moore

CORROSIVITY1

CORROSIVITY TEST RESULTS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
LAVEEN AREA CONVEYANCE CHANNEL
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600220001	10/2001	B-46

APPENDIX C

ENVIRONMENTAL SAMPLING RESULTS

August 7, 2001
Project No. 600220001

Mr. Warren Rosebraugh
Maricopa County Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

Subject: Environmental Sampling Results
Laveen Area Conveyance Channel
Maricopa County, Arizona
FCD Project No. 1170831

Dear Mr. Rosebraugh:

Ninyo & Moore is pleased to provide this letter report on environmental sampling conducted at the above-referenced site. The following discusses sampling activities and laboratory results.

SAMPLING ACTIVITIES

On June 29, 2001, a Ninyo & Moore representative collected five soil (sediment) samples from the invert of the existing conveyance channel. The water depth in the channel varied from 1 to 2 feet, depending on sample location. A figure depicting sample locations will be provided in our geotechnical report. Soil samples were collected by advancing a decontaminated hand auger approximately 6 inches into the sediment. The collected saturated soil samples were placed into 6-inch brass sleeves, labeled, and placed on ice for sample preservation.

The soil samples were relinquished with appropriate chain-of-custody documentation to an Arizona Department of Health Services (ADHS) certified analytical laboratory for sample analysis, within 24 hours of being collected. The soil samples were provided to the laboratory and extracted within the required 2-hour holding time. Soil samples S-1 and S-2 were combined by laboratory personnel into one composite sample representing the western portion of the channel, soil sample S-3 represents the central portion, and the composite of S-4 and S-5 represent the eastern portion. The composite of S-1 and S-2, S-3, and the composite of S-4 and S-5 were analyzed for volatile organic compounds (VOCs) using EPA Method 8260B, for total petroleum hydrocarbons (TPH) using ADHS Method 418.1AZ, for eight toxic compound leaching procedure (TCLP) metals using EPA Method

SW1311/6010B & 7470A, for chlorinated herbicides using EPA Method SW8151A, and for pesticides using EPA Method SW8081.

ANALYTICAL RESULTS

The analytical results indicated that no contaminant constituents were detected in concentrations above laboratory minimum detection limits, except for 4,4-Dichlorodiphenyldichloroethylene (4,4-DDE) in the composite sample for S-1 and S-2 and in the composite sample for S-4 and S-5. The reported concentration of 4,4-DDE in the composite sample for S-1 and S-2 is 0.020 mg/kg, and the reported concentration of 4,4-DDE in the composite sample for S-4 and S-5 is 0.028 mg/kg. DDE is a breakdown product of DDT. DDT is an insecticide banned from use in the United States in 1972. There are very few studies on the effects of DDE; thus DDE is regulated as DDT. The concentration of 4,4-DDE in both samples is well below Arizona Residential Soil Remediation Levels of 13 mg/kg. A copy of the analytical results and the laboratory chain-of-custody are enclosed.

LIMITATIONS

The environmental services described in this report have been conducted in general accordance with current regulatory guidelines and the standard-of-care exercised by environmental consultants performing similar work in the project area. No warranty, expressed or implied, is made regarding the professional opinions presented in this report. Variations in site conditions may exist and conditions not observed or described in this report may be encountered during subsequent activities. Please also note that this study did not include an evaluation of geotechnical conditions or potential geologic hazards.

Ninyo & Moore's opinions and recommendations regarding environmental conditions, as presented in this report, are based on limited subsurface assessment and chemical analysis. Further assessment of potential adverse environmental impacts from past on-site and/or nearby use of hazardous materials may be accomplished by a more comprehensive assessment. The samples collected and used for testing, and the observations made, are believed to be representative of the area(s) evaluated; however, conditions can vary significantly between sampling locations. Variations in soil and/or groundwater conditions will exist beyond the points explored in this evaluation.

The environmental interpretations and opinions contained in this report are based on the results of laboratory tests and analyses intended to detect the presence and concentration of specific chemical or physical constituents in samples collected from the subject site. The testing and analyses have been conducted by an independent laboratory which is certified by the State of Arizona to conduct such tests. Ninyo & Moore has no involvement in, or control over, such testing and analysis. Ninyo & Moore, therefore, disclaims responsibility for any inaccuracy in such laboratory results.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires any additional information, or has questions regarding content, interpretations presented, or completeness of this document.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

If you have any questions regarding this issue, please contact the undersigned at your convenience.

Sincerely,
NINYO & MOORE

G. Pat Cordova
Environmental Project Manager

Robert W. McMichael, P.E.
Manager/Chief Engineer

GPC/avv

Enclosure: Laboratory Analytical Report

LABORATORY ANALYTICAL REPORT

TRANSWEST
GEOCHEM

August 03, 2001

Pat Cordova
Ninyo & Moore
5035 S. 33rd St.
Phoenix, AZ 85040

RE: Flood Control
Work Order No.: 0106241

Dear Pat,

Transwest Geochem, Inc. received 3 samples on 6/29/2001 9:37:00 AM for the analyses presented in the following report.

The Case Narrative of this report addresses any Quality Control and/or Quality Assurance issues associated with this Work Order.

If you have any questions regarding these test results, please feel free to call us at (602) 437-0330.

Sincerely,

Beth Proffitt
Project Manager

ADHS License No. AZM133/AZ0133

Client: Ninyo & Moore
Work Order: 0106241
Project Name: Flood Control
Project Number:

Date Printed: 03-Aug-01

CASE NARRATIVE

Transwest Geochem, Inc. uses the methods outlined in the following references:

Code of Federal Regulations, 40CFR, Part 136, Revised July 1995.

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992 and 19th Edition, 1995.

Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, Revised August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/R-94/111, Revised May 1994.

Hach, Water Analysis Handbook, 2nd Edition, 1992.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition.

Metals were analyzed using multi-element ICP instrumentation. Some metals reported in the QC report may not be associated with this Work Order.

Secondary Source QC Sample (LCSV) results may not be reported for all methods and/or analysis dates.

The sample introduction technique for Method 8015AZ used by this laboratory is direct injection.

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order.

Data qualifiers ("flags") contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

Analytical Comments for Method SW8081, Blank Spike, Batch 4331: LCS recovery was below laboratory limits. LCSD recovery and RPD were acceptable.

3725 E. Atlanta Ave. • Suite 2 • Phoenix, Arizona 85040 • (602) 437-0330 • 1-800-927-5183 • Fax (602) 437-0660

TRANSWEST GEOCHEM

Date Printed 02-Aug-01
License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Project Name: Flood Control
Project Number:
Work Order: 0106241
Date Received: 29-Jun-01

Work Order Sample Summary

Client Sample ID	Lab Sample ID	Test Code	Collection Date
S-1, 2	0106241-01A	SW1311/6010B	6/29/2001 8:42:00 AM
		SW1311/7470A	6/29/2001 8:42:00 AM
		SW8081	6/29/2001 8:42:00 AM
		SW8260B	6/29/2001 8:42:00 AM
	0106241-01B	EPA418.1AZ	6/29/2001 8:42:00 AM
	0106241-01C	SW8151	6/29/2001 8:32:00 AM
S-3	0106241-02A	SW1311/6010B	6/29/2001 8:59:00 AM
		SW1311/7470A	6/29/2001 8:59:00 AM
		SW8081	6/29/2001 8:59:00 AM
		SW8260B	6/29/2001 8:59:00 AM
	0106241-02B	EPA418.1AZ	6/29/2001 8:59:00 AM
	0106241-02C	SW8151	6/29/2001 8:59:00 AM
S-4, 5	0106241-03A	SW1311/6010B	6/29/2001 9:20:00 AM
		SW1311/7470A	6/29/2001 9:20:00 AM
		SW8081	6/29/2001 9:20:00 AM
		SW8260B	6/29/2001 9:20:00 AM
	0106241-03B	EPA418.1AZ	6/29/2001 9:20:00 AM
	0106241-03C	SW8151	6/29/2001 9:20:00 AM

CLIENT: Ninyo & Moore
Project Name: Flood Control
Project Number:
Work Order: 0106241
Date Received: 29-Jun-01

Data Qualifiers

One or more of the following data qualifiers may be associated with your analytical and/or quality control data.

J1	CCV recovery following this sample was below acceptance limits. Reanalysis confirms low recovery caused by matrix effect.
L2	The associated blank spike recovery was below laboratory acceptance limits. See case narrative.
M2	Matrix spike recovery was low, the method control sample recovery was acceptable.
S6	Surrogate recovery was below laboratory and method acceptance limits. Reextraction and/or reanalysis confirms low recovery caused by matrix effect.

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Project Name: Flood Control
Project Number:
Work Order: 0106241
Date Received: 29-Jun-01

Definitions

Analytical Spike (AS)	The AS is a known amount of a target analyte added to a sample after it has been distilled, digested, or extracted and is ready for analysis. The AS is generally performed if the MS has failed. It is used to indicate interference that arises from sample distillation, digestion, or extraction as opposed to interference that is innate to the matrix.
Continuing Curve Verification (CCV)	The CCV is also referred to as a curve check. This is a standard analyzed at specified intervals during an analysis. The CCV verifies the stability and accuracy of the calibration curve. There are specific CCV recovery acceptance criteria for each method.
Dilution Factor (DF)	The DF is an indication of how much a sample had to be diluted in order to quantitate it on a standard curve. The DF is indicated in the reported sample result. The sample PQL increases as the dilution increases.
Internal Standard (IS)	The IS is a compound that is similar to the organic compound of interest in terms of chemical composition but is unique in that it is rare in the environment. The same concentration of IS is added to every sample for some organic methods.
Laboratory Control Sample (LCS)	The LCS is also referred to as a blank spike. The LCS is an addition of a known amount of a target analyte (from the same source as calibration standards or spikes) to an aliquot of deionized water or other appropriate clean matrix. The LCS is processed through the entire method procedure in the same manner as samples.
Matrix Spike (MS)	The MS is a known amount of a target analyte added to a sample. The MS is processed through the entire method procedure in the same manner as samples.
Method Blank (MB)	The MB is an aliquot of deionized water or other appropriate clean matrix that is thought to be free of the analyte in question. The MB is processed through the entire extraction or analysis procedure and is used to indicate contamination in the lab.
Method Detection Limit (MDL)	The MDL is the lowest level of detection of which a method is capable.
Practical Quantitation Limit (PQL)	The PQL is the lowest value at which Transwest Geochem can detect an analyte in matrix with a high degree of confidence. The PQL will increase as the DF increases. The PQL is greater than or equal to the MDL.
Relative Percent Difference (RPD)	The RPD is a measure of precision (the ability to obtain the same result on re-analysis of the same sample). It is calculated using the result of a sample, MS, LCS, or LCSV and its associated duplicate result.
Secondary Source QC Sample (LCSV)	The LCSV is also referred to as a second source laboratory control sample. It is the same type of standard as a calibration or spiking standard but is obtained from a different source. The LCSV is an indication of the primary standard quality, method performance, and instrument performance.
Surrogate	A surrogate compound is similar to the organic compound of interest in terms of chemical composition but is unique in that it is rare in the environment. When surrogates are used, they are added to every sample, blank and standard. Surrogate recovery is used as an indication of extraction and/or analytical success.
Trip Blank (TB)	The TB is a portion of deionized water preserved in the same manner as the samples. The TB travels from the lab, to the field, and then back to the lab with the samples from the field. The TB serves as an indication of contamination introduced during sample transportation.

