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GEOTECHNICAL/ENVIRONMENTAL/MATERIAL ENGINEERS
11029 N. 24th AVE., SUITE 805 • PHOENIX, ARIZONA 85029 • (602) 997-6391

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: 43rd Avenue Channel
Flood Control Basin

LOCATION: 43rd Avenue & Southern
Phoenix, Arizona

A117.902

SPEEDIE AND ASSOCIATES
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REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: 43rd Avenue Channel Flood Control Basin

LOCATION: 43rd Avenue & Southern Phoenix, Arizona

CLIENT: Maricopa Flood Control District

PROJECT NO: 980172SA

DATE: October 16, 1998

Registered Professional Engineer (Civil)
CERTIFICATE NO. 14388
GREGG ALAN CREASER
Date Signed 10-16-98
ARIZONA U.S.A.

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INTRODUCTION

This report presents the results of a subsoil investigation carried out for the Flood Control District of Maricopa County 43rd Avenue Channel, FCD Project No. 117010. The project includes a Flood Control Detention Basin to be located at the southeast corner of 43rd Avenue and Southern Avenue, and a storm drain to be located in 43rd Avenue from Baseline Road to an outfall north of Broadway Road at the Salt River in Phoenix, Arizona.

Preliminary information calls for the construction of a 20± acre storm water detention basin and about 2 miles of storm sewer pipeline along 43rd Avenue. The basin will be as deep as 25 to 30 feet. Improvements will include a pump station and possible small park area. The pipeline will be located within the 43rd Avenue right of way, flowing north from Baseline Road to the Salt River. It is assumed that the pipeline will be no deeper than 20 feet deep on the southern end to 35 feet deep on the north end. It is assumed that the pump station will be supported in a slab on grade building located outside of the detention basin.

At the time this report was issued, a new pump station was being planned for the area of the northeast corner of 43rd Avenue and Weir. This site will be drilled, and a monitoring well installed when permits are received. An addendum will be issued with the new data and any revisions that may be required to the foundation recommendations for the pump house.

GENERAL SITE AND SOIL CONDITIONS

Site Conditions - The retention basin/pump station is located in a vacant lot area bounded on the north by Southern Avenue, on the south and east by residential property and the west by 43rd Avenue. At the time of the investigation, the site was covered with grasses, weeds and small trees. A small dry wash was noted in the south central portion of the site. There was no indications of previous foundations visible on the surface. The proposed storm drain is located along the 43rd Avenue alignment. The roadway is paved with asphaltic concrete of various widths. The adjacent development includes a mixture of vacant, agricultural, commercial and residential development.

General Subsurface Conditions - Subsoil conditions at the retention basin/pump station site at 43rd Avenue consists of fine sandy to silty clay and fine sandy silt to depths of 7 to 13 feet below grade where it grades into silty sand of various gradations including gravel with some clay lenses noted. At about 16 feet, the gradation turned into sand, gravel and cobbles (SGC) where auger refusal was encountered. A monitoring

well installed in this area using a Becker Hammer rig indicated that the SGC materials extend to at least 35 feet, the termination point of the boring. Standard penetration resistance (SPT) values range from 10 to 50+ blows per foot of penetration.

Subsoils at the boring locations along the pipe line alignment are comprise of fine grained interbedded sandy clays, sandy silts, clayey sands, silty sands, silty and clayey gravels overlying sands, gravels and cobbles of various gradations. The depth to the contact with the cobbly soil is on the order of 15 to 18 feet on the southern end, becoming shallower to the north, generally at a depth greater than 10 feet. All of the pipeline borings were drilled with a Becker Hammer Drill (AP1100) due to the concern about advancing the borings to the prescribed depth in cobbles. The recorded penetration resistance (casing pile driver) values range from 5 to 100+ blows per foot of penetration.

No pipeline borings were advanced to groundwater during this investigation due to the lack of the required ADWR permits. Borings B-9 to B-12 were terminated at the recorded depths of 31 to 34 feet deep at the point were the soils became very moist indicating that the boring was approaching the groundwater surface. The water table was originally encountered at a depth of 35±feet during the drilling of the monitoring well site. A second reading of the monitoring well 6 days after completion indicated a stable water table depth of 27 feet. Based on the ADWR well records reviewed and attached in the appendix of this report, the regional water table is reported to be 35 to 50 feet deep south of Southern Avenue and 30 to 40 feet north of Southern. These reported depths are consistent with the indications in the pipeline borings where the soils become very moist at the level the boring was terminated. This level will likely fluctuate depending on time of year, flows in the Salt River and the effects of draw down on the adjacent wells.

Laboratory testing along the pipeline alignment revealed plasticity indices ranging from "non-plastic" to 12 percent. The fraction finer than the No. 200 sieve ranges from 6 to 93 percent. Laboratory resistivity tests indicated results ranging from 1330 to 4670 ohm-cm in the saturated state and pH values of 8.4 to 9.0. Sulfate contents ranged from 0.11 percent for the surface fine grained soils at the pump station to 0.0037 for the deeper sandy soils The upper clayey subsoils in the retention basin area exhibit a potential for volume increase due to wetting on the order of 3.2 percent when compacted to moistures and densities normally expected during construction. When subjected to an axial pressure of 2,200 lbs/ft^2, an undisturbed sample exhibited additional strain on the order of 2.5 percent when inundated.

ANALYSIS AND RECOMMENDATIONS

General

The shallow groundwater will be a factor that needs to be addressed in the design and construction of the basin and pipeline. For preliminary analysis, it is recommended that a current static level of 27 to 30 feet below grade be used. As the well data indicates, it appears that this water table may be under a slight pressure as the table rose after penetrating the water surface. This may result in unstable excavations as they approach the water table. The water table will likely fluctuate over time and may rise above the current levels as the area is developed and the amount of groundwater pumping is reduced. Flows in the Salt River may also have an impact on water levels, especially along the pipeline close to the outfall. Depending on the depth of the pipeline north of Southern Avenue, groundwater may be encountered. It may be possible to control the water in trenches and/or excavations by simple pumping and/or allowing it to drain through the pipe and/or trench back to the River (assuming that the flowline is above the current River water level). A detailed ground water hydrology study would be required to estimate what those future water levels may be and quantities of water that may be generated during construction.

PIPELINE ANALYSIS

Soil Corrosion - Laboratory resistivity tests indicated results ranging from 1330 to 4670 ohm-cm in the saturated state and pH values of 8.4 to 9.0. Sulfate contents ranged from 0.11 percent for the surface fine grained soils at the pump station to 0.0037 for the deeper sandy soils This reflects a moderate to severe degree of corrosiveness in a saturated state. Accordingly, suitable pipe wall thickness and corrosion protection should be selected per the trench/traffic load and lifetime requirements of the project. Type II cement will be adequate for concrete in contact with the ground.

Excavation - The presence of non and or low cohesive soils and cobbles at the depths encountered will result in unstable trench concerns. This in-ability to hold a vertical cut and proper bottom shape were these materials are encountered will make cast-in-place concrete pipe not feasible. These cobbles may also result in the need to require bedding under the pipe to prevent cobbles from inflicting point loads and injury to the pipe. Bedding should be selected per the requirements of the pipe materials used and the trench loading conditions.

All excavations should be braced and/or shored in accordance with all current governmental guidelines. Each section should be addressed by the responsible general and/or excavating contractor for

establishing safe cut slopes in accordance with current OSHA guidelines. Based on the types of soils encountered in the borings, the upper fine grained soils (Type B) would need to be sloped at 1:1 and the lower granular soils (Type C) would need to be sloped at 1½:1. Cuts deeper than 20 feet and/or bracing would have to be designed by a professional engineer. The fact that a boring was advanced to a particular depth should not lead to the assumption that it is necessarily excavatable by conventional means. Very dense and/or cemented conditions may require more aggressive removal techniques. The presence of very dense conditions and cobbles (and possible small boulders) may impede progress and the ability to cut neat trenches.

The non-cohesive soils will likely not be suitable for temporary support systems such as Soil Nailing. Other systems such as a braced soldier beam and lagging system may be better suited for these conditions. This system consists of drilled shaft caissons with steel I- beam grouted into place with wood lagging installed as the excavation continues.

PUMP STATION ANALYSIS

Analysis - While the exact configuration of the structure is unknown at this time, it is assumed that the structure will be a slab on grade, masonry wall building. An alternate recommendation is provided in the event that there is a below grade wet well vault supporting a structure above. Analysis of the field and laboratory data indicates that the shallow subsoils at the pump station site are generally favorable for the support of the proposed structure subject to remedial earthwork. Test results indicate that the shallow soils are sensitive to moisture increases which could result in excessive settlement should the bearing soils become wet. Accordingly, recommendations are made to over-excavate and re-compact the bearing soils to a depth of 2+ feet below the proposed bottom of footing elevation or existing grade, whichever is deeper. Any screen walls or other minor structure not connected to the pump house may be founded on the shallow soils at reduced bearing capacity with increased risk for settlement.

Excavation for a wet well structure would likely extend to depths greater than 20 feet below grade which will terminate within the very dense silty sand and/or gravely soil. It was not possible to auger drill to the prescribed depth. In order to advance the well to the prescribed depth, it was necessary to use special drilling equipment. This granular zone typically continues as heavy granular material of various gradations with some thin fine grained deposits possible. It is not expected to have any substantial clay deposits that would have a negative impact on the type of structure proposed. The excavation should be examined during construction to ensure the exposed soils are as assumed for the recommendations presented herein.

