ATL, INC.

CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

EEC/MKE
OAK STREET STORM DRAIN, PHASE II DESIGN
56TH STREET TO MILLER ROAD
FCD 97-39
ATL JOB NO. 198007

027

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ATL Job No. 198007

July 28, 1998

GEOTECHNICAL INVESTIGATION

REPORT FOR

EEC / MKE

PROJECT

OAK STREET STORM DRAIN, PHASE II DESIGN
56TH STREET TO MILLER ROAD
FCD 97-39
ATL JOB NO. 198007

Reviewed by:

Registered Professional Engineer (Civil) CERTIFICATE NO. 22719 David Preston Hayes Date Signed 7/29/98 ARIZONA, U.S.A.

David P. Hayes, PE
Executive Vice President

Prepared by:

Ammi Osorio
Project Engineer

ATL, INC.
CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

PHOENIX – CORPORATE OFFICE
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July 28, 1998

Mr. Mark Gavan, P.E., R.L.S.
EEC / MKE
3501 N. 16th Street
Phoenix, Arizona 85016-7702

Re: Geotechnical Investigation
Oak Street Storm Drain, Phase II Design
56th Street to Miller Road
FCD 97- 39
ATL Job No. 198007

Dear Mr. Gavan:

This report presents the results of a geotechnical investigation for the proposed Oak Street Storm Drain System from 56th Street to Miller Road in Scottsdale, Arizona. Services were performed in accordance with ATL's Proposal No. P97332, dated January 8, 1998.

The soil investigation consisted of drilling eleven (11) boreholes to depths ranging from 10 to 21½ feet below existing grade along the storm drain alignment. The soil encountered consisted primarily of sands and clays with cementation observed throughout the depth of each boring. The soils encountered were non-corrosive as indicated by pH and resistivity testing. The soil is generally re-usable as trench backfill except for material from two locations that was highly plastic. A field Percolation test was performed in the Auto Park Basin area, resulting in a percolation rate of 3 MPI. An allowable bearing capacity of 4,000 psf was determined for the eastern portion of the site from material sampled at a depth of 15 feet below grade. Refer to Section 7.0 of this report for details of the analysis.

ATL has appreciated the opportunity to be of service to EEC / MKE on this project and looks forward to a continued association on future projects. Should any questions arise, please do not hesitate to contact us at your earliest convenience.

Very truly yours,

David P. Hayes, P.E.
Executive Vice President

DPH/brc

TUCSON
820 E. 47th Street B-1
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Fax (520) 623-4603

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Globe, AZ 85502
(520) 425-8999
Fax (520) 425-9597

COTTONWOOD
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Cottonwood, AZ 86326
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Prescott Valley, AZ 86314
(520) 759-2238
Fax (520) 759-2239

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3002-A Rigel Avenue
Las Vegas, NV 89102
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GEOTECHNICAL INVESTIGATION

REPORT FOR

EEC / MKE

PROJECT

OAK STREET STORM DRAIN, PHASE II DESIGN
56TH STREET TO MILLER ROAD
FCD 97 - 39
ATL JOB NO. 198007

1.0 PROJECT DESCRIPTION

This is a joint project between the Flood Control District (FCD) of Maricopa County, the City of Phoenix and the City of Scottsdale with the FCD acting as the design lead agency. The project will include the Phase II design of the storm drain along Oak Street, from 56th Street to Miller Road, along with a basin design for the Auto Park. The storm

drain will be designed to intercept and convey the runoff from a10-year storm from the contributing water shed. The Auto Park Basin will be designed to detain a 100-year, 6-hour duration storm. The scope of work will also include the design of a sediment trap at the inlets on the west side of 64th Street. The estimated length of the storm drain system is 2 miles.

2.0 LOCATION AND SITE DESCRIPTION

The project site is located Northeast of Squaw Peak Freeway (SR51), between 56th Street and Miller Road, in Scottsdale, Arizona. A Vicinity Map is provided in Plate No.3.

Scottsdale borders the Central Highland Province but is a part of the Basin-Range Province. The soil formation generally consists of unconsolidated, fine-textured, alluvial deposits of clay, silt, and sand occurring on gently sloping, to nearly level, surfaces in the floors of the valley basins. Most of these surficial materials were deposited as sediments brought down by sheet wash from the higher parts of alluvial fans. In the cultivated areas of the Valley basins, significant quantities of silt and clay were also deposited from muddy irrigation waters. At very shallow depths, almost all of these alluvial materials contain zones and layers of accumulated lime carbonate ("caliche"). The Camelback Mountain is located approximately 2-miles north of the project site and the Papago Park is located south of the project.

Currently, the area consists of commercial office buildings, residential housing and vacant land.

3.0 SCOPE OF WORK

ATL's responsibility was to determine the soil classification within the construction zone and evaluate their physical characteristics. The overall investigation was conducted in accordance with the latest version of NAVFAC DM-7.1.

Field and laboratory data were used to produce this report, addressing the following issues:

a) Allowable Bearing Capacities with Associated Settlements.

b) Equivalent Fluid Pressures.

c) Corrosivity Potential of the Soil.

d) Recommended uses for Excavated Material.

e) Suggested Construction Materials Specifications.