Transwest Geochem, Inc.
Analytical Results

Client Name: Ninyo & Moore
Project Name/No.: Flood Control
Samples Received: 6/29/01

TGI ID No.: 0106241
ADHS Cert. No.: AZM133/AZ0133

TGI ID/ SAMPLE NUMBER	CLIENT ID	Matrix	Units	ADHS 418.1 AZ				
				Date Extracted	Date Analyzed	Dil.	TPH	Percent Moisture
0106241 -01	S-1,2 COMP.	Soil	mg/kg	7/6/01	7/6/01	1	<20	32
0106241 -02	S-3	Soil	mg/kg	7/6/01	7/6/01	1	<20	24
0106241 -03	S-4,5 COMP.	Soil	mg/kg	7/6/01	7/6/01	1	<20	23

Notes:
418.1AZ *Values are reported as wet weight. % Moisture data is reported as required by the method.*

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-01
Project Name: Flood Control
Project Number:

Client Sample ID: S-1, 2
Collection Date: 6/29/2001 8:42:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Arsenic	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Barium	<5.0	5.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Cadmium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Chromium	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Lead	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Selenium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Silver	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Mercury	<0.0020	0.0020		mg/L	1	SW1311/7470A	7/9/01	7/9/01	TL	4323

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-01
Project Name: Flood Control
Project Number:

Client Sample ID: S-1, 2
Collection Date: 6/29/2001 8:42:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Acetone	<1.5	1.5		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Benzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Bromobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Bromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Bromodichloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Bromoform	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Bromomethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
2-Butanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
n-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
sec-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
tert-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Carbon tetrachloride	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Chlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Chloroethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
2-Chloroethylvinylether	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Chloroform	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Chloromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
2-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
4-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Dibromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2-Dibromoethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,3-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,4-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Dichlorodifluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,1-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,1-Dichloroethene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
cis-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
trans-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2-Dichloropropane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,3-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
2,2-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,1-Dichloropropene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
cis-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
trans-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Ethylbenzene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
2-Hexanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
4-Isopropyltoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Methyl tert-butyl ether	<0.20	0.20		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
4-Methyl-2-pentanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Methylene chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
n-Propylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Styrene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-01
Project Name: Flood Control
Project Number:

Client Sample ID: S-1, 2
Collection Date: 6/29/2001 8:42:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
1,1,2,2-Tetrachloroethane	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Tetrachloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Toluene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2,3-Trichlorobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,1,1-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,1,2-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Trichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Trichlorofluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2,3-Trichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2,4-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,3,5-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Vinyl acetate	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Vinyl chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Xylenes, Total	<0.15	0.15		mg/Kg	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
4-Bromofluorobenzene (Surrogate)	82	73-120		%REC	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Dibromofluoromethane (Surrogate)	78	72-119		%REC	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
1,2-Dichloroethane-d4 (Surrogate)	78	72-117		%REC	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Toluene-d8 (Surrogate)	85	78-116		%REC	1	SW8260B	6/29/01	7/2/01 14:35	JM	GCMS10_010702A
Aldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
alpha-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
beta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
delta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
gamma-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Chlordane	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
4,4'-DDD	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
4,4'-DDE	0.020	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
4,4'-DDT	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/17/01 00:01	BM	4331
Dieldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Endosulfan I	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Endosulfan II	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Endosulfan sulfate	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Endrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Endrin aldehyde	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Heptachlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Heptachlor epoxide	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Methoxychlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Toxaphene	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 18:52	BM	4331
Decachlorobiphenyl (Surrogate)	94	49-141		%REC	1	SW8081	7/10/01	7/19/01 18:52	BM	4331

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-02
Project Name: Flood Control
Project Number:

Client Sample ID: S-3
Collection Date: 6/29/2001 8:59:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Arsenic	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Barium	<5.0	5.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Cadmium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Chromium	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Lead	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Selenium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Silver	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Mercury	<0.0020	0.0020		mg/L	1	SW1311/7470A	7/9/01	7/9/01	TL	4323

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-02
Project Name: Flood Control
Project Number:

Client Sample ID: S-3
Collection Date: 6/29/2001 8:59:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Acetone	<1.5	1.5		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Benzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Bromobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Bromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Bromodichloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Bromoform	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Bromomethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
2-Butanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
n-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
sec-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
tert-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Carbon tetrachloride	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Chlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Chloroethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
2-Chloroethylvinylether	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Chloroform	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Chloromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
2-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
4-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Dibromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2-Dibromoethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,3-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,4-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Dichlorodifluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,1-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,1-Dichloroethene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
cis-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
trans-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2-Dichloropropane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,3-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
2,2-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,1-Dichloropropene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
cis-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
trans-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Ethylbenzene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
2-Hexanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
4-Isopropyltoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Methyl tert-butyl ether	<0.20	0.20		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
4-Methyl-2-pentanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Methylene chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
n-Propylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Styrene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-02
Project Name: Flood Control
Project Number:

Client Sample ID: S-3
Collection Date: 6/29/2001 8:59:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
1,1,2,2-Tetrachloroethane	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Tetrachloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Toluene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2,3-Trichlorobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,1,1-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,1,2-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Trichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Trichlorofluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2,3-Trichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2,4-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,3,5-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Vinyl acetate	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Vinyl chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Xylenes, Total	<0.15	0.15		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
4-Bromofluorobenzene (Surrogate)	86	73-120		%REC	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Dibromofluoromethane (Surrogate)	85	72-119		%REC	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
1,2-Dichloroethane-d4 (Surrogate)	82	72-117		%REC	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Toluene-d8 (Surrogate)	90	78-116		%REC	1	SW8260B	6/29/01	7/2/01 15:08	JM	GCMS10_010702A
Aldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
alpha-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
beta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
delta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
gamma-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Chlordane	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
4,4'-DDD	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
4,4'-DDE	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
4,4'-DDT	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/16/01 23:28	BM	4331
Dieldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Endosulfan I	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Endosulfan II	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Endosulfan sulfate	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Endrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Endrin aldehyde	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Heptachlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Heptachlor epoxide	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Methoxychlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Toxaphene	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 20:31	BM	4331
Decachlorobiphenyl (Surrogate)	95	49-141		%REC	1	SW8081	7/10/01	7/19/01 20:31	BM	4331

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-03
Project Name: Flood Control
Project Number:

Client Sample ID: S-4, 5
Collection Date: 6/29/2001 9:20:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Arsenic	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Barium	<5.0	5.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Cadmium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Chromium	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Lead	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Selenium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Silver	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Mercury	<0.0020	0.0020		mg/L	1	SW1311/7470A	7/9/01	7/9/01	TL	4323

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-03
Project Name: Flood Control
Project Number:

Client Sample ID: S-4, 5
Collection Date: 6/29/2001 9:20:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Acetone	<1.5	1.5		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Benzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Bromobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Bromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Bromodichloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Bromoform	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Bromomethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
2-Butanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
n-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
sec-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
tert-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Carbon tetrachloride	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Chlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Chloroethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
2-Chloroethylvinylether	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Chloroform	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Chloromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
2-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
4-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Dibromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2-Dibromoethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,3-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,4-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Dichlorodifluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,1-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,1-Dichloroethene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
cis-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
trans-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2-Dichloropropane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,3-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
2,2-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,1-Dichloropropene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
cis-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
trans-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Ethylbenzene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
2-Hexanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
4-Isopropyltoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Methyl tert-butyl ether	<0.20	0.20		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
4-Methyl-2-pentanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Methylene chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
n-Propylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Styrene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A

TRANSWEST GEOCHEM

Date Printed 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Lab ID: 0106241-03
Project Name: Flood Control
Project Number:

Client Sample ID: S-4, 5
Collection Date: 6/29/2001 9:20:00 AM
Matrix: SOIL

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
1,1,2,2-Tetrachloroethane	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Tetrachloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Toluene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2,3-Trichlorobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,1,1-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,1,2-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Trichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Trichlorofluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2,3-Trichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2,4-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,3,5-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Vinyl acetate	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Vinyl chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Xylenes, Total	<0.15	0.15		mg/Kg	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
4-Bromofluorobenzene (Surrogate)	88	73-120		%REC	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Dibromofluoromethane (Surrogate)	88	72-119		%REC	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
1,2-Dichloroethane-d4 (Surrogate)	87	72-117		%REC	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Toluene-d8 (Surrogate)	90	78-116		%REC	1	SW8260B	6/29/01	7/2/01 15:42	JM	GCMS10_010702A
Aldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
alpha-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
beta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
delta-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
gamma-BHC	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Chlordane	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
4,4'-DDD	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
4,4'-DDE	0.027	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
4,4'-DDT	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/17/01 01:40	BM	4331
Dieldrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Endosulfan I	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Endosulfan II	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Endosulfan sulfate	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Endrin	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Endrin aldehyde	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Heptachlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Heptachlor epoxide	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Methoxychlor	<0.015	0.015		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Toxaphene	<0.050	0.050		mg/Kg	1	SW8081	7/10/01	7/19/01 21:03	BM	4331
Decachlorobiphenyl (Surrogate)	95	49-141		%REC	1	SW8081	7/10/01	7/19/01 21:03	BM	4331

Transwest Geochem, Inc.
Analytical Quality Control Data
ADHS Method 418.1AZ

Client Name: Ninyo & Moore
Project Name/No.: Flood Control
Samples Received: 6/29/01

TGI ID No.: 0106241
ADHS Cert. No.: AZM133/AZ0133

Reagent Blank/LCS ADHS 418.1AZ	
Units:	mg/kg
Matrix:	Soil
Reagent Blank Result:	<20
LCS Amount:	100
LCS Result:	87
Percent Recovery:	87%
Limits:	85-146%
Date Extracted:	7/6/01
Date Analyzed:	7/6/01
Samples Linked:	0106241 -1,2,3

MS/MSD ADHS 418.1AZ	
Units:	mg/kg
Matrix:	Soil
Sample Result:	<20
Spike Amount:	100
Spike Result:	85
Percent Recovery:	85%
Duplicate Result:	85
Percent Recovery:	85%
Limits:	65-134%
RPD:	0%
Date Extracted:	7/6/01
Date Analyzed:	7/6/01
Samples Spiked:	0106241 -2
Sample Linked:	0106241 -1,2,3

Date: 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Method Blank

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Arsenic	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Barium	<5.0	5.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Cadmium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Chromium	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Lead	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Selenium	<0.50	0.50		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Silver	<1.0	1.0		mg/L	1	SW1311/6010B	7/3/01	7/3/01	AD	4312
Mercury	<0.0020	0.0020		mg/L	1	SW1311/7470A	7/9/01	7/9/01	TL	4323