The clayey surface soils exhibit a swell potential. The potential is usually strong enough to cause differential movements of any surface slabs-on-grade such as floors and sidewalks but not enough to cause damage to structures. Accordingly, attention must be paid to provide proper drainage to limit the potential for water infiltrating under slabs. A minimum slope of at least 5 percent for a distance of 10 feet is recommended for unpaved landscaped areas. Typical recommendations to reduce the swell potential include reducing the compaction requirements and requiring higher moisture contents during pad preparation and/or requiring at least one foot of non-expansive material to be placed directly beneath the building slabs and slabs contiguous to the structure such as sidewalks. The site-available low and non-plastic soils that will be generated during excavation of the retention basin can be used in this regard.

For exterior slabs on grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of outswinging doors. Pinning typically consists of 24 inch long No. 4 reinforcing steel dowels placed at 12 inch centers.

Site Preparation - The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Additional material should be removed to provide space for the required 12 inches of non-expansive under slab fill.

If grading plans require placing structural fill below footing bottom elevation, the exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum ($\pm$2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

All cut areas and areas above footing bottom elevation that are to receive only floor slab fill should be scarified 8 inches, moisture-conditioned to optimum and uniformly compacted to 95 percent of maximum dry density as determined by ASTM D-698. Areas that expose clayey soils (CL or SC classification should be scarified 8 inches, moisture-conditioned to at least optimum to 3 percent above optimum and lightly but uniformly compacted to at least 90 but not more than 95 percent of maximum dry density.

Foundation Design - It is recommended that the pump station wet well structure be founded on a pad/mat foundation bearing on undisturbed native dense granular soil at 20+ feet below existing grade. The surface pump station building not supported by the wet well may be supported on shallow spread foundations bearing on at least 30 inches (24 inches of fill and 6$\pm$ inches pre-compacted subgrade) at minimum depth

below lowest adjacent grade. Screen walls and/or any other minor surface structures may be founded on the native soils at reduced bearing capacity. The following allowable bearing capacities are available for design:

Recommended Allowable Bearing Capacities

Location	Bearing Medium	Bearing Depth, ft	Bearing Capacity, psf
Pump Station Wet Well	Very Dense Silty Gravel	2.0(1)	6,000
Pump Station	2.5 ft. Engineered Fill	1.5(2)	2,500
Minor Structures	Native Sandy Silt/Clay	1.5(3)	1,500

Notes:

1. Bearing Depth refers to depth below pump station base slab level at 20+ feet below grade
2. Bearing Depth refers to depth below lowest adjacent grade within 5 feet of foundation element bearing on at least 2.5 feet (2.0 ft. fill + 6 in. compacted subgrade) of engineered fill.
3. Bearing Depth refers to depth below lowest adjacent grade within 5 feet of foundation element bearing on undisturbed native soil.

These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from the proposed structure **must** be maintained at all times.

Estimated settlements under design loads are on the order of ½ to ¾-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude (or greater for footings bearing on fine grained native soils) could occur if native supporting soils were to experience a significant increase in moisture content. Positive drainage away from structures, and controlled routing of roof runoff **must** be provided to prevent ponding adjacent to perimeter walls. Planters requiring heavy watering should be considered with caution. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these

movements. Reinforcement and frequent control joints are suggested to allow slight movement and prevent minor floor slab cracking.

Lateral Pressures - The following lateral pressure values may be utilized for the proposed construction:

Active Pressure	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressure	
Continuous Footings	350 pcf
Spread Footings or Drilled Piers	400 pcf
Coefficient of Friction (With Passive Pressure)	0.35
Coefficient of Friction (Without Passive Pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive native soils should not be used as wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

Fill And Backfill - Clayey native soils (with Unified Soil Classification of CL or SC) are considered suitable for use in general grading fills but should **not** be used in the top foot of pad fill (in the case of slabs-on-grade for surface structures) or as wall backfill. The top foot should be completed with an approved low or non-expansive soil, either selectively used on-site soils or import. Import can be common borrow (as specified below) or select granular soil. If select is used, the 4 inches of under slab A.B.C. may be included as part of the 12 inches. Otherwise, a full 12 inches of common borrow should be used in addition to the normal 4 inches of A.B.C.

Well graded granular soils are recommended for wall backfill in the saturated zone. If native soils are to be used for wall backfill (as opposed to importing granular soil) above that level, low to non-plastic soils such as the silty sands and gravels should be selectively stockpiled for use in this regard. Maximum particle size should not exceed 3 inches. The upper 24 inches of wall backfill may consist of the clayey soils act as a barrier to surface water infiltration.

Successful backfill of sub-surface walls is difficult to achieve given the tight access. The cleaner sandy soils located in the intermediate zone or well graded granular import should be specified for all below- grade wall backfill. Placement and compaction must be carefully controlled in order to minimize the potential for post construction settlement should the backfill zone be subjected to water infiltration. Even the most well controlled fills could experience additional settlement on the order of 1 inch if subjected to significant moisture increases. Accordingly, consideration should be given to constructing a structural slab over the backfill zone in the most critical areas or reinforce and pin the landing/entry slabs to the building stem wall to span over the backfill zone. This will reduce the potential for the exterior slab dropping and creating a tripping hazard.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ± 2 percent (optimum to $+3$ percent for underslab fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas		
	1.	Below footing level	95
	2.	Below slabs-on-grade (non-expansive soils)	95
	3.	Below slabs-on-grade (expansive native soils)	90 - 95 (max)
B.	Utility Trench Backfill		
	1.	More than 2.0' below finish S/G	90
	2.	Within 2.0' of finish S/G	95
C.	Aggregate Base Course		
	1.	Below floor slabs	95

D. Landscape Areas

1.	Miscellaneous fill	90
2.	Utility trench - more than 1.0' below F/G	85
3.	Utility trench - within 1.0' of F/G	90

Utilities Installation - Trench excavations for shallow utilities can be accomplished by conventional trenching equipment although very dense soils and cobbles (and possibly boulders) may impede progress and could require the use of heavier equipment. Trench walls may stand near-vertical for the short periods of time required to install utilities although some sloughing may occur in looser and/or sandy soils necessitating laying back of side slopes and/or shoring (see above). Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches may be carried out with native excavated material (<3 inches in size). This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

Slabs-On-Grade - To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for Aggregate Base Course (A.B.C.) as per M.A.G. Specification Section 702 should be utilized beneath slabs-on-grade near the surface. Dried subgrade soils **must** be re-moistened prior to placing the A.B.C. if allowed to dry out.

A Modulus of Subgrade Reaction, k, of 250 pci. may be used for design of the pump station base slab.

GENERAL

The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a Soils Engineer monitor the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,

SPEEDIE & ASSOCIATES, INC.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 10-16-98
ARIZONA, U.S.A.

Gregg A. Creaser, P.E.

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LOG LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CONSOLIDATION TEST DATA