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Method Blank

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Acetone	<1.5	1.5		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Benzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Bromobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Bromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Bromodichloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Bromoform	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Bromomethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
2-Butanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
n-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
sec-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
tert-Butylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Carbon tetrachloride	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Chlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Chloroethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
2-Chloroethylvinylether	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Chloroform	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Chloromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
2-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
4-Chlorotoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Dibromochloromethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2-Dibromoethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,3-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,4-Dichlorobenzene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Dichlorodifluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2-Dichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1-Dichloroethene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
cis-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
trans-1,2-Dichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2-Dichloropropane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,3-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
2,2-Dichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1-Dichloropropene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
cis-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
trans-1,3-Dichloropropene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Ethylbenzene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
2-Hexanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
4-Isopropyltoluene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Methyl tert-butyl ether	<0.20	0.20		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
4-Methyl-2-pentanone	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Methylene chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
n-Propylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Styrene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1,2,2-Tetrachloroethane	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Method Blank

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Tetrachloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Toluene	<0.10	0.10		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2,3-Trichlorobenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1,1-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,1,2-Trichloroethane	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Trichloroethene	<0.050	0.050		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Trichlorofluoromethane	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2,3-Trichloropropane	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2,4-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,3,5-Trimethylbenzene	<0.25	0.25		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Vinyl acetate	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Vinyl chloride	<0.50	0.50		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Xylenes, Total	<0.15	0.15		mg/Kg	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
4-Bromofluorobenzene	100	73-120		%REC	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Dibromofluoromethane	102	72-119		%REC	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
1,2-Dichloroethane-d4	101	72-117		%REC	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Toluene-d8	101	78-116		%REC	1	SW8260B	6/29/01	7/2/01 08:25	JM	GCMS10_010702A
Aldrin	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
alpha-BHC	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
beta-BHC	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
delta-BHC	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
gamma-BHC	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Chlordane	<0.017	0.017		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
4,4'-DDD	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
4,4'-DDE	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
4,4'-DDT	<0.0050	0.0050	JI	mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Dieldrin	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Endosulfan I	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Endosulfan II	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Endosulfan sulfate	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Endrin	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Endrin aldehyde	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Heptachlor	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Heptachlor epoxide	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Methoxychlor	<0.0050	0.0050		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Toxaphene	<0.017	0.017		mg/Kg	1	SW8081	7/10/01	7/19/01 13:56	BM	4331
Decachlorobiphenyl	95	49-141		%REC	1	SW8081	7/10/01	7/19/01 13:56	BM	4331

TRANSWEST GEOCHEM

Date: 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Sample Matrix Spike

Analyte	Result	PQL	SPK value	SPK Ref Val	% Rec	Low Limit	High Limit	RPD Ref Val	% RPD	RPD Limit	Qual
Sample ID: 0106241-03ASD	Batch ID: 4312			Test Code: SW1311/6010B				Date Analyzed: 7/3/01			
Client ID: S-4, 5				Units: mg/L				Date Prepared: 7/3/01			
Arsenic	10.16	1.0	10.00	<1.0	102%	75	125	10.22	1%	20	
Barium	11.16	5.0	10.00	<5.0	112%	75	125	11.12	0%	20	
Cadmium	9.190	0.50	10.00	<0.50	92%	75	125	9.257	1%	20	
Chromium	9.190	1.0	10.00	<1.0	92%	75	125	9.284	1%	20	
Lead	10.41	1.0	10.00	<1.0	104%	75	125	10.47	1%	20	
Selenium	10.61	0.50	10.00	<0.50	106%	75	125	10.65	0%	20	
Silver	4.552	1.0	5.000	<1.0	91%	75	125	4.553	0%	20	
Sample ID: 0106241-03AS	Batch ID: 4312			Test Code: SW1311/6010B				Date Analyzed: 7/3/01			
Client ID: S-4, 5				Units: mg/L				Date Prepared: 7/3/01			
Arsenic	10.22	1.0	10.00	<1.0	102%	75	125				
Barium	11.12	5.0	10.00	<5.0	111%	75	125				
Cadmium	9.257	0.50	10.00	<0.50	93%	75	125				
Chromium	9.284	1.0	10.00	<1.0	93%	75	125				
Lead	10.47	1.0	10.00	<1.0	105%	75	125				
Selenium	10.65	0.50	10.00	<0.50	107%	75	125				
Silver	4.553	1.0	5.000	<1.0	91%	75	125				
Sample ID: 0106241-03ASD	Batch ID: 4323			Test Code: SW1311/7470A				Date Analyzed: 7/9/01			
Client ID: S-4, 5				Units: mg/L				Date Prepared: 7/9/01			
Mercury	0.01113	0.0020	0.01000	<0.0020	111%	86	120	0.01061	5%	20	
Sample ID: 0106241-03AS	Batch ID: 4323			Test Code: SW1311/7470A				Date Analyzed: 7/9/01			
Client ID: S-4, 5				Units: mg/L				Date Prepared: 7/9/01			
Mercury	0.01061	0.0020	0.01000	<0.0020	106%	86	120				
Sample ID: 0106241-02AS	Batch ID: GCMS10_010702A			Test Code: SW8260B				Date Analyzed: 7/2/01 16:49			
Client ID: S-3				Units: mg/Kg				Date Prepared: 6/29/01			
Benzene	0.7500	0.050	1.000	<0.050	75%	73	111				
Chlorobenzene	0.7985	0.050	1.000	<0.050	80%	79	105				
1,1-Dichloroethene	0.6850	0.10	1.000	<0.10	69%	62	120				
Toluene	0.7430	0.10	1.000	<0.10	74%	74	112				
Trichloroethene	0.7895	0.050	1.000	<0.050	79%	78	110				
4-Bromofluorobenzene	2.061	N/A	2.500	N/A	82%	73	120				
Dibromofluoromethane	2.050	N/A	2.500	N/A	82%	72	119				
1,2-Dichloroethane-d4	2.041	N/A	2.500	N/A	82%	72	117				
Toluene-d8	1.991	N/A	2.500	N/A	80%	78	116				

TRANSWEST GEOCHEM

Date: 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Sample Matrix Spike

Analyte	Result	PQL	SPK value	SPK Ref Val	% Rec	Low Limit	High Limit	RPD Ref Val	% RPD	RPD Limit	Qual
Sample ID: 0106241-02ASD	Batch ID: GCMS10_010702A			Test Code: SW8260B				Date Analyzed: 7/2/01 17:22			
Client ID: S-3				Units: mg/Kg				Date Prepared: 6/29/01			
Benzene	0.7065	0.050	1.000	<0.050	71%	73	111	0.7500	6%	20	M2
Chlorobenzene	0.7325	0.050	1.000	<0.050	73%	79	105	0.7985	9%	20	M2
1,1-Dichloroethene	0.6685	0.10	1.000	<0.10	67%	62	120	0.6850	2%	20	
Toluene	0.7220	0.10	1.000	<0.10	72%	74	112	0.7430	3%	20	M2
Trichloroethene	0.7320	0.050	1.000	<0.050	73%	78	110	0.7895	8%	20	M2
4-Bromofluorobenzene	1.955	N/A	2.500	N/A	78%	73	120				
Dibromofluoromethane	1.910	N/A	2.500	N/A	76%	72	119				
1,2-Dichloroethane-d4	1.905	N/A	2.500	N/A	76%	72	117				
Toluene-d8	1.920	N/A	2.500	N/A	77%	78	116				S6
Sample ID: 0106241-01A-MS	Batch ID: 4331			Test Code: SW8081				Date Analyzed: 7/17/01 01:07			
Client ID: S-1, 2				Units: mg/Kg				Date Prepared: 7/10/01			
4,4'-DDT	0.09950	0.015	0.1000	<0.015	100%	37	189				
Sample ID: 0106241-01A-MS	Batch ID: 4331			Test Code: SW8081				Date Analyzed: 7/19/01 19:58			
Client ID: S-1, 2				Units: mg/Kg				Date Prepared: 7/10/01			
gamma-BHC	0.08450	0.015	0.1000	<0.015	85%	72	108				
Dieldrin	0.09750	0.015	0.1000	<0.015	98%	70	135				
Methoxychlor	0.08600	0.015	0.1000	<0.015	86%	76	137				
Decachlorobiphenyl	0.09450	N/A	0.1000	N/A	95%	49	141				

TRANSWEST GEOCHEM

Date: 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Blank Spike (primary source)

Analyte	Result	PQL	SPK value	SPK Ref Val	% Rec	Low Limit	High Limit	RPD Ref Val	% RPD	RPD Limit	Qual
Sample ID: LCSD-4312	Batch ID: 4312			Test Code: SW1311/6010B				Date Analyzed: 7/3/01			
				Units: mg/L				Date Prepared: 7/3/01			
Arsenic	10.14	1.0	10.00	<1.0	101%	85	115	10.27	1%	20	
Barium	10.67	5.0	10.00	<5.0	107%	85	115	10.77	1%	20	
Cadmium	9.281	0.50	10.00	<0.50	93%	85	115	9.383	1%	20	
Chromium	9.253	1.0	10.00	<1.0	93%	85	115	9.375	1%	20	
Lead	10.43	1.0	10.00	<1.0	104%	85	115	10.57	1%	20	
Selenium	10.49	0.50	10.00	<0.50	105%	85	115	10.64	1%	20	
Silver	4.491	1.0	5.000	<1.0	90%	85	115	4.546	1%	20	
Sample ID: LCS-4312	Batch ID: 4312			Test Code: SW1311/6010B				Date Analyzed: 7/3/01			
				Units: mg/L				Date Prepared: 7/3/01			
Arsenic	10.27	1.0	10.00	<1.0	103%	85	115				
Barium	10.77	5.0	10.00	<5.0	108%	85	115				
Cadmium	9.383	0.50	10.00	<0.50	94%	85	115				
Chromium	9.375	1.0	10.00	<1.0	94%	85	115				
Lead	10.57	1.0	10.00	<1.0	106%	85	115				
Selenium	10.64	0.50	10.00	<0.50	106%	85	115				
Silver	4.546	1.0	5.000	<1.0	91%	85	115				
Sample ID: LCSD-4323	Batch ID: 4323			Test Code: SW1311/7470A				Date Analyzed: 7/9/01			
				Units: mg/L				Date Prepared: 7/9/01			
Mercury	0.01037	0.0020	0.01000	<0.0020	104%	87	118	0.009798	6%	20	
Sample ID: LCS-4323	Batch ID: 4323			Test Code: SW1311/7470A				Date Analyzed: 7/9/01			
				Units: mg/L				Date Prepared: 7/9/01			
Mercury	0.009798	0.0020	0.01000	<0.0020	98%	87	118				
Sample ID: LCS-4331	Batch ID: 4331			Test Code: SW8081				Date Analyzed: 7/19/01 14:29			
				Units: mg/Kg				Date Prepared: 7/10/01			
gamma-BHC	0.02567	0.0050	0.03333	<0.0050	77%	75	104				
4,4'-DDT	0.02883	0.0050	0.03333	<0.0050	86%	89	126				L2
Dieldrin	0.02750	0.0050	0.03333	<0.0050	83%	87	116				L2
Methoxychlor	0.02767	0.0050	0.03333	<0.0050	83%	88	125				L2
Decachlorobiphenyl	0.03267	N/A	0.03333	N/A	98%	49	141				
Sample ID: LCSD-4331	Batch ID: 4331			Test Code: SW8081				Date Analyzed: 7/19/01 15:02			
				Units: mg/Kg				Date Prepared: 7/10/01			
gamma-BHC	0.02967	0.0050	0.03333	<0.0050	89%	75	104	0.02567	14%	20	
4,4'-DDT	0.03333	0.0050	0.03333	<0.0050	100%	89	126	0.02883	14%	20	
Dieldrin	0.03217	0.0050	0.03333	<0.0050	97%	87	116	0.02750	16%	20	
Methoxychlor	0.03183	0.0050	0.03333	<0.0050	95%	88	125	0.02767	14%	20	
Decachlorobiphenyl	0.03583	N/A	0.03333	N/A	107%	49	141				

TRANSWEST GEOCHEM

Date: 02-Aug-01

License No. AZM133/AZ0133

CLIENT: Ninyo & Moore
Work Order: 0106241
Project: Flood Control

QC SUMMARY REPORT

Secondary Source Blank Spike

Analyte	Result	PQL	SPK value	SPK Ref Val	% Rec	Low Limit	High Limit	RPD Ref Val	% RPD	RPD Limit	Qual
Sample ID: LCSV SOIL 6/29	Batch ID: GCMS10_010702A			Test Code: SW8260B				Date Analyzed: 7/2/01 11:13			
				Units: mg/Kg				Date Prepared: 6/29/01			
Benzene	0.9080	0.050	1.000	<0.050	91%	76	112				
Chlorobenzene	0.9110	0.050	1.000	<0.050	91%	79	109				
1,1-Dichloroethene	0.8255	0.10	1.000	<0.10	83%	62	120				
Toluene	0.8770	0.10	1.000	<0.10	88%	76	114				
Trichloroethene	0.9095	0.050	1.000	<0.050	91%	77	112				
4-Bromofluorobenzene	2.407	N/A	2.500	N/A	96%	73	120				
Dibromofluoromethane	2.465	N/A	2.500	N/A	99%	72	119				
1,2-Dichloroethane-d4	2.433	N/A	2.500	N/A	97%	72	117				
Toluene-d8	2.422	N/A	2.500	N/A	97%	78	116				
Sample ID: LCSVD SOIL 6/2	Batch ID: GCMS10_010702A			Test Code: SW8260B				Date Analyzed: 7/2/01 11:47			
				Units: mg/Kg				Date Prepared: 6/29/01			
Benzene	0.8735	0.050	1.000	<0.050	87%	76	112	0.9080	4%	20	
Chlorobenzene	0.8845	0.050	1.000	<0.050	88%	79	109	0.9110	3%	20	
1,1-Dichloroethene	0.8480	0.10	1.000	<0.10	85%	62	120	0.8255	3%	20	
Toluene	0.8930	0.10	1.000	<0.10	89%	76	114	0.8770	2%	20	
Trichloroethene	0.8840	0.050	1.000	<0.050	88%	77	112	0.9095	3%	20	
4-Bromofluorobenzene	2.442	N/A	2.500	N/A	98%	73	120				
Dibromofluoromethane	2.387	N/A	2.500	N/A	95%	72	119				
1,2-Dichloroethane-d4	2.369	N/A	2.500	N/A	95%	72	117				
Toluene-d8	2.464	N/A	2.500	N/A	99%	78	116				

TRANSWEST GEOCHEM
3725 East Atlanta Avenue, Suite 2
Phoenix, Arizona 85040
Phone: (602) 437-0330
Fax: (602) 437-0660

Chain of Custody 010624JJ

TGI Work Order No: 010624JJ

Date 6-25-01 Page 1 of 1

Project Manager:	Steve N.		
Client Name:	Ninyo & Moore		
Address:	5035 South 33rd Street		
City, State ZIP:	Phoenix, AZ 850		
Phone:	602-243-1600	Fax:	602-243-2699

Bill to:	SAME		
Company:			
Address:			
City, State ZIP:			
Phone:		Fax:	

P.O. No.:	600220001
Project Name:	Flood Control
Project Number:	

SAMPLE RECEIPT

Temperature:	Ambient / Cold	Ice:	
Received Intact:	Y	Absent / Present	
Custody Seals:	N	Wet / Blue	
Total No. of Containers:	5		

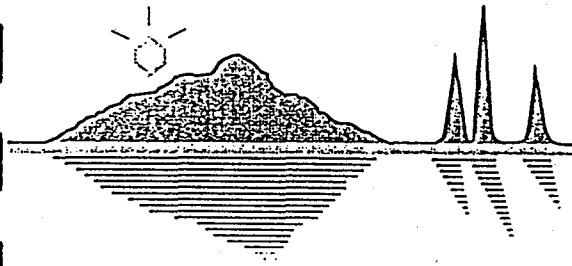
ANALYSIS REQUEST

Sample Identification	Matrix	Date Sampled	Time Sampled	Lab ID	No. of Containers	TPH, (418.1 /418.1AZ)	TPH, 8015AZR.1	BTEX (8021B)	Volatile Organics GCMS (624/8260AZ)	SDWA Volatiles, (524.2)	Semi-Volatile Organics GCMS (625/8270)	Organochlorine Pesticides (608/8081)	PCB's, (8082)	PAH, EPA 8310	8 RCRA Metals	13 Priority Pollutant Metals	TCLP Metals	18 CAM Metals	Comments
S-1	Soil	6-74	8:32	1	1	X			X								X	X	3 composite
S-2	Soil	6-74	8:42	1	1	X			X								X	X	
S-3	Soil	6-74	8:59	2	1	X			X								X	X	
S-4	Soil	6-74	9:11	3	1	X			X								X	X	3 Composite
S-5	Soil	6-74	9:20	3	1	X			X								X	X	

Relinquished by: (Signature)	(Print Name)	Date/Time	Received by: (Signature)	(Print Name)	Date/Time
1	George P. Cardona	6-24-01/9:37		Skye Harden	6/24, 9:37
2					
3					

White copy to TGI, Yellow copy for final report, Pink copy to sampler

Revised: 6/29/00



TRANSWEST GEOCHEM

August 3, 2001

Pat Cordova
Ninyo & Moore
5035 S. 33rd St.
Phoenix, AZ 85040

Re: Flood Control/600220001
Work Order No.: 0106241

Dear Pat,

Attached is the original Report of Analysis from Precision Analytical Laboratories, Inc. for the sample received on 6/29/2001 9:37:00 AM. The following analysis was performed:

Method SW8151A – Chlorinated Herbicides

If you have any questions regarding the results, please call me. We appreciate your business and thank you for choosing Transwest Geochem.

Sincerely,

Michael E. Farber for:

Beth Proffitt
Project Manager

ADHS License No. AZM133/AZ0133

Precision Analytical Laboratories, Inc.
A Division of Aerotech Laboratories, Inc.

July 10, 2001

Beth Proffitt
Transwest Geochem, Inc.
3725 E. Atlanta Ave.
Suite 2
Phoenix, AZ 85040
TEL: (602) 437-0330
FAX (602) 437-0660

RE: Flood Control/0106241 Order No.: 0106777

Dear Beth Proffitt:

Precision Analytical Laboratories, Inc. received 3 samples on 6/29/2001 for the analyses presented in the following report.

This report includes the following information:
- Case Narrative.
- Analytical Report: includes test results, report limit (Limit), any applicable data qualifier (Qual), units, dilution factor (DF), and date analyzed.
- QC Summary Report.

This communication is intended only for the individual or entity to whom it is directed. It may contain information that is privileged, confidential, or otherwise exempt from disclosure under applicable law. Dissemination, distribution, or copying of this communication by anyone other than the intended recipient, or a duly designated employee or agent of such recipient, is prohibited. If you have received this communication in error, please notify us immediately and destroy this message and all attachments thereto. If you have any questions regarding these test results, please do not hesitate to call.

Sincerely,

Carlene McCutcheon
Project Manager

CC:

Precision Analytical Laboratories, Inc.
A Division of Aerotech Laboratories, Inc.

Date: *10-Jul-01*

CLIENT: Transwest Geochem, Inc.
Project: Flood Control/0106241
Lab Order: 0106777

CASE NARRATIVE

Data Qualifiers:

Listed below are data qualifiers which may be used in your analytical report to explain any analytical or quality control issues. If one or more of the following data qualifiers is associated with your analytical or quality control data it will be noted in your report under the column header "QUAL". Any quality control deficiencies that cannot be adequately described by these qualifiers will be addressed in the analytical comments section of this case narrative.

B1 Target analyte detected in method blank at or above the method reporting limit.
D1 Sample required dilution due to matrix interference.
D2 Sample required dilution due to high concentration of target analyte.
D3 Sample dilution required due to insufficient sample.
D4 Minimum reporting level (MRL) adjusted to reflect sample amount received and analyzed.
E1 Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
E2 Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to sample matrix.
E3 Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements.
E4 Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL).
E6 Concentration estimated. Internal standard recoveries did not meet method acceptance criteria.
E7 Concentration estimated. Internal standard recoveries did not meet laboratory acceptance criteria.
H1 Sample analysis performed past holding time. See case narrative.
H2 Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3 Sample was received and analyzed past holding time.
H4 Sample was extracted past required extraction holding time, but analyzed within analysis holding time. See case narrative.
K1 The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criteria of at least 2 mg/L. The reported result is an estimated value.
K2 The sample dilutions set up for the BOD analysis failed to meet the criteria of a residual dissolved oxygen of at least 1 mg/L. The reported result is estimated.
L1 The associated blank spike recovery was above laboratory acceptance limits. See case narrative.
L2 The associated blank spike recovery was below laboratory acceptance limits. See

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CLIENT: Transwest Geochem, Inc.
Project: Flood Control/0106241
Lab Order: 0106777

CASE NARRATIVE

case narrative.

M1 Matrix spike recovery was high, the method control sample recovery was acceptable.

M2 Matrix spike recovery was low, the method control sample recovery was acceptable.

M3 The accuracy of the spike recovery value is reduced since the analyte concentration in the sample is disproportionate to spike level. The method control sample recovery was acceptable.

M4 The analysis of the spiked sample required a dilution such that the spike concentration was diluted below the reporting limit. The method control sample recovery was acceptable.

M5 Analyte concentration was determined by the method of standard addition (MSA).

N1 See case narrative.

Q1 Sample integrity was not maintained. See case narrative.

Q2 Sample received with head space.

Q3 Sample received with improper chemical preservation.

Q5 Sample received without chemical preservation, but preserved by the laboratory.

Q6 Sample was received above recommended temperature.

Q7 Sample inadequately dechlorinated.

Q8 Insufficient sample received to meet method QC requirements. QC requirements satisfy ADEQ policies 0154 and 0155.

Q10 Sample received in inappropriate sample container.

Q11 Sample is heterogeneous. Sample homogeneity could not be readily achieved using routine laboratory practices.

R2 RPD exceeded the laboratory control limit. See case narrative.

R3 Sample RPD between the primary and confirmatory analysis exceeded 40%. Per EPA Method 8000B, the higher value was reported.

R4 RPD exceeded the method control limit. Recovery met acceptance criteria.

R5 RPD exceeded the laboratory control limit. Recovery met acceptance criteria.

S2 Surrogate recovery was above laboratory and method acceptance limits.

S4 Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample.

S6 Surrogate recovery was below laboratory and method acceptance limits. Reextraction and/or reanalysis confirms low recovery caused by matrix effect.