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

pH & RESISTIVITY TEST DATA

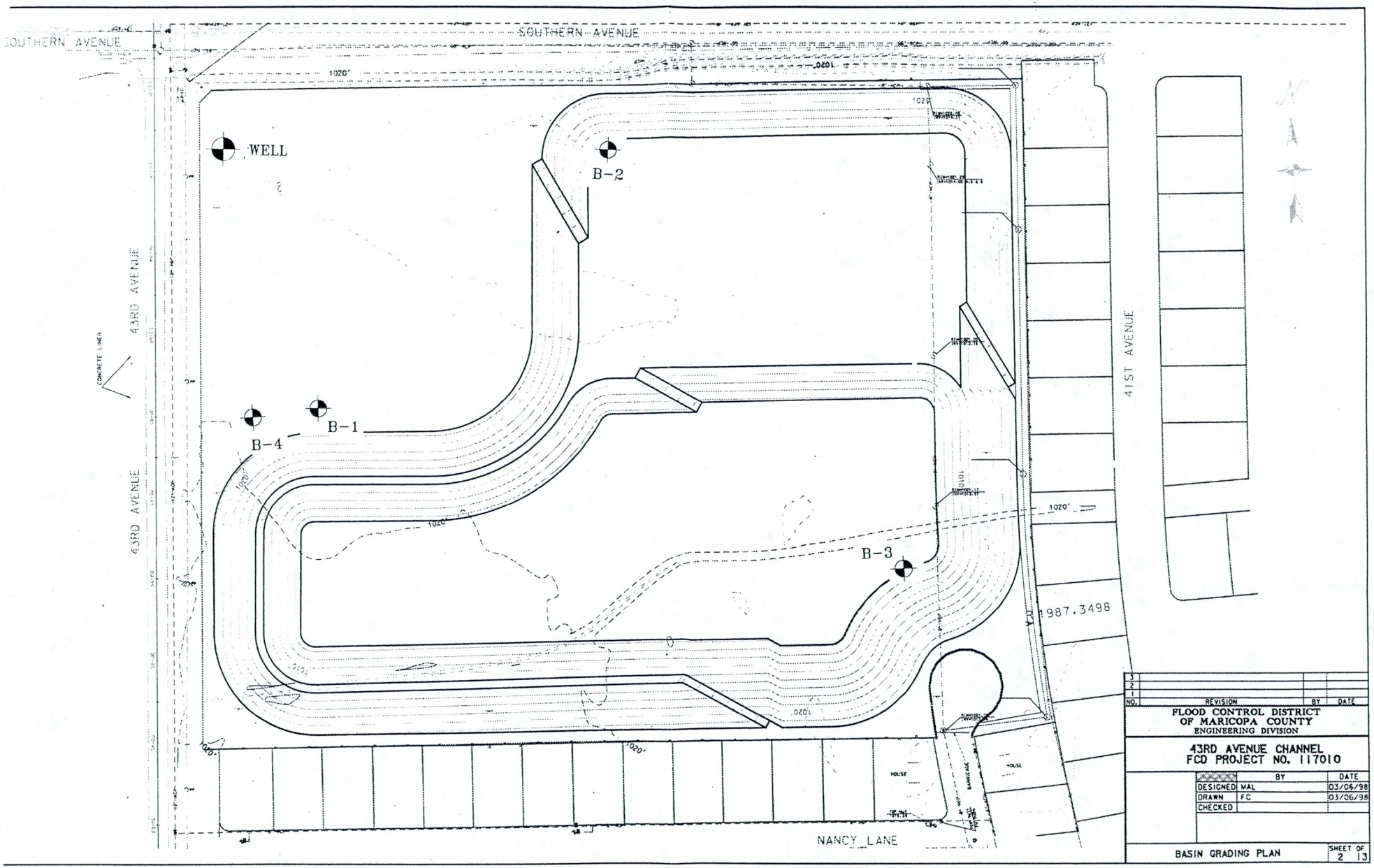
SOIL CHEMISTRY DATA

WELL DATA

FIELD AND LABORATORY INVESTIGATION

On March 12, 1998, a total of three soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our soils technician, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-55 drill rig utilizing 7-inch diameter hollow stem flight augers. On March 25, 1998, we returned to the site to attempt to deepen the borings with a truck-mounted CME-75HD drill rig utilizing 7-inch diameter hollow stem flight augers. Auger refusal was again met at shallow depth. On May 11 and 12, 1998, a total of nine soil test borings were drilled in 43rd Avenue and the well site with a truck-mounted AP1100 Becker Hammer drill using air to return cutting to the surface. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and design parameters. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Laboratory resistivity, pH and sulfate tests were also conducted for corrosivity analysis. All field and laboratory data are presented in this appendix.



- Approximate Soil Boring Locations

SOIL BORING LOCATION PLAN

Flood Detention Basin
SEC 43rd Ave. & Southern Ave.
Phoenix, Arizona

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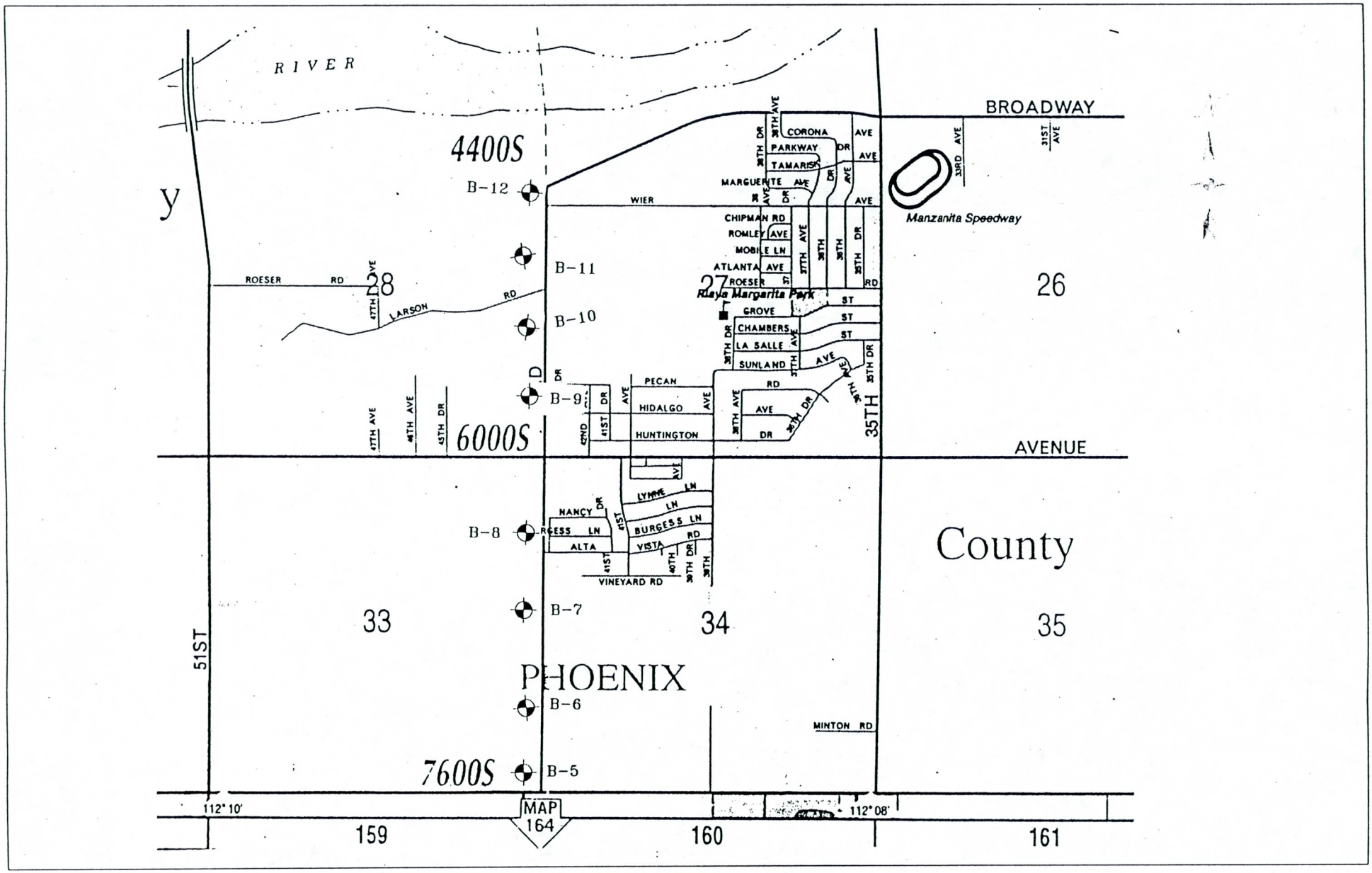
DR:	KRG	CHK:	GAC	REV:	KRG	DATE:	05-28-98	Project No. 980172SA



⊕ – Approximate Soil Boring Locations

SOIL BORING LOCATION PLAN

43th Ave. Storm Drain
43rd Ave. Baseline to Broadway
Phoenix, Arizona

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DR:	CHK:	REV:	DATE:	Project No.
KRG	GAC	KRG	05-28-98	980172SA

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Very Stiff to Stiff Brown SANDY SILT (ML-Moist)	RS-1	2.0	9.4	101.7	
5	Weak Calcareous Cementation	S-2	6.0	--	--	
10		S-3	11.0	--	--	
12.5	Very Dense Brown WELL GRADED SAND (SW-Moist) with Little Gravel	S-4	15.5	--	--	65/12"
15						
17.0	Auger Refusal on Cobbles					
20						
25						
30						
35						

Boring Date: 3-12-98
Field Engineer/Technician: K.Gravel
Driller: B. Freeman
Contractor: Heber Mining

Water Level

Depth	Hour	Date
Dry		

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Log of Test Boring Number: B- 1

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: 980172SA

Rig Type: **CME-55**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Very Stiff Brown SANDY CLAY (CL-Moist) with Weak Calcareous Cementation	RS-1	2.0	12.9	85.7	
3.0	Stiff Brown SANDY SILT (ML-Moist) with Weak Calcareous Cementation	BS-2	4.5	--	--	
5		S-3	6.0	--	--	
10		S-4	11.0	--	--	
11.5	Very Dense Brown SILTY SAND (SM-Moist) With Little Gravel	S-5	15.0	--	--	50/6"
15						
16.0	Auger Refusal on Cobbles					
20						
25						
30						
35						

Boring Date: **3-12-98**
Field Engineer/Technician: **K.Gravel**
Driller: **B. Freeman**
Contractor: **Heber Mining**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 2**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