S7 Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.

S9 The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria. The method control sample recovery was acceptable.

S10 Surrogate recovery was above laboratory and method acceptance limits. See case narrative (N1).

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CLIENT: Transwest Geochem, Inc.
Project: Flood Control/0106241
Lab Order: 0106777

CASE NARRATIVE

T2 Cited ADHS licensed method does not contain this analyte as part of method compound list.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

V1 CCV recovery was above method acceptance limits. This target analyte was not detected in the sample.

V2 CCV recovery was above method acceptance limits. This target analyte was detected in the sample. The sample could not be reanalyzed due to insufficient sample.

V5 CCV recovery after a group of samples was above acceptance limits. This target analyte was not detected in the sample. Acceptable per EPA Method 8000B.

Samples were analyzed using methods outlined in references such as:

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992 and 19th Edition, 1995.

Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition.

40 CFR, Part 136, Revised 1995. Appendix A to Part 136- Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater.

NIOSH Manual of Analytical Methods, Fourth Edition, 1994.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, 1999.

Precision Analytical Laboratories, Inc (PAL) holds the following certifications:
Arizona (certification no. AZ0610) and California (I-2410).
PAL- Tucson laboratory Arizona certification number: AZ0609.
PAL- North Phoenix laboratory Arizona certification number: AZ0611.

PAL participates in the AIHA Proficiency Analytical Testing (PAT) program for metals, solvents, and formaldehyde.

Analytical Comments:

All method blanks and laboratory control spikes met EPA method and/or laboratory quality control objectives for the analyses included in this report.

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Precision Analytical Laboratories, Inc.
A Division of Aerotech Laboratories, Inc.

Date: *10-Jul-01*

CLIENT:	Transwest Geochem, Inc.	**Client Sample ID:**	S-1,2
Lab Order:	0106777	**Tag Number:**	01C
Project:	Flood Control/0106241	**Collection Date:**	6/29/2001 8:32:00 AM
Lab ID:	0106777-01A	**Matrix:**	SOIL

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
CHLORINATED HERBICIDES		**SW8151A**				Analyst: MH
Dichlorprop	< 0.020	0.020		mg/Kg	1	7/7/2001
Pentachlorophenol	< 0.0050	0.0050		mg/Kg	1	7/7/2001
Dicamba	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-D	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-TP (Silvex)	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-T	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-DB	< 0.010	0.010		mg/Kg	1	7/7/2001
Dinoseb	< 0.010	0.010		mg/Kg	1	7/7/2001
Surr: DCAA	70.0	22-160		%REC	1	7/7/2001

Qualifiers:

- ND - Not Detected at the Reporting Limit
- J - Analyte detected below quantitation limits
- B - Analyte detected in the associated Method Blank
- * - Value exceeds Maximum Contaminant Level
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- E - Value above quantitation range

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Precision Analytical Laboratories, Inc.
A Division of Aerotech Laboratories, Inc.

Date: *10-Jul-01*

CLIENT:	Transwest Geochem, Inc.	**Client Sample ID:**	S-3
Lab Order:	0106777	**Tag Number:**	02C
Project:	Flood Control/0106241	**Collection Date:**	6/29/2001 8:59:00 AM
Lab ID:	0106777-02A	**Matrix:**	SOIL

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
CHLORINATED HERBICIDES		**SW8151A**				Analyst: MH
Dichlorprop	< 0.020	0.020		mg/Kg	1	7/7/2001
Pentachlorophenol	< 0.0050	0.0050		mg/Kg	1	7/7/2001
Dicamba	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-D	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-TP (Silvex)	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-T	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-DB	< 0.010	0.010		mg/Kg	1	7/7/2001
Dinoseb	< 0.010	0.010		mg/Kg	1	7/7/2001
Surr: DCAA	67.0	22-160		%REC	1	7/7/2001

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

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Precision Analytical Laboratories, Inc.
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Date: *10-Jul-01*

CLIENT:	Transwest Geochem, Inc.	**Client Sample ID:**	S-4,5
Lab Order:	0106777	**Tag Number:**	03C
Project:	Flood Control/0106241	**Collection Date:**	6/29/2001 9:20:00 AM
Lab ID:	0106777-03A	**Matrix:**	SOIL

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
CHLORINATED HERBICIDES		**SW8151A**				Analyst: MH
Dichlorprop	< 0.020	0.020		mg/Kg	1	7/7/2001
Pentachlorophenol	< 0.0050	0.0050		mg/Kg	1	7/7/2001
Dicamba	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-D	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-TP (Silvex)	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4,5-T	< 0.010	0.010		mg/Kg	1	7/7/2001
2,4-DB	< 0.010	0.010		mg/Kg	1	7/7/2001
Dinoseb	< 0.010	0.010		mg/Kg	1	7/7/2001
Surr: DCAA	70.5	22-160		%REC	1	7/7/2001

Qualifiers:

- ND - Not Detected at the Reporting Limit
- J - Analyte detected below quantitation limits
- B - Analyte detected in the associated Method Blank
- * - Value exceeds Maximum Contaminant Level
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- E - Value above quantitation range

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Precision Analytical Laboratories, Inc.

Date: *10-Jul-01*

CLIENT: Transwest Geochem, Inc.
Work Order: 0106777
Project: Flood Control/0106241

QC SUMMARY REPORT
Method Blank

Sample ID MB-4642 Batch ID: 4642 Test Code: SW8151A Units: mg/Kg Analysis Date 7/6/2001 Prep Date 7/5/2001
Client ID: Run ID: GC2_010706A SeqNo: 125887

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dichlorprop	< 0.020	0.02									
Pentachlorophenol	< 0.0050	0.005									
Dicamba	< 0.010	0.01									
2,4-D	< 0.010	0.01									
2,4,5-TP (Silvex)	< 0.010	0.01									
2,4,5-T	< 0.010	0.01									
2,4-DB	< 0.010	0.01									
Dinoseb	< 0.010	0.01									
Surr: DCAA	0.149	0	0.2	0	74.5	22	160	0			

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

Precision Analytical Laboratories, Inc.

Date: *10-Jul-01*

CLIENT: Transwest Geochem, Inc.
Work Order: 0106777
Project: Flood Control/0106241

QC SUMMARY REPORT
Sample Matrix Spike

Sample ID 0106775-01A MS **Batch ID:** 4642 **Test Code:** SW8151A **Units:** mg/Kg **Analysis Date** 7/6/2001 **Prep Date** 7/5/2001
Client ID: **Run ID:** GC2_010706A **SeqNo:** 125890

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
2,4-D	0.065	0.01	0.1	0	65	32.4	156	0			
2,4,5-TP (Silvex)	0.0759	0.01	0.1	0	75.9	49	127	0			
Surr: DCAA	0.135	0	0.2	0	67.5	22	160	0			

Sample ID 0106775-01A MSD **Batch ID:** 4642 **Test Code:** SW8151A **Units:** mg/Kg **Analysis Date** 7/6/2001 **Prep Date** 7/5/2001
Client ID: **Run ID:** GC2_010706A **SeqNo:** 125891

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
2,4-D	0.0666	0.01	0.1	0	66.6	32.4	156	0.065	2.43	35	
2,4,5-TP (Silvex)	0.086	0.01	0.1	0	86	49	127	0.0759	12.5	35	
Surr: DCAA	0.151	0	0.2	0	75.5	22	160	0.135	0	0	

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

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Precision Analytical Laboratories, Inc.

Date: *10-Jul-01*

CLIENT: Transwest Geochem, Inc.
Work Order: 0106777
Project: Flood Control/0106241

QC SUMMARY REPORT
Laboratory Control Spike - generic

Sample ID LCS-4642 Batch ID: 4642 Test Code: SW8151A Units: mg/Kg Analysis Date 7/6/2001 Prep Date 7/5/2001
Client ID: Run ID: GC2_010706A SeqNo: 125888

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
2,4-D	0.064	0.01	0.1	0	64	32.4	156	0			
2,4,5-TP (Silvex)	0.0764	0.01	0.1	0	76.4	49	127	0			
Surr: DCAA	0.142	0	0.2	0	71	22	160	0			

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

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CHAIN-OF-CUSTODY

TRANSWEST GEOCHEM

Beth Proffitt
3725 E. Atlanta Avenue
Suite 2
Phoenix, AZ 85040-2960

TEL: (602) 437-0330
FAX: (602) 437-0660

Work Order: 0106241

Project: Flood Control

Subcontractor:
Precision Analytical Laboratories, Inc.
1725 West 17th St.
Tempe, AZ 85281

TEL: (480) 967-1310
FAX: (480) 967-1019

29-Jun-01

Client Sample ID	TGI ID	Matrix	Collection Date	Containers	Requested Tests: 8151_S					
S-1, 2	01C	Soil	6/29/2001 8:32:00 AM	1	1					
S-3	02C	Soil	6/29/2001 8:59:00 AM	1	1					
S-4, 5	03C	Soil	6/29/2001 9:20:00 AM	1	1					

Comments: After analysis, the samples do not need to be returned and can be disposed per your standard laboratory practices. Please provide a QC report, including Method Blank data.

Sample Receipt		
Temperature:	Ambient / Cold	Ice:
Received Intact:	yes	Absent / Present
Custody Seals:	no	Wet / Blue
Total No. of Containers:	3	3.1 °C.

		Date/Time		Date/Time
Relinquished by:	Billy Whitehead	6/29/01	1450	
Relinquished by:			Received by:	6/29/01 1450
			Received by:	


Ninyo & Moore

APPENDIX D

AGRONOMIC TESTS RESULTS

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

August 21, 2001 Lab #: SP 107342-06

Ninyo & Moore
5035 South 33rd St.
Phoenix, AZ 85040

Recommendations for Laveen Area Channel

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.
B. Select only those plants that have a high or greater tolerance to free limestone for planting at this site.
C. Select only those plants that have a high or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil amendments	
a. Organic (well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	25.0 lbs.

	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	0.00 lbs.
b. Phosphorus (P_2O_5)	1.70 lbs.
c. Potassium (K_2O)	0.00 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	0.00 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.45 lbs.
h. Copper (Cu)	.000 lbs.
i. Boron (B)	.000 lbs.