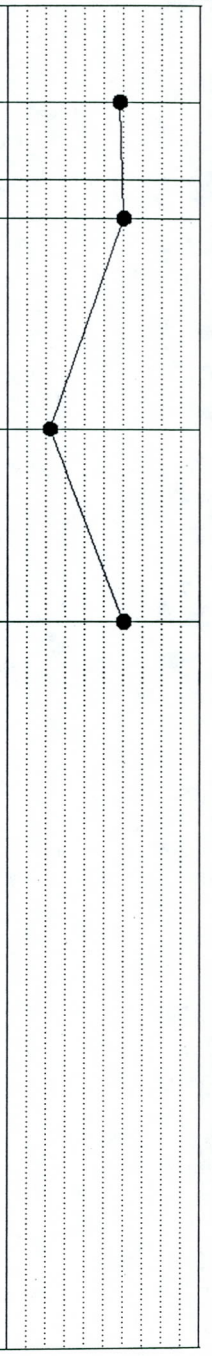
Project No.: **980172SA**

Rig Type: **CME-55**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Very Stiff Brown SANDY CLAY SILTY CLAY (ML/CL-Moist) with Weak Calcareous Cementation	S-1	2.5	--	--
		BS-2	4.5	--	--
5		RS-3	5.5	--	--
	7.0				
	Medium Dense Brown SILTY SAND (SM-Moist) with Fine Layers of Clay				
10		S-4	11.0	--	--
	with Little Gravel				
15		S-5	16.0	--	--
	17.0				
	Auger Refusal on Cobbles				
20					
25					
30					
35					

Graphic Log

Penetration Resistance Blows per Foot (0, 25, 50)



Boring Date: **3-12-98**
Field Engineer/Technician: **K.Gravel**
Driller: **B. Freeman**
Contractor: **Heber Mining**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 3**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: CME-75
Boring Type: Hollow Stem Auger
Surface Elevation: N/A

Depth (feet)	Graphic Log	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Brown SILTY SAND (SM-Dry)					
5							
10							
15		15.0 Brown WELL GRADED SAND (SW-Dry) with Trace Cobbles					
20							
		21.9 Auger Refusal on Cobbles					
25							
30							
35							

Boring Date: 3-25-98
Field Engineer/Technician: K. Gravel
Driller: J. Carter
Contractor: Heber Mining

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 4

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: 980172SA

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 12+50 L 20

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Firm Brown SANDY SILTY CLAY (CL/ML-Dry)		2.0	--	--	
			4.0	--	--	
5	5.0		6.0	--	--	
	Medium Dense to Very Dense Brown SILTY SAND (SM-Dry)		8.0	--	--	
10	Trace Gravel		10.0	--	--	59/12"
			12.0	--	--	
			14.0	--	--	
15	Layer of Silty Sand		16.0	--	--	
	Strong Calcareous Cementation		18.0	--	--	
	18.5					
20	Very Dense Brown SILTY SAND (SM-Moist) with Little Gravel and Cobbles size Calcareous Cementation Nodules		20.0	--	--	
			22.0	--	--	
			24.0	--	--	
25	25.0 End of Boring	BS-1	25.0	--	--	
30						
35						

Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 5**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 24+00 L 20

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Firm Brown SANDY SILT (ML-Dry)		2.0	--	--	
			4.0	--	--	
5			6.0	--	--	
6.5	Medium Dense Brown SILTY SAND (SM-Dry) with Little Gravel		8.0	--	--	
9.0	Medium to Very Dense Brown SILTY GRAVEL (GM-Dry) with Little Sand & Trace Cobbles		10.0	--	--	
10			12.0	--	--	
	Little Cobbles		14.0	--	--	
15			16.0	--	--	
	Some Cobbles		18.0	--	--	
20			20.0	--	--	80/12"
			22.0	--	--	
			24.0	--	--	
25.0	End of Boring	BS-1	25.0	--	--	
30						
35						

Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 6**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 35+00 L 20

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Stiff Brown SANDY CLAY (CL-Dry)		2.0	--	--	
			4.0	--	--	
5.0	Very Stiff Brown SANDY SILT (ML-Dry) with Trace Gravel		6.0	--	--	
			8.0	--	--	
			10.0	--	--	
12.0	Medium Dense Brown SILTY FINE SAND (SP-Moist) with Trace Gravel and Trace Cobbles		12.0	--	--	
			14.0	--	--	
			16.0	--	--	
			18.0	--	--	
			20.0	--	--	
20.5	Dense to Very Dense Brown SILTY GRAVEL (GM-Dry) with Trace Cobbles		22.0	--	--	102/12"
			24.0	--	--	54/12"
25.0	End of Boring	BS-1	25.0	--	--	

Penetration Resistance: 0 – 25 – 50

Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 7**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: Becker AP1100
Boring Type: Air Compressed
Surface Elevation: N/A
Station: 51+50 L 20

Depth (feet)	Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Firm Brown SANDY SILT (ML-Dry)			2.0	--	--
				4.0	--	--
5				6.0	--	--
		6.5		8.0	--	--
	Medium Dense Brown SILTY SAND (SM-Dry) with Trace Gravel			10.0	--	--
10	with Little Gravel			12.0	--	--
		14.0		14.0	--	--
15	Medium Dense to Dense Brown SILTY GRAVEL (GM-Dry) with Little Sand & Trace Cobbles			16.0	--	--
				18.0	--	--
20		20.0		20.0	--	--
	Medium Dense Brown SILTY FINE SAND (SM-Dry) with Little Gravel & Trace Cobbles			22.0	--	--
				24.0	--	--
25	End of Boring	25.0	BS-1	25.0	--	--
30						
35						

Penetration Resistance Blows per Foot (0, 25, 50)

Boring Date: 5-12-98
Field Engineer/Technician: K. Gravel
Driller: B. Mouis
Contractor: Layne Enviro.

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 8

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: 980172SA

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 71+00 L 20

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Very Stiff Brown SANDY SILT (ML-Dry) with Trace Gravel		2.0	--	--	
			4.0	--	--	
5			6.0	--	--	
6.0	Dense Brown SILTY FINE SAND (SP-Dry) with Some Gravel		8.0	--	--	
10.0			10.0	--	--	
10	Dense to Very Dense Brown SANDY SILTY GRAVEL (GM-Dry) with Trace Cobbles		12.0	--	--	
13.0	Medium Dense Brown SILTY FINE SAND (SM-Dry) with Little Gravel		14.0	--	--	
15			16.0	--	--	
18.0			18.0	--	--	
20	Medium to Very Dense Brown Interbedded SILTY GRAVEL/SILTY SAND (GM/SM-Dry to Moist)		20.0	--	--	
			22.0	--	--	
			24.0	--	--	
25			26.0	--	--	
	with Little Cobbles		28.0	--	--	78/12"
			30.0	--	--	
30		BS-1	31.0	--	--	
31.0	End of Boring					
35						

Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 9**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 80 + 70 L20

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Firm to Hard Brown SANDY SILT (ML-Dry) with Little Gravel		2.0	--	--	
			4.0	--	--	
5			6.0	--	--	
			8.0	--	--	
10		BS-1	10.0	--	--	
12.0			12.0	--	--	
	Dense to Very Dense Brown SILTY GRAVEL (GM-Dry) with Little Sand & Cobbles		14.0	--	--	77/12"
15			16.0	--	--	52/12"
			18.0	--	--	53/12"
20			20.0	--	--	
22.0			22.0	--	--	
	Medium to Very Dense Brown WELL GRADED GRAVEL (GW-Moist)		24.0	--	--	
25			26.0	--	--	59/12"
27.0			28.0	--	--	
	Very Dense Brown SILTY GRAVEL (GM-Moist) with Little Cobbles		30.0	--	--	
30			32.0	--	--	92/12"
34.0		BS-2	34.0	--	--	68/12"
35	End of Boring					

Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-10**

Storm Water Detention Basin

43th Ave. & Southern SEC

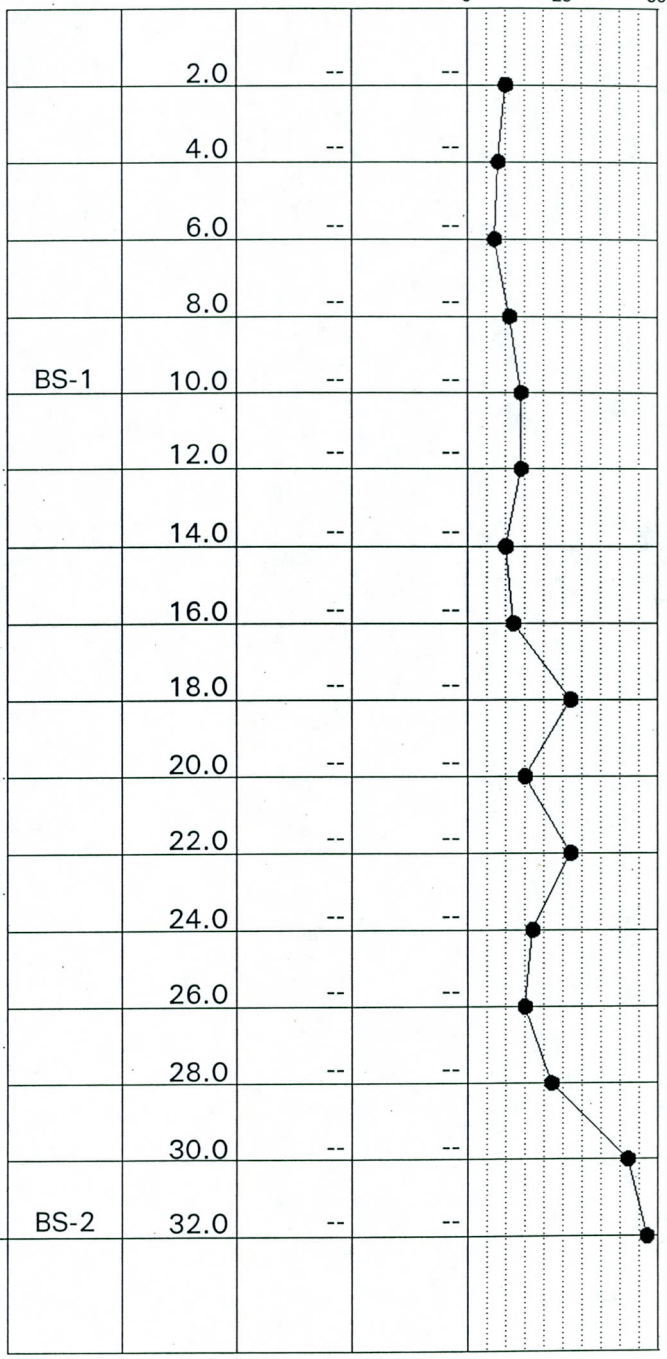
Arizona, Phoenix

Project No.: **980172SA**

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 92+00 L 24

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Firm to Hard Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel		2.0	--	--
			4.0	--	--
5			6.0	--	--
			8.0	--	--
10		BS-1	10.0	--	--
12.0			12.0	--	--
	Medium Dense Brown SILTY SAND (SM-Dry) with Little Gravel & Trace Cobbles		14.0	--	--
15			16.0	--	--
			18.0	--	--
20.0			20.0	--	--
	Dense Brown SILTY GRAVEL (GM-Dry)		22.0	--	--
23.0					
	Medium Dense Brown SILTY SAND (SM-Dry) with Little Gravel & Trace Cobbles		24.0	--	--
25			26.0	--	--
27.0					
	Dense Brown SILTY GRAVEL (GM-Moist) with Little Cobbles		28.0	--	--
30			30.0	--	--
32.0	End of Boring	BS-2	32.0	--	--
35					

Penetration Resistance Blows per Foot (0, 25, 50)



Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-11**

Storm Water Detention Basin

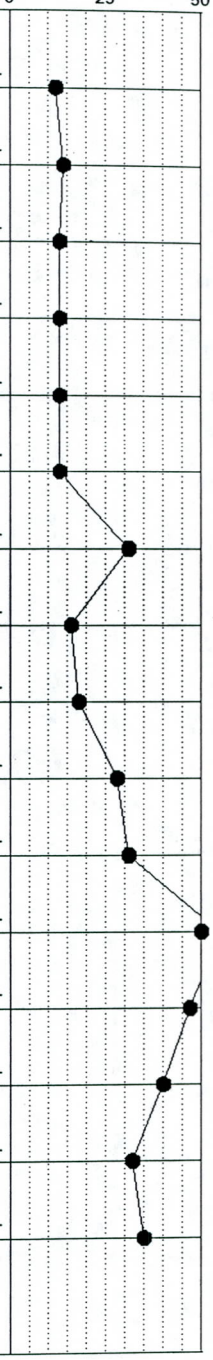
43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: **Becker AP1100**
Boring Type: **Air Compressed**
Surface Elevation: **N/A**
Station: 102+50 L 18

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Medium Dense Brown SILTY FINE SAND (SP-Dry) with Trace Gravel		2.0	--	--
			4.0	--	--
5			6.0	--	--
			8.0	--	--
9.0	Medium Dense Brown SILTY SAND (SM-Dry)	BS-1	10.0	--	--
10			12.0	--	--
13.0	Medium Dense Brown SANDY SILTY GRAVEL (GM-Dry)		14.0	--	--
15			16.0	--	--
	Trace Cobbles		18.0	--	--
20		BS-2	20.0	--	--
22.0	Dense Brown SANDY COARSE GRAVEL (GW-Moist) with Trace to Little Cobbles		22.0	--	--
25			24.0	--	--
			26.0	--	--
			28.0	--	--
30			30.0	--	--
32.0	End of Boring	BS-3	32.0	--	--
35					



Boring Date: **5-12-98**
Field Engineer/Technician: **K. Gravel**
Driller: **B. Mouis**
Contractor: **Layne Enviro.**

Water Level

Depth	Hour	Date
Dry		

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-12**

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: **980172SA**

Rig Type: Becker AP1100
Boring Type: Air Compressed
Surface Elevation: N/A
Station: 61+40, R 50

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Brown SILTY FINE SAND (SM-Dry) with Trace Gravel		2.0	--	--	
			4.0	--	--	
5			6.0	--	--	
			8.0	--	--	
10			10.0	--	--	
			12.0	--	--	
			14.0	--	--	
15	Trace Cobbles 15.0		16.0	--	--	64/12"
	Brown SANDY SILTY GRAVEL (GM-Dry) with Little Cobbles		18.0	--	--	
20			20.0	--	--	
			22.0	--	--	
			24.0	--	--	82/12"
25			26.0	--	--	88/12"
			28.0	--	--	70/12"
30	29.5		30.0	--	--	
	Brown SILTY GRAVEL (GM-Moist to Wet) with Little Sand		32.0	--	--	
			34.0	--	--	57/12"
35	35.0					

Penetration Resistance Blows per Foot: 0, 25, 50

Boring Date: 5-12-98
Field Engineer/Technician: K. Gravel
Driller: B. Mouis
Contractor: Layne Enviro.

Water Level

Depth	Hour	Date
35'	10:00 am	5-12-98
27'	2:30 pm	5-18-98

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: WELL

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: 980172SA

Depth (feet)	Graphic Log	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
35		End of Boring					
40							
45							
50							
55							
60							
65							
70							

Rig Type: Becker AP1100
Boring Type: Air Compressed
Surface Elevation: N/A
Station: 61+40, R 50

Boring Date: 5-12-98
Field Engineer/Technician: K. Gravel
Driller: B. Mouis
Contractor: Layne Enviro.

Water Level

Depth	Hour	Date
35'	10:00 am	5-12-98
27'	2:30 pm	5-18-98

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: WELL

Storm Water Detention Basin

43th Ave. & Southern SEC

Arizona, Phoenix

Project No.: 980172SA

TABULATION OF TEST DATA

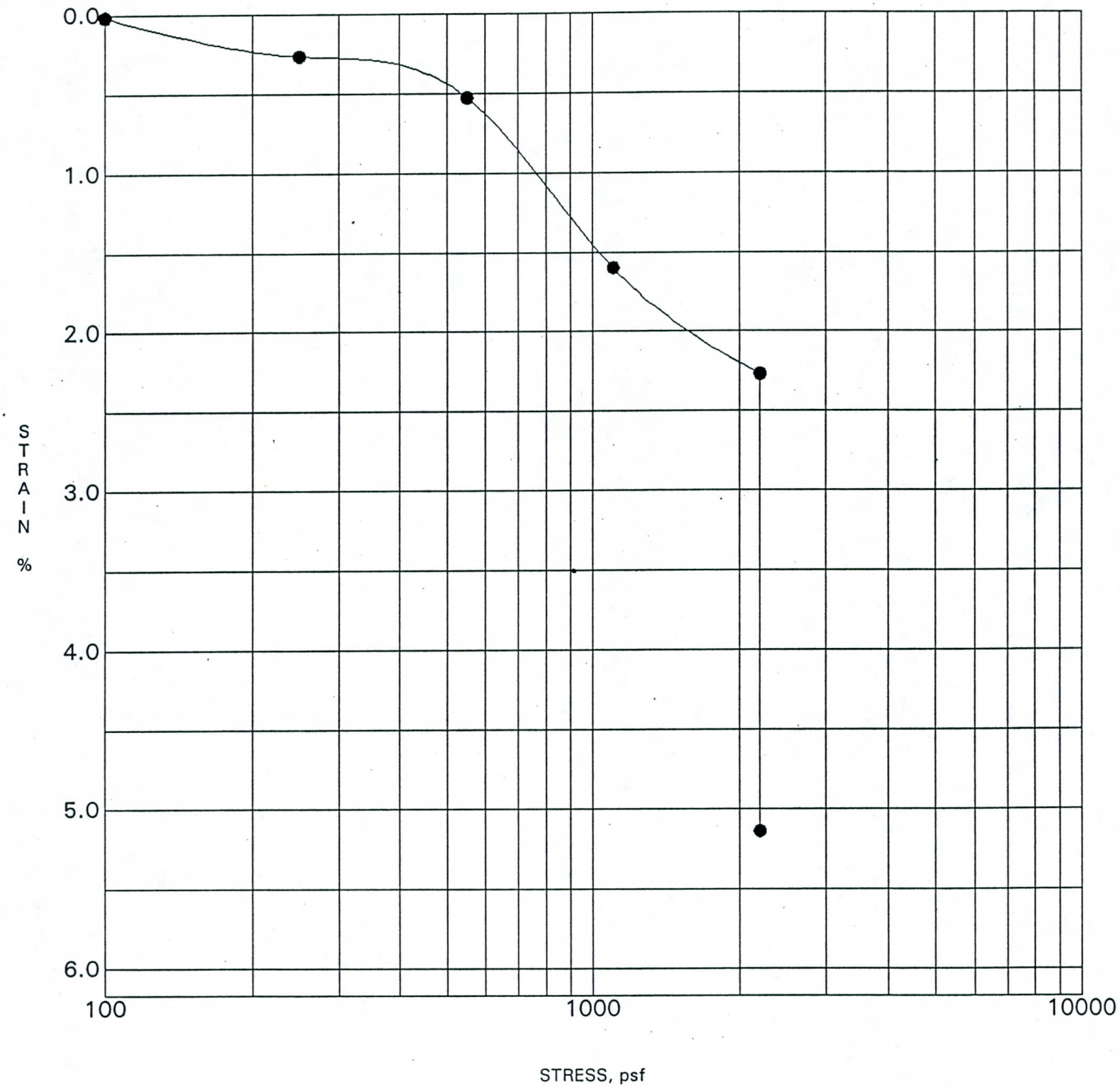
SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	DEPTH OF SAMPLE TIP	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B- 1	RS-1	RS	2.0	9.4	101.7	85.9	99	100	100	100	23	23	NP	ML	SILT
B- 2	RS-1	RS	2.0	12.9	85.7	93.3	100	100	100	100	33	21	12	CL	LEAN CLAY
B- 3	BS-2	BULK	4.5	--	--	69.2	94	98	99	100	24	20	4	CL-ML	SANDY SILTY CLAY
B- 3	S-5	SPT	16.0	--	--	30.3	56	64	70	100	22	20	2	SM	SILTY SAND with GRAVEL
B- 5	BS-1	BULK	25.0	--	--	45.4	68	77	80	100	26	25	1	SM	SILTY SAND with GRAVEL
B- 6	BS-1	BULK	25.0	--	--	8.1	31	55	61	100	NP	NP	NP	SP-SM	POORLY GRADED SAND with SILT and GRAVEL
B- 7	BS-1	BULK	25.0	--	--	30.1	60	77	80	100	NP	NP	NP	SM	SILTY SAND with GRAVEL
B- 8	BS-1	BULK	25.0	--	--	5.7	28	53	55	100	NP	NP	NP	SP-SM	POORLY GRADED SAND with SILT and GRAVEL
B- 9	BS-1	BULK	31.0	--	--	12.4	43	74	77	100	NP	NP	NP	SP-SM	POORLY GRADED SAND with SILT and GRAVEL
B-10	BS-1	BULK	10.0	--	--	63.2	96	97	98	100	21	21	NP	ML	SANDY SILT
B-11	BS-1	BULK	10.0	--	--	51.7	82	91	93	100	27	19	8	CL	SANDY LEAN CLAY
B-12	BS-1	BULK	10.0	--	--	19.2	95	100	100	100	NP	NP	NP	SM	SILTY SAND