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FAX: 209/942-0423

Field Office
Visalia, CA
TEL: 559/734-9473
FAX: 559/734-8435
Mobile: 559/737-2399

B. **Tree and Shrub Backfill Mix**

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commercial Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that you periodically add N-pHURIC to the irrigation water to obtain a water pH of 5.0 to facilitate the leaching of Sodium.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	3/4 lb.
Phosphorus	1/3 lb.
Potassium	1/3 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

August 21, 2001

Ninyo & Moore
5035 South 33rd St.
Phoenix, AZ 85040

Description : B-13
Project : Laveen Area Channel

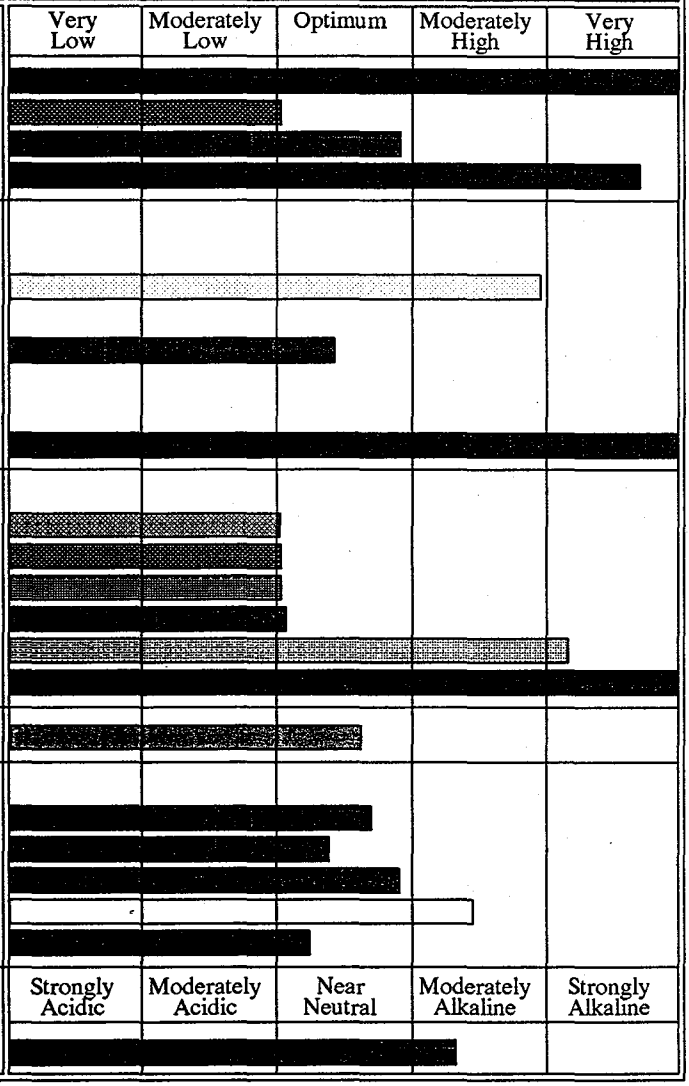
Lab ID : SP 107342-06
Customer ID: 2-18569

Sampled On : June 21, 2001
Sampled By : Ninyo & Moore
Received On: August 15, 2001
Depth : 0-5'
Meth. Irrg. : S.S. Sprinklers

LANDSCAPE SOIL ANALYSIS

Test Description	Result		Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	272	PPM	10 - 70
Phosphorus	14	PPM	12 - 60
Potassium (Exch)	470	PPM	81 - 500
Potassium (Sol)	4.1	meq/L	0.25 - 1.0
Secondary Nutrients			
Calcium (Exch)	3700	PPM	---
Calcium (Sol)	62	meq/L	2.0 - 50
Magnesium (Exch)	430	PPM	---
Magnesium (Sol)	27	meq/L	1.5 - 60
Sodium (Exch)	420	PPM	---
Sodium (Sol)	118	meq/L	See SAR
Sulfate	71	meq/L	0.6 - 20
Micro Nutrients			
Zinc	2.2	PPM	0.7 - 50
Manganese	3.4	PPM	1.4 - 50
Iron	11.5	PPM	8.0 - 100
Copper	1.3	PPM	0.2 - 15
Boron	3.5	PPM	0.3 - 2.1
Chloride	78.4	meq/L	0.1 - 4.0
CEC	25.1	meq/100g	Variable
% Base Saturation			
CEC - Calcium	74.1	%	60 - 80
CEC - Magnesium	13.9	%	10 - 20
CEC - Potassium	4.7	%	2 - 5
CEC - Sodium	7.3	%	0 - 5
CEC - Hydrogen	0.0	%	0 - 3
pH	7.8	---	5.8 - 8.2

Graphical Results Presentation



Good — Problem

Table continued next page...

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Field Office
Visalia, CA
TEL: 559/734-9473
FAX: 559/734-8435
Mobile: 559/737-2399

August 21, 2001

Ninyo & Moore

Lab ID : SP 107342-06
Customer ID: 2-18569
Description : B-13

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Optimum Range	Graphical Results Presentation
Others			Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	22.5 mmhos/cm	0.5 - 2.0	
SAR	17.7	0.1 - 6	
Limestone	8.4 %	0 - 0.1	
Lime Requirement	0.0 Tons/AF	---	0 / 1 / 2 / 3 / 4 / 5 / 6
Moisture	12.6 %	1/2 Satn. %	Very Low / Moderately Low / Optimum / Moderately High / Very High
Saturation	33.9 %	20 - 60	Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic

Good Problem

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

DHN:md

Darrell H. Nelson, President

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

HIGH LIME SOILS

High lime soils, also called calcareous soils, contain greater than 2% by weight calcium carbonate ($CaCO_3$). These soils are typically light in color, silty in texture and often poorly drained.

Sensitive plants growing in high lime soils exhibit a lime-inducer chlorosis due to the unavailability of iron to the plants. Characteristically the leaves turn yellow with the veins remaining green and often the edges of the leaves are burned.

Unfortunately there are no treatments to alleviate this problem for a long period of time. Application of chelated iron to the soil or foliage provides temporary cessation of chlorosis, but the iron must be reapplied frequently to maintain symptomless plants. Therefore, it is important to select suitable plants for the landscape that can tolerate high lime conditions. A few species that are resistant and susceptible are listed below.

Plants Intolerant of High Lime Soils

Groundcovers

Dichondra	Dichondra repens
Strawberry	Fragaria sp.
Spring Cinquefoil	Potentilla verna
African Daisy	Osteospermum sp.
Star Daisy	Trachelospermum jasminoides
Periwinkle	Vinca sp.

Shrubs & Trees

Abelia	Abelia sp.
Acacia	Acacia sp.
Azalea	Azalea sp.
Bottlebrush	Callistemon sp.
Camellia	Camellia sp.
Catalpa	Catalpa sp.
Citrus	Citrus sp.
Eucalyptus	Eucalyptus sp.
Hibiscus	Hibiscus sp.
Hydrangea	Hydrangea sp.
Black Walnut	Juglans nigra
Sweet Gum	Liquidambar styraciflua
Crabapple	Malus sp.

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Shrubs & Trees (cont'd)

Photinia	Photinia serrulata
Monterey Pine	Pinus radiata
Evergreen Rear	Pyrus kawakamii
Firethorn	Pyracantha sp.
Rhododendron	Rhododendron sp.
Rose	Rosa sp.
Weeping Willow	Salix babylonica
Western Red Cedar	Thuja plicata
Viburnum	Viburnum sp.
Wisteria	Wisteria sp.

Plants Tolerant of High Lime Soils

Groundcovers

Manzanita	Arctostaphylos sp.
Cape Weed	Arctotheca calendula
Australian Saltbush	Atriplex semibaccata
Coyote Bush	Baccharis pilularis
Ice Plant	Carpobrotus sp.
Bellflower	Campanula sp.
Wild Lilac	Ceanothus sp.
Ice Plant	Drosanthemum sp.
Gazania	Gazania sp.
Ice Plant	Lampranthus sp.
Lantana	Lantana sp.
Myoporum	Myoporum parvifolium
Lippia	Phyla nodifera
Prostrate Rosemary	Rosmarinus 'Prostratus'

Shrubs

Strawberry Tree	Arbutus unedo
Manzanita	Arctostaphylos sp.
Bougainvillea	Bougainvillea sp.
Boxwood	Buxus sp.
Pink Powder Puff	Calliandra sp.
Natal Plum	Carissa sp.
Wild Lilac	Ceanothus sp.
Rock Rose	Cistus sp.

Shrubs (cont'd)

Broom	Cytisus sp.
Hop Bush	Dodonaea viscosa
Silverberry	Eleagnus pungens
Euonymus	Euonumus sp.
Pineapple Guava	Feijoa sellowiana
Flannel Bush	Fremontodendron sp.
Grevillea	Grevillea 'Noelii'
Hakea	Hakea sp.
Veronica	Hebe sp.
Toyon	Heteromeles arbutifolia
Holly	Ilex sp.
Privet	Ligustrum sp.
Oregon Grape	Mahonia aquifolium
Myoporum	Myoporum latium
Oleander	Nerium oleander
Mock Orange	Pittosporum sp.
Cape Plumbago	Plumbago auriculata
Catalina Cherry	Prunus caroliniana
Indian Hawthorn	Raphiolepis sp.
Buckthorn	Rhamnus sp.
Sumac	Rhus sp.
Gooseberry, Currant	Ribes sp.
Rosemary	Rosmarinus officinalis
Elderberry	Sambucus sp.
Xylosma	Xylosma congestum
Yucca	Yucca sp.

Trees	**Growth Rate**	
Albizia	Moderate	Albizia sp.
Alder	Very Fast	Alnus sp.
Bottletree	Slow	Brachychiton populneum
Ironwood	Slow	Casuarina sp.
Cedar	Slow	Cedrus sp.
Carob	Slow	Ceratonia siliqua
Loquat	Fast	Eriobotrya japonica
Ash, Modesto	Very Fast	Fraxinus sp.
Silk Oak	Moderate (dirty)	Grevillea robusta
Jacaranda	Moderate	Jacaranda acutifolia
Chinaberry	Fast	Melia azedarach
Mulberry	Very Fast	Morus sp.

Trees (cont'd)	Growth Rate (cont'd)	
Olive	Moderate	Olea europaea
Palms	Very Slow	Phoenix sp.
Canary Island Pine	Moderate	Pinus canariensis
Aleppo Pine	Moderate	Pinus halepensis
Oak	Very Slow	Quercus sp.
African Sumac	Fast	Rhus lancea
Pepper	Fast	Schinus sp.
Elm	Fast	Ulmus sp.
Palms	Slow	Washingtonia sp.

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS
SOIL ANALYSES TERMS

Primary Nutrients

Nitrogen
Nitrogen is essential to plant growth and is usually available in two forms:

a) Nitrate-Nitrogen - D.I. (de-ionized) water extractable
This is a water soluble form of nitrogen which is most readily available to plants but is also vulnerable to leaching.

b) Ammonium Nitrogen - potassium chloride extractable
The ammonium nitrogen found in soil is usually derived from decomposing organic matter and is readily absorbed by plants.

Phosphorus
Phosphorus is essential to plant growth. The sodium bicarbonate method is used to measure the available phosphorus in calcareous soils. The weak Bray is the more appropriate method to measure available phosphorus in soils having a pH of less than 6.

Potassium - Ammonium acetate (exchangeable) and saturated paste (water soluble) extractable.
Potassium is essential to plant growth. Ample levels of exchangeable potassium do not always result in optimum plant uptake. The rate at which exchangeable potassium becomes available to plants is influenced by soil type, pH, temperature and moisture content. The soluble potassium found in a soil is readily available for plant uptake.

Secondary Nutrients

Calcium, Magnesium - Ammonium acetate (exchangeable) and saturated paste (water soluble) extractable.
These elements are essential to plant growth and also influence soil structure. See SAR.

Sodium - Ammonium acetate (exchangeable) and saturated paste (water soluble) extractable.
This element is not generally believed to be essential to plant growth. A high level of sodium in relation to calcium and magnesium will result in poor soil structure. See SAR.

Sulfate - Saturated paste (water soluble) extractable
Sulfur is an essential plant nutrient. Sulfate is a readily available form of sulfur in soil.