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

Storm Water Detention Basin
43th Ave. & Southern SEC
Arizona, Phoenix
Project No. 980172SA

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST



BORING B- 2

SAMPLE No. RS-1

Sample inundated at end of test at 2200 psf

PROJECT	Flood Detention Basin - 43rd Ave & Southern SEC	JOB NO.	980172SA
		DATE	3/12/98

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Flood Detention Basin

PROJECT NO.: 980172SA

LOCATION: 43rd Ave & Southern SEC

DATE: 3/12/98

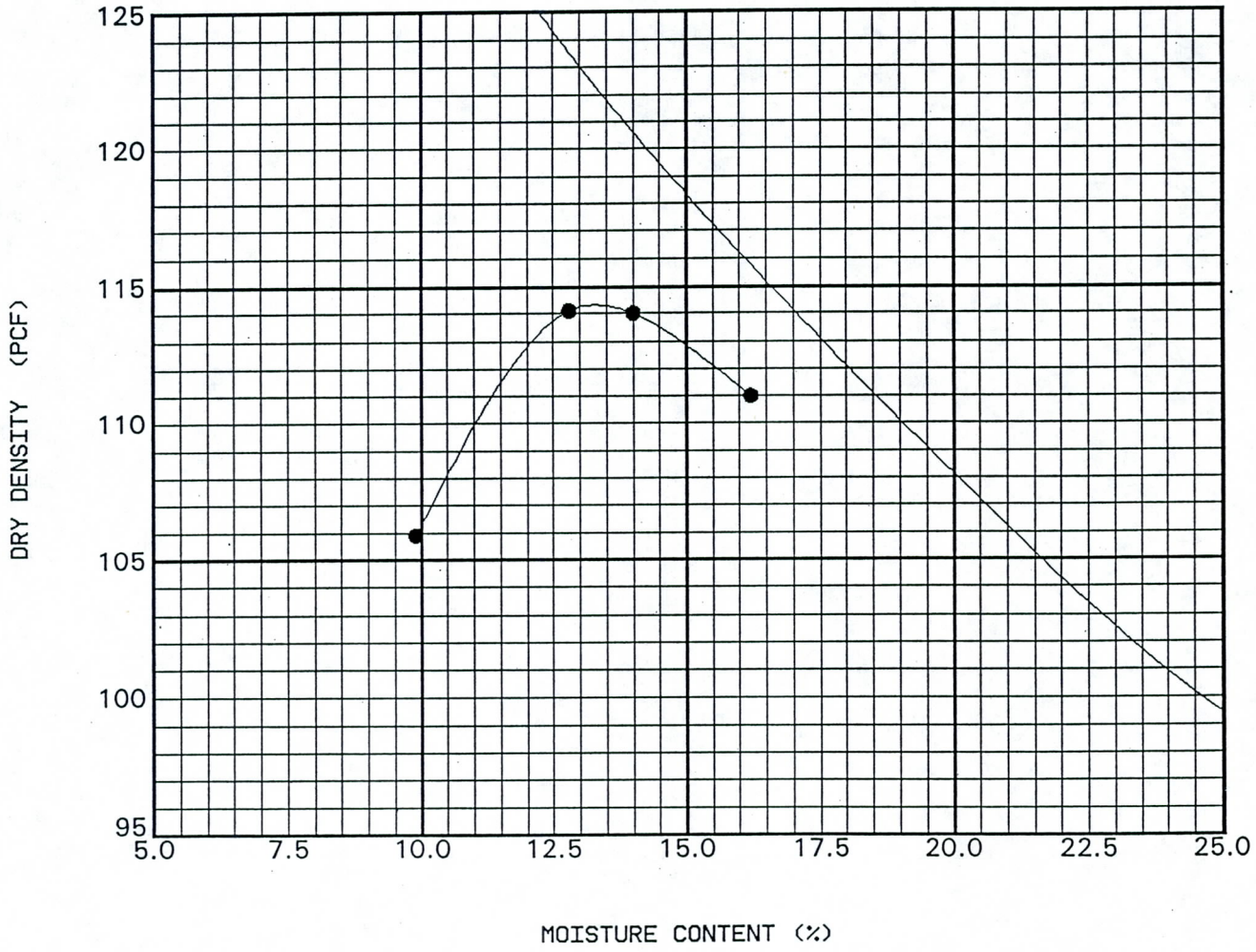
BORING NO.: B- 3 SAMPLE NO.: BS-2 SAMPLE DEPTH: 4.50

METHOD OF COMPACTION: ASTM D698A

LIQUID LIMIT: 24 PLASTIC LIMIT: 20 PLASTICITY INDEX: 4

CLASSIFICATION: CL-ML ASTM SOIL DESCRIPTION: SANDY SILTY CLAY

MAXIMUM DRY DENSITY: 114.5 PCF OPTIMUM MOISTURE CONTENT: 13.4 %



SPEEDIE AND ASSOCIATES

SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE (%)	PERCENT COMPACTION	INITIAL DEGREE of SATURATION (%)	FINAL DEGREE of SATURATION (%)	TOTAL SWELL (%)
B- 3 BS-2	4.5	108.7	12.0	94.9	61.2	97.0	3.2

PERCENT COMPACTION BASED ON A MAXIMUM DRY DENSITY OF 114.5 pcf @ 13.4 % MOISTURE

Flood Detention Basin
43rd Ave & Southern SEC
Phoenix, Arizona
Project No. 980172SA

SPEEDIE AND ASSOCIATES

Project: 43rd Avenue Channel
Flood Control Basin
Phoenix, Arizona

Project No.: 980172SA

pH & Resistivity Results

Location/Depth	pH	Lab Resistivity (ohm-cm)
B-2/4.5	8.5	1330
B-5/25	8.6	1400
B-6/25	8.9	2000
B-7/25	9.0	4670
B-8/25	8.4	2,335
B-9/31	8.7	1800
B-10/10	8.5	2401

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980511-01
Date Reported: 3/18/98
Date Received: 3/13/98 13:59
Project Number: 980172SA

Requested Analysis

Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-2 @4.5' #13314	pH	ADOT237	8.5	S.U.	3/18/98
#13314	SULFATE	ADOT733	0.11	%	3/18/98

Approved By: Padang

947 South 48th Street, Suite 127 Tempe, Arizona 85281 Phone (602) 858-1841 Fax (602) 858-0752

MEMBER ACIL

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-01
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

	Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-10	16516	pH	ADOT237	8.7	S.U.	5/27/98
@ 25'	16516	SULFATE	ADOT733	0.0086	%	5/27/98

Approved By: Badang

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-02
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

	Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-11	16517	pH	ADOT237	8.9	S.U.	5/27/98
@ 25'	16517	SULFATE	ADOT733	0.0037	%	5/27/98

Approved By: Gadang

947 South 48th Street, Suite 127 Tempe, Arizona 85281 Phone (602) 858-1841 Fax (602) 858-0752

MEMBER ACIL

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-03
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
16518	pH	ADOT237	8.9	S.U.	5/27/98
16518	SULFATE	ADOT733	0.028	%	5/27/98

B-12
@ 25'

Approved By: D. Adang

947 South 48th Street, Suite 127 Tempe, Arizona 85281 Phone (602) 858-1841 Fax (602) 858-0752

MEMBER ACIL

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-04
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

	Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-13	16519	pH	ADOT237	8.5	S.U.	5/27/98
C 25'	16519	SULFATE	ADOT733	0.0081	%	5/27/98

Approved By: Gadang

947 South 48th Street, Suite 127 Tempe, Arizona 85281 Phone (602) 858-1841 Fax (602) 858-0752

MEMBER ACIL

Laboratory Consultants, Ltd.

Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-05
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

	Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-14,	16520	pH	ADOT237	8.7	S.U.	5/27/98
C 31	16520	SULFATE	ADOT733	0.0051	%	5/27/98

Approved By: Gadang

947 South 48th Street, Suite 127 Tempe, Arizona 85281 Phone (602) 858-1841 Fax (602) 858-0752

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Speedie & Associates
Mr. Mike Whitman
11029 North 24th Avenue
Phoenix, Az 85029

Sample Number: 980874-06
Date Reported: 5/27/98
Date Received: 5/20/98 15:19
Project Number: 980172SA

Requested Analysis

	Client Sample ID	Analysis	Method	Result	Units	Date Analyzed
B-15 @ 34'	16522	pH	ADOT237	8.5	S.U.	5/27/98
	16522	SULFATE	ADOT733	0.0053	%	5/27/98

Approved By: Gadang

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MEMBER ACIL

CODES AND DEFINITIONS

Water Uses

A	Irrigation
B	Utility (Water Co.)
C	Commercial
D	Domestic
E	Municipal
F	Industrial
G	Recreational
H	Subdivision
I	Mining
J	Stock
K	Other - Exploration
L	Drainage
M	Monitoring
N	None
O	Other - Non-Production
R	Recharge
T	Test

Legal Description

A	Northeast
B	Northwest
C	Southwest
D	Southeast
Q	Quadrant
T	Township
R	Range
S	Section
Q1	Quarter of Section (160 Acres)
Q2	Quarter Quarter of Section (40 Acres)
Q3	Quarter Quarter Quarter of Section (10 acres)
M	Month
D	Day
YR	Year well was established
REG #	Well Registration Number

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	21				MARICOPA COUNTY DOT			N	07	28	1997	564115
A	01	02	21				SWIFT	225	100	D	08	16	1983	800927
A	01	02	21	A	A	A	TNT BESTWAY	104	48	M	02	17	1989	523578
A	01	02	21	A	A	A	TNT BESTWAY	99	57	M	02	17	1989	523580
A	01	02	21	A	A	A	TNT BESTWAY INC	98	57	M	02	17	1989	523579
A	01	02	21	A	A	D	PETERSON, WALDA			N	08	22	1992	536461
A	01	02	21	A	D	D	PETERSON	316	63	DJ	02	16	1982	602890
A	01	02	21	A	D	D	PETERSON	115	61	AD	02	16	1982	602889
A	01	02	21	B	B		ROSEMAN			D	02	17	1983	504807
A	01	02	21	B	B	A	SCHER, LULA	205	105	D	06	14	1982	634833
A	01	02	21	B	C	A	STEPSTONE INC	310	75	FD	11	26	1984	509789
A	01	02	21	B	C	B	JACKSON			D	06	14	1982	636948
A	01	02	21	B	C	D	MYERS CROSS DEVELCO			D	11	13	1984	509633
A	01	02	21	B	C	D	MYERS CROSS DEVELPMT	520	62	AD	09	21	1990	528898
A	01	02	21	B	C	D	PRATTE CONSTRUCTION	213	50	D	09	04	1984	509075
A	01	02	22				ANTON	270	67	JD	07	26	1983	800825
A	01	02	22	A	A		DAYTON			ADJ	03	24	1982	631454
A	01	02	22	A	C	B	FISKE, JOHN HENRY	200	44	D	01	09	1992	534115
A	01	02	22	A	D	C	MARICOPA BY-PRODUCTS	52	40	N	03	07	1997	561527
A	01	02	22	B			NIX TRUST EL AL			AD	06	17	1982	629210
A	01	02	22	B	B		NIX	140	75	D	06	11	1982	636758
A	01	02	22	B	B	B	STANTON INDUSTRIES			N	08	22	1992	536430
A	01	02	22	B	B	B	TNT BESTWAY TRANS	90	50	M	08	18	1995	551026
A	01	02	22	B	B	B	TNT BESTWAY TRANSP.	100	65	M	07	31	1989	525441
A	01	02	22	B	B	B	TNT BESTWAY TRANSPRT	70	70	N	06	16	1992	535717
A	01	02	22	B	B	B	TNT BESTWAY TRANSPT.	83		T	03	01	1993	538071
A	01	02	22	B	B	C	MASTER WINDOW	81	64	M	08	15	1996	559582

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	22	B	B	C	MASTER WINDOW	81	64	M	08	15	1996	559581
A	01	02	22	B	B	C	MASTERVIEW WINDOW			M	08	15	1996	559586
A	01	02	22	B	B	C	MASTERVIEW WINDOW	81	64	M	08	15	1996	559580
A	01	02	22	B	B	C	MASTERVIEW WINDOW	81	64	M	08	15	1996	559585
A	01	02	22	B	B	C	MASTERVIEW WINDOW	81	64	M	08	15	1996	559584
A	01	02	22	B	B	C	MASTERVIEW WINDOW	81	65	M	07	11	1991	532390
A	01	02	22	B	B	C	MASTERVIW WINDOW	81	64	M	08	15	1996	559583
A	01	02	22	B	B	C	TNT BESTWAY	98	48	M	08	26	1988	522185
A	01	02	22	B	B	C	TNT BESTWAY	99	48	M	08	26	1988	522186
A	01	02	22	B	B	C	TNT BESTWAY			M	07	26	1988	521897
A	01	02	22	B	B	C	TNT BESTWAY	100	57	M	08	26	1988	522183
A	01	02	22	B	B	C	TNT BESTWAY	100	55	M	08	26	1988	522184
A	01	02	22	B	B	C	TNT BESTWAY TRAN			N	08	22	1992	536455
A	01	02	22	B	B	C	TNT BESTWAY TRANS IC			M	08	11	1989	525505
A	01	02	22	B	B	C	TNT BESTWAY TRANS IC	88	55	F	07	26	1988	521879
A	01	02	22	B	B	C	TNT BESTWAY TRANSP.			M	12	13	1988	523066
A	01	02	22	B	B	C	TNT BESTWAY TRANSPRT	120	60	F	08	25	1989	525597
A	01	02	22	B	B	C	TNT BESTWAY TRANSPRT			N	06	26	1996	558573
A	01	02	22	B	B	C	TNT BESTWAY TRANSPRT			T	09	11	1995	551699
A	01	02	22	B	B	C	TNT BESTWAY TRANSPRT			T	09	11	1995	551700
A	01	02	22	B	C		MILLER, G.A.	123	82	D	01	13	1987	804293
A	01	02	22	B	D		WEINBERGER	150	75	DF	03	05	1982	629867
A	01	02	22	B	D	A	FIKSE			FDA	12	23	1981	623000
A	01	02	22	B	D	D	SEHNAL, JOE	70	48	M	07	06	1994	544393
A	01	02	22	B	D	D	SHENAL PAUL & HARDIN	150	80	ADF	06	14	1982	626050
A	01	02	22	C	B	A	VALENTE	10		L	06	07	1982	612846
A	01	02	22	C	B	A	VALENTE	300	120	F	06	07	1982	612845

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	22	D	A	A	MALLIN BROTHERS IRON	186	43	F	07	11	1983	800684
A	01	02	27				CALMAT CO			N	10	26	1990	529781
A	01	02	27				CALMAT OF ARIZONA	150		N	05	20	1996	557824
A	01	02	27				MCKELVEY	80	40	D	06	16	1982	639898
A	01	02	27				SHUMWAY	100	40	D	06	11	1982	636097
A	01	02	27	A	B		CALLAWAY			J	02	22	1982	630205
A	01	02	27	B	B	C	RACETTE, GUY			AJD	06	14	1982	625207
A	01	02	27	B	B	D	FIRST INTERSTATE BK	0	0	D	06	10	1982	619327
A	01	02	27	B	C	C	CALMAT CO	250	45	A	03	09	1990	527384
A	01	02	27	C	C	B	HOOVER	305	185	D	01	21	1985	510104
A	01	02	28				CALMAT CO			N	10	26	1990	529780
A	01	02	28				CALMAT OF ARIZONA	120		N	05	20	1996	557825
A	01	02	28				SMITH	0	0	D	02	11	1982	624503
A	01	02	28				YUROCHKO, ESTATE OF	0	0		09	29	1981	606970
A	01	02	28	A	D	A	AZ SAND & ROCK	0	0	A	06	04	1982	611453
A	01	02	28	A	D	D	STANLEY STRUCTURES	165	30	F	05	03	1982	609588
A	01	02	28	B			GODMAN	50	40	D	06	18	1982	640209
A	01	02	28	B			PETERSON	350		JD	06	01	1982	634268
A	01	02	28	B			VALENZUELA, JOSE		45	D	12	24	1986	804204
A	01	02	28	B	D	B	CALMAT CO	250	40	L	06	14	1982	628465
A	01	02	28	B	D	D	SANTA FE PACIFICE	500		N	10	28	1996	560007
A	01	02	28	C	A	A	MERCER			D	01	02	1981	86690
A	01	02	28	C	A	B	CALMAT CO		35	DA	01	28	1987	804433
A	01	02	28	C	A	B	GIBSON			JD	06	14	1982	635057
A	01	02	28	C	A	D	COPLEN ET AL	140	43	A	06	14	1982	628466
A	01	02	28	C	B	C	MCREYNOLDS	150		DJ	06	14	1982	629585
A	01	02	28	D	A	A	WILDMAN	125	60	D	04	30	1982	610885