Micronutrients

Zinc, Manganese, Iron, Copper - DTPA extractable
These elements are essential to plant growth but are required in very small quantities.

Boron - Saturated paste (water soluble) extractable. A hot water extraction is used in the analysis of soils with very low levels of boron to determine deficiency potential.
Boron is an essential plant nutrient. Boron is required in very small quantities and can also be very toxic when present, even in slightly higher than needed levels.

Chloride - Saturated paste (water soluble) extractable
Chloride is essential to plant growth in quantities ranging from less than 150 ppm (0.015%) to over 1000ppm (0.1%), depending upon specific plant requirements. Actual chloride deficiencies are rare.

Cation Exchange Capacity (CEC)

The CEC is a measure of a soil's capacity to hold the positively charged ions of calcium, magnesium, potassium, sodium and hydrogen. The proper balance (ratio) of these elements has an important impact on soil structure and affects their availability for plant uptake.

Conversion Factors

* 1 acre foot of soil = 4,000,000 (approx.)
* PPM x 4 ~ lbs./acre ft
* Meq/l x eq. wt. = ppm
* SO_4 x 0.33 = S
* P x 2.3 = P_2O_5
* K x 1.2 = K_2O
* NO_3 x 0.23 = N

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FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

August 21, 2001 Lab #: SP 107342-05

Ninyo & Moore
5035 South 33rd St.
Phoenix, AZ 85040

Recommendations for Laveen Area Channel

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.
B. Select only those plants that have a high or greater tolerance to free limestone for planting at this site.
C. Select only those plants that have a high or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil amendments	
a. Organic (well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	25.0 lbs.
	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	0.00 lbs.
b. Phosphorus (P_2O_5)	0.00 lbs.
c. Potassium (K_2O)	0.00 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	0.00 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.00 lbs.
h. Copper (Cu)	.000 lbs.
i. Boron (B)	.000 lbs.

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B. **Tree and Shrub Backfill Mix**

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commercial Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that you periodically add N-pHURIC to the irrigation water to obtain a water pH of 5.0 to facilitate the leaching of Sodium.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	1/2 lb.
Phosphorus	1/2 lb.
Potassium	1/2 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

August 21, 2001

Ninyo & Moore
5035 South 33rd St.
Phoenix, AZ 85040

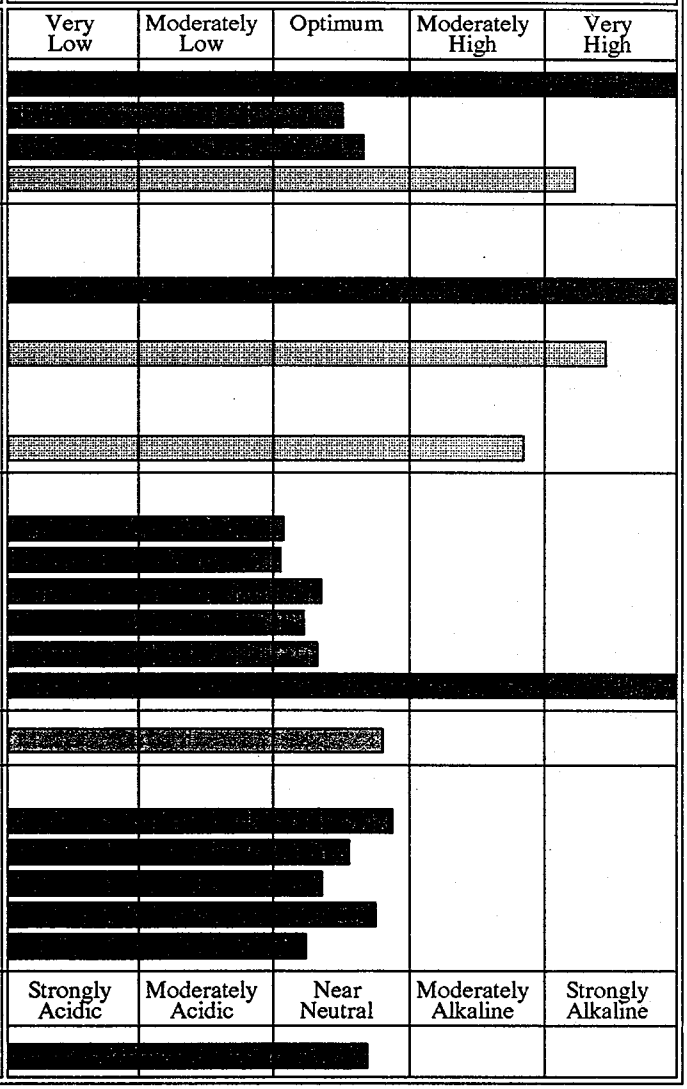
Description : B-6
Project : Laveen Area Channel

Lab ID : SP 107342-05
Customer ID: 2-18569

Sampled On : June 13, 2001
Sampled By : Ninyo & Moore
Received On: August 15, 2001
Depth : 0-5'
Meth. Irrg. : S.S. Sprinklers

LANDSCAPE SOIL ANALYSIS

Test Description	Result		Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	700	PPM	10 - 70
Phosphorus	37	PPM	12 - 60
Potassium (Exch)	360	PPM	81 - 500
Potassium (Sol)	2.7	meq/L	0.25 - 1.0
Secondary Nutrients			
Calcium (Exch)	4700	PPM	---
Calcium (Sol)	178	meq/L	2.0 - 50
Magnesium (Exch)	570	PPM	---
Magnesium (Sol)	80	meq/L	1.5 - 60
Sodium (Exch)	250	PPM	---
Sodium (Sol)	89	meq/L	See SAR
Sulfate	37	meq/L	0.6 - 20
Micro Nutrients			
Zinc	4.9	PPM	0.7 - 50
Manganese	4.6	PPM	1.4 - 50
Iron	41.6	PPM	8.0 - 100
Copper	3.7	PPM	0.2 - 15
Boron	0.9	PPM	0.3 - 2.1
Chloride	185	meq/L	0.1 - 4.0
CEC	30.0	meq/100g	Variable
% Base Saturation			
CEC - Calcium	77.7	%	60 - 80
CEC - Magnesium	15.7	%	10 - 20
CEC - Potassium	3.1	%	2 - 5
CEC - Sodium	3.6	%	0 - 5
CEC - Hydrogen	0.0	%	0 - 3
pH	7.2	---	5.8 - 8.2



Good — Problem

Table continued next page...

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August 21, 2001

Ninyo & Moore

Lab ID : SP 107342-05
Customer ID: 2-18569
Description : B-6

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Optimum Range	Graphical Results Presentation
Others			Satisfactory | Possible Problem | Moderate Problem | Increasing Problem
Soil Salinity	35.0 mmhos/cm	0.5 - 2.0	
SAR	7.8	0.1 - 6	
Limestone	7.7 %	0 - 0.1	
			0 | 1 | 2 | 3 | 4 | 5 | 6
Lime Requirement	0.0 Tons/AF	---	
			Very Low | Moderately Low | Optimum | Moderately High | Very High
Moisture	16.8 %	1/2 Satn. %	
			Loamy Sand | Sandy Loam | Loam | Silt Loam | Clay Loam | Clay | Organic
Saturation	43.8 %	20 - 60	

Good Problem

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

DHN:md

Darrell H. Nelson, President

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

October 23, 2001

Ninyo & Moore
5035 South 33rd Street
Phoenix, Arizona 85040

Subject: **Fertilization Recommendation for Bermuda Grass - Soil Analysis Lab No. SP 107342-06**

The salt content of this soil is very high and will adversely affect the germination of seeded Bermuda grass. Therefore, it is strongly recommended that you leach this soil prior to planting. An application of 200 pounds of gypsum should be made to the surface of this soil prior to making a leaching irrigation. Make certain that the soil is thoroughly leached prior to making the application of the fertilizers recommended below.

It is recommended that you apply the following fertilizer materials and rates for the growing of Bermuda Grass. Note that the recommended amounts of fertilizer is for one year, starting at the time of planting.

1) **Nitrogen** - Apply 40 pounds of Ammonium-Nitrate (33-0-0) per acre or 1.0 pounds per 1,000 square feet every three months.

2) **Phosphorus** - Apply 40 pounds of Ammonium-Phosphate (11-52-0) per acre or 1.0 pounds per 1,000 square feet every three months.

All of the above fertilizer materials should be mixed into the surface four to six inches of soil if possible.

If you have questions, please call or write.

Sincerely,
Fruit Growers Laboratory, Inc.

Darrell H. Nelson
President

DHN:kdm

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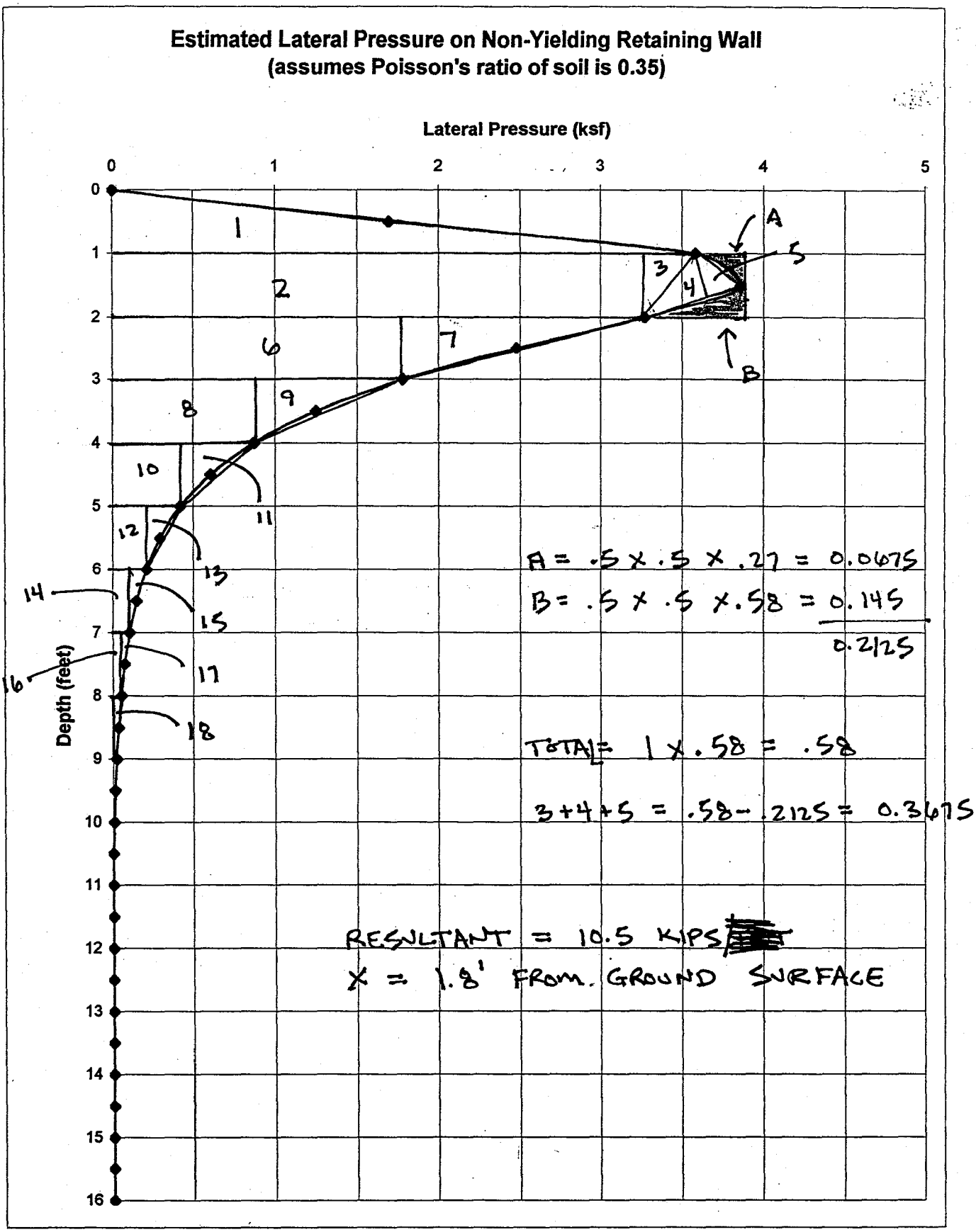
APPENDIX E

HAND CALCULATIONS FOR RETAINING WALL HORIZONTAL FORCES

1- FOOT WIDE STRIP



SDJ.