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	28	D	B	D	BACON, BERTHA	150	40	DJ	06	14	1982	629589
A	01	02	28	D	D	A	MCCONNELL	0	0	D	12	17	1981	600331
A	01	02	29	A	A		CORONADO ENGINEERING			N	02	23	1993	538244
A	01	02	29	A	A		TEX-STRUCT INC	65	7	L	05	30	1984	507729
A	01	02	29	A	B	A	FYM UNLIMITED, INC	240	100	JD	06	09	1982	625907
A	01	02	29	B	B	C	PIONEER CONCRETE OF	302	44	I	08	20	1986	511382
A	01	02	29	D	A	C	LINCOLN	372	60	JD	12	10	1981	600469
A	01	02	29	D	B	C	HAYES, TOM	160	26	DJ	07	17	1996	559030
A	01	02	29	D	D	A	JDL & CO LLC	201	60	A	12	10	1981	600468
A	01	02	30	A	A	D	UNION ROCK & MAT COR	265	67	FDA	02	24	1982	604166
A	01	02	30	B	B		KING			D	06	10	1982	636003
A	01	02	30	B	B		KING			D	06	10	1982	636004
A	01	02	30	B	B	B	SHREVE, FAYE			D	06	14	1982	636829
A	01	02	30	B	B	C	SHREVE, FAYE			D	06	14	1982	636828
A	01	02	30	B	C	C	SALT RIVER PROJECT	38	13	M	03	06	1987	517073
A	01	02	30	B	C	C	SALT RIVER PROJECT	34	11	M	03	06	1987	517071
A	01	02	30	B	C	D	SALT RIVER PROJECT	34	14	M	03	06	1987	517072
A	01	02	30	B	C	D	SALT RIVER PROJECT	27	6	M	03	06	1987	517074
A	01	02	30	B	C	D	SALT RIVER PROJECT	33	14	M	03	06	1987	517070
A	01	02	30	C	C	C	GIFFORD-HILL CEMENT	400	25	F	03	02	1987	804529
A	01	02	30	D	D	C	PENINSULA-HOROWITZ	400	20	A	06	14	1982	626268
A	01	02	30	D	D	D	BARNHART, DANIEL	181	35	D	04	02	1986	513867
A	01	02	31	A	A	A	PENINSULA-HOROWITZ	400	20	A	06	14	1982	626269
A	01	02	31	A	A	A	SALT RIVER PROJECT	600	89	BA	05	18	1982	607697
A	01	02	31	B	A	C	FRIEDENSTAB, ALVIN			DJ	09	11	1996	556212
A	01	02	31	B	D	A	RICHARDS, SHARON	625	62	D	08	08	1988	521999
A	01	02	31	B	D	B	JOHNSON, NORMAN			D	01	23	1987	516579

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	31	B	D	B	THOMPSON, DALE	600	16	D	12	17	1986	516215
A	01	02	31	B	D	B	THOMPSON, DALE			D	10	30	1986	515962
A	01	02	31	B	D	B	TIETJE, RUDOLPH			D	06	30	1997	563601
A	01	02	31	C	B	B	MORRIS, KEITH	505	0	D	06	11	1982	623534
A	01	02	31	D	A	D	HOLT	145	45	D	10	07	1982	504097
A	01	02	31	D	B	B	MORRIS, KEITH	0	0	D	06	11	1982	623535
A	01	02	31	D	B	B	PENINSULA	1470	0	D	06	11	1982	623537
A	01	02	31	D	B	C	RANDALL, GAIL	370	60	D	09	24	1987	519133
A	01	02	31	D	C		CHICKASHA COTTON OIL			L	07	22	1985	511234
A	01	02	31	D	C		CHICKASHA COTTON OIL			L	05	29	1985	511235
A	01	02	32	A	A	A	PENINSULA-HOROWITZ	400	20	A	06	14	1982	626271
A	01	02	32	A	A	A	SALT RIVER PROJECT	500	48	AB	04	29	1992	607696
A	01	02	32	B	A	A	PENINSULA-HOROWITZ	400	20	A	06	14	1982	626270
A	01	02	32	B	B	B	POHLCAT MOUNTAINVIEW		35	D	10	09	1986	804007
A	01	02	32	C	C	D	POHLCAT MOUNTAINVIEW	400	30	D	06	11	1982	624173
A	01	02	32	D	D	D	VALLEY NATIONAL BANK			A	10	09	1986	804008
A	01	02	33				MENDOZA			D	06	14	1982	651073
A	01	02	33	A	D	D	BASELINE & 51ST AVE	250	35	A	06	14	1982	625399
A	01	02	33	B			RAMPEY, LULA			A	05	20	1985	802293
A	01	02	33	B	A		STRAKER	120	35	AJD	07	15	1982	640378
A	01	02	33	B	A	B	TRYON		50	D	06	14	1982	636286
A	01	02	33	B	A	B	TRYON	202	50	AJ	02	16	1982	603876
A	01	02	33	B	B	B	WEST	90	28	D	03	23	1982	502420
A	01	02	33	B	B	D	ANDERSON-CLAYTON CO			DJ	06	14	1982	626786
A	01	02	33	B	C	A	SOUTH MTN GIN	470	70	D	06	12	1982	635904
A	01	02	33	B	D	A	WILLIAMS, CHET	200	40	A	06	14	1982	625400
A	01	02	33	C	B		HITCHENS	200	40	DA	06	14	1982	636348

Q	T	R	S	Q1	Q2	Q3	NAME	WELLDEPTH	WATERLEVEL	WATERUSE	MMISS	DDISS	YRISS	REGNO
A	01	02	33	C	B	C	TUMBLEWEED SVC			M	02	06	1995	547458
A	01	02	33	C	B	C	TUMBLEWEED SVC			M	02	06	1995	547459
A	01	02	33	C	B	C	TUMBLEWEED SVC			M	02	06	1995	547460
A	01	02	33	C	B	D	BENNETT	138	40	D	04	14	1982	638691
A	01	02	33	C	C		TEMPE ASSOCIATES	0	22	A	06	14	1982	625439
A	01	02	33	C	D		TEMPE ASSOCIATES			DJA	06	04	1987	804668
A	01	02	33	D	D		HALEY, BILL	110	50	D	06	09	1982	635270
A	01	02	34	A	B		JENKINS & LUECKE			DJ	06	14	1982	628389
A	01	02	34	A	B		JENKINS & LUECKE			ADJ	06	14	1982	628388
A	01	02	34	A	C	C	BURNETT	137	30	DJ	06	14	1982	636838
A	01	02	34	A	C	C	RAWLINGS, DONALD ROE	151	50	JAD	02	03	1986	803485
A	01	02	34	A	D		CLARK	159	60	AJD	06	14	1982	634830
A	01	02	34	A	D		SHAULIS	162	42	D	06	01	1982	634421
A	01	02	34	A	D	A	GARCIA	635	40	D	01	24	1983	504673
A	01	02	34	A	D	A	HOM, SAM			D	03	27	1986	803613
A	01	02	34	A	D	A	HONG			D	05	20	1982	633958
A	01	02	34	B	D	D	BLR ASSOCIATES	234	70	A	04	28	1982	606385
A	01	02	34	C	C	C	RAWLINGS, DAVID	365	36	AJD	09	02	1983	800916
A	01	02	34	D	A		MEADOWS	100		DJ	03	04	1982	629834
A	01	02	34	D	A		REDSTOM, THOMAS	0	0	DJ	05	27	1982	617345
A	01	02	34	D	D		ONEY	150	80	DJ	05	28	1982	642017
A	01	02	34	D	D	A	CIRCLE K STORES	111	87	M	11	06	1995	552921
A	01	02	34	D	D	A	CIRCLE K STORES	105	80	M	11	06	1995	552922
A	01	02	34	D	D	A	CIRCLE K STORES	110	85	M	11	06	1995	552923
A	01	02	34	D	D	A	CIRCLE K STORES	111	87	M	11	06	1995	552920
A	01	02	34	D	D	A	CIRCLE K STORES	110	87	M	11	06	1995	552919
A	01	02	34	D	D	A	FULLER	160	72	D	06	14	1982	636824
A	01	02	34	D	D	A	HILL	100		DJ	06	10	1982	633518
A	01	02	34	D	D	D	COPPOCK	100		D	06	09	1982	635495