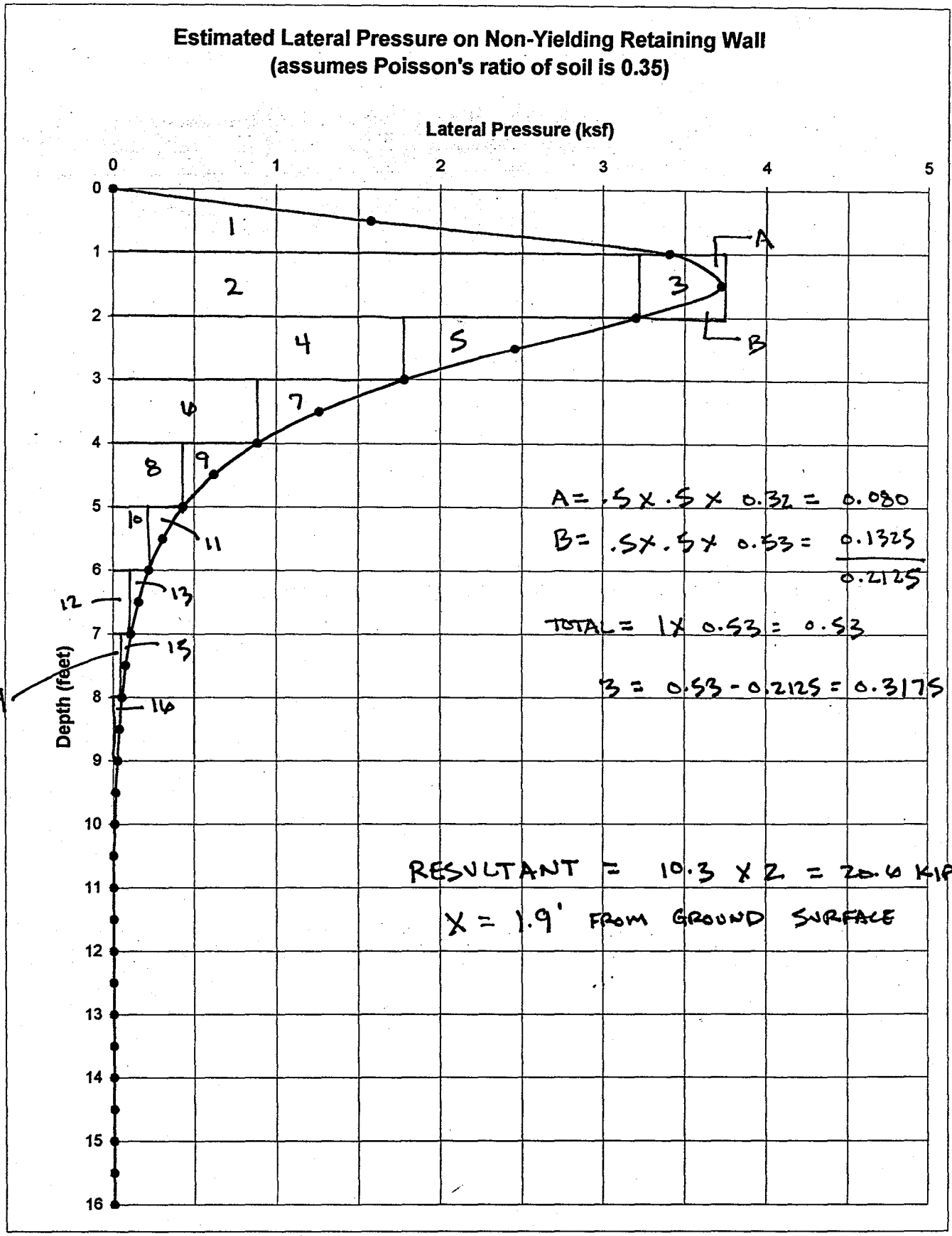
1- FOOT WIDE STRIP

1	.5 x 1 x 3.58	1.79
2	1 x 3.27	3.27
3	.5 x 1 x .31	~~0.155~~
4	.5 x (FROM PLOT)	0.3675
5	.5 x	
6	1 x 1.78	1.78
7	.5 x 1 x 1.49	0.745
8	1 x .87	0.87
9	.5 x 1 x .91	0.455
10	1 x .42	0.42
11	.5 x 1 x .49	0.245
12	1 x .21	0.210
13	.5 x 1 x .21	0.105
14	1 x .104	0.104
15	.5 x 1 x .106	0.053
16	1 x 0.05	0.050
17	.5 x 1 x .056	0.028
18	.5 x 1 x .05	0.025

~~10.57~~ 10.52 KIPS

SDN.

2-FOOT WIDE STRIP



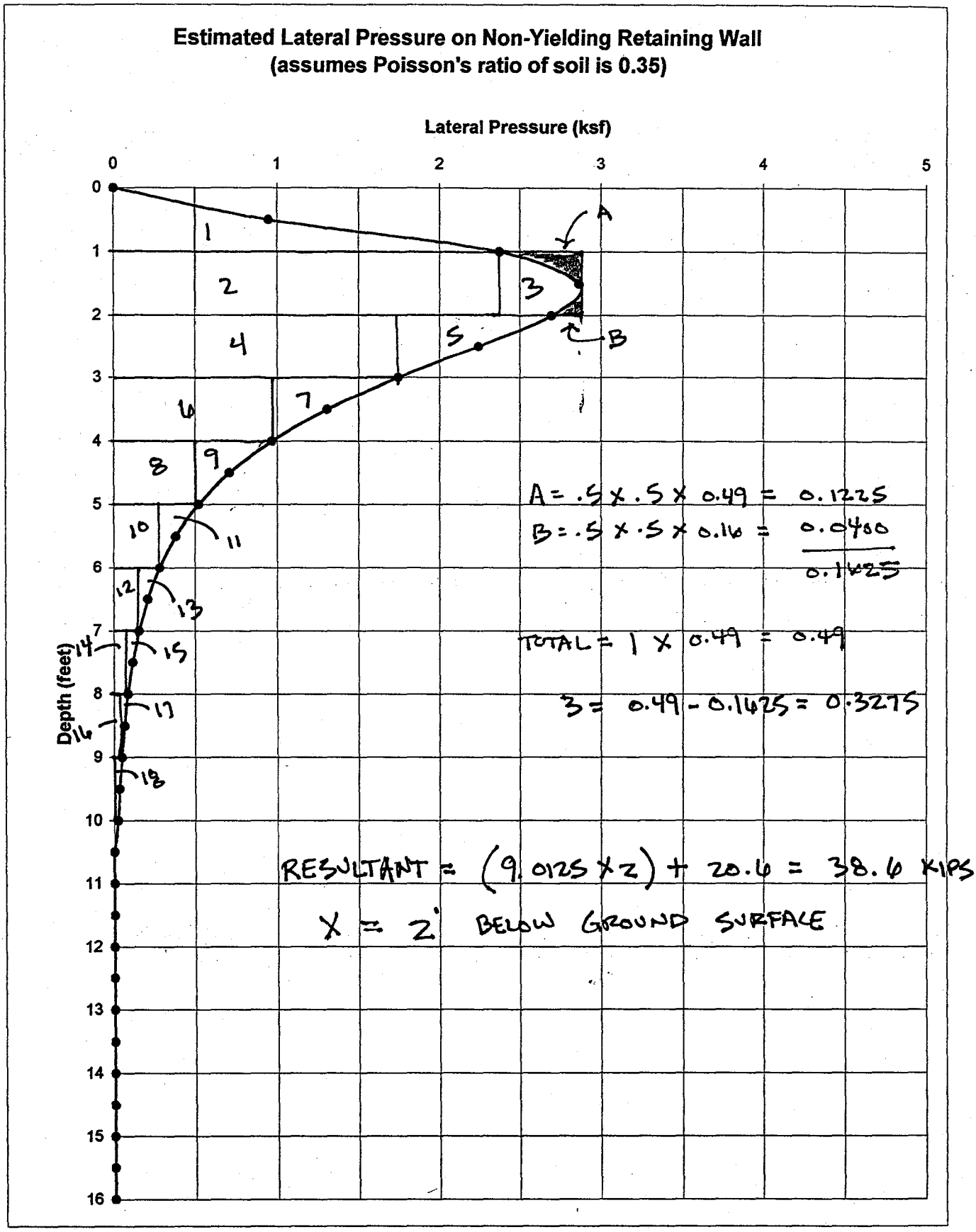
SDN.

2-FOOT WIDE STRIP

1	.5 x 1 x 3.41	1.705
2	1 x 3.20	3.20
3	0.3175	0.3175
4	1 x 1.78	1.78
5	.5 x 1 x 1.42	0.710
6	1 x 0.88	0.88
7	.5 x 1 x 0.90	0.45
8	1 x 0.44	0.44
9	.5 x 1 x .44	0.22
10	1 x .22	0.22
11	.5 x 1 x .22	0.11
12	1 x .11	0.11
13	.5 x 1 x .11	0.055
14	1 x 0.05	0.050
15	.5 x 1 x 0.06	0.030
16	.5 x 1 x 0.05	0.025
1		10.3

SDN.

4 FOOT WIDE STRIP



STDN.

4-FOOT WIDE STRIP

1	.5 x 1 x 2.37	1.185
2	1 x 2.37	2.37
3	.3275	0.3275
4	1 x 1.74	1.74
5	.5 x 1 x 0.96	0.48
6	1 x 0.96	0.96
7	.5 x 1 x 0.78	0.39
8	1 x 0.52	0.52
9	.5 x .$ x 0.44	0.22
10	1 x .28	0.28
11	.5 x .$ x 0.24	0.12
12	1 x .15	0.15
13	.5 x 1 x 0.13	0.065
14	1 x .08	0.08
15	.5 x 1 x 0.07	0.035
16	1 x 0.05	0.05
17	.5 x 1 x 0.03	0.0150
18	.5 x 1 x 0.05	0.0250
		9.0125 ✓
		SDN.