4.0 DRILLING AND SAMPLING PROCEDURES

The investigation consisted of drilling eleven (11) borings to depths that ranged from 10 feet to 21½ feet below existing grade. Plate No. 4 provides a site map detailing the boring locations.

A Mobile B-50 drill rig, with 8-inch and 4-inch outside diameter hollow stem continuous flight augers, was used to drill and sample the borings. Standard Penetration Test (SPT) values were obtained beginning at five (5) feet below grade, using a split-spoon sampler driven 18 inches with a 140-pound hammer falling thirty inches, in accordance with ASTM Standard D-1586. Ring samples were taken for additional laboratory analysis. A Shelby Tube sample was obtained to determine the unconfined compressive strength of the native material. Bulk samples of the existing native material were selectively sampled off the auger flights and returned to the laboratory for additional analysis. In addition, a Field Percolation Test was performed in the location of the detention basin in order to determine the permeability of the soil. Using the Arizona Department of Environmental Quality (ADEQ) procedures outlined in ***Engineering Bulletin No. 12***, an 18" diameter hole was drilled to a depth of 10 feet below grade. The hole was pre-soaked with water. After pre-soaking for 24 hours, readings were taken, measuring the time it took the 6-inch depth of water to drop an inch. The hole was refilled with water and the procedure was repeated until a constant drop rate was obtained. Results of the test are presented in Section 6.0 of this report.

At the completion of drilling, each borehole was returned to its original state by backfilling with excess soil from the hole. Cold mix was placed in the top 12 inches for

those borings drilled in asphaltic concrete pavement. All samples were transported to ATL's Phoenix Laboratory for analysis. Edited boring logs are presented in Appendix A.

5.0 LABORATORY TESTING

Bulk samples of the subgrade material were collected off the auger flights throughout the depth of each boring. Visual field classifications noted on the field boring logs were modified by the results of index tests such as Sieve Analysis and Atterberg Limits. Unified Soils Classifications are presented on the edited logs in Appendix A.

Moisture Content tests were performed to determine the amount of water present in the soil at the time of sampling. Standard Proctor Analyses were completed on the subgrade material to determine the relationship between the maximum dry density and optimum moisture content. A Consolidation Test was conducted to determine the amount of vertical movement a sample would experience under specific loading and moisture conditions. A Percent Swell Test was performed to determine the expansion tendencies of the material under given surcharge load when water is added. Dry Unit Weight determinations were made in order to evaluate shrink potential during construction. An Unconfined Compressive Strength Test was performed to determine the compressive strength of the soil that will constitute the trench walls as required by OSHA. In addition, pH and Resistivity Tests were performed on the subgrade material to determine the corrosivity potential of the soil.

The following table lists the types and quantities of tests performed to provide the project design information:

TEST	QUANTITY
Sieve Analysis	10
Atterberg Limit	10
Moisture Content	10
Standard Proctors	2
Dry Unit Weight	1
Consolidation Test	1
Swell Test	1
Unconfined Compressive Strength Test	1
pH/Resistivity Tests	2

All laboratory tests were conducted in accordance with ASTM published procedures. The soils shown on the edited boring logs were classified using the Unified Soils Classifications System (USCS) as presented in ASTM D2488.

6.0 SUMMARY OF EXISTING CONDITIONS

Classification data for the soils sampled from the borings suggest the following soil profile variation. Detailed Boring Logs are presented in Appendix A. Please note that no groundwater was encountered during drilling nor prior to backfilling each borehole.

a) On Oak Street, from 56th Street to Miller Road, the existing pavement section consisted of 2 to 6 inches of asphaltic concrete, supported by 4 to 12 inches of aggregate base. In Boring Nos. 1 and 3, there was no aggregate base beneath the asphaltic concrete. The subgrade consisted of light brown sand and clay materials. The sandy materials were classified as **silty, SAND (SM)**, **clayey SAND (SC)** or a combination. of **silty, clayey SAND (SC-SM)**. The clayey materials were classified as either a **sandy, lean CLAY (CL)** or a **sandy, fat CLAY (CH)**. Indications of cementation were found in each boring, throughout boring depth. *N values* obtained from SPT tests revealed materials in a "Very Hard" condition, except for Boring Nos. 5,8, and 9. Boring Nos. 5 and 8 exhibited a "Firm" to "Very Firm" condition. Boring No. 9 exhibited a "Moderately Firm" condition.

b) At the Auto Park Basin, the material consisted of a **light brown to dark brown, clayey SAND (SC)** with gravel throughout the boring depth. *N values* obtained revealed subgrade material in a "Hard" condition.

Laboratory tests results indicated minus No. 200 contents of 21% and 29% for the SC-SM samples. Plasticity Indices were 4 and 6 respectively. The minus No. 200 contents for the SC materials ranged from 34% to 51%, with Plasticity Indices ranging from 19 to 28. The SM sample tested had minus No. 200 contents of 25% with Plasticity Index of 15. The CH sample tested had minus No. 200 of 52% and 60% with Plasticity Indices of 30 and 37. The CL sample tested had minus No. 200 content of 51% with a Plasticity Index of 16.

Standard Proctor analyses were performed on SC and CH samples. The results obtained were summarized as follows:

Boring No.	USCS	Depth (feet)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
4	SC	10 - 15	106.7	15.3
7	CH	0 - 15	107.9	17.1

The in-situ *Dry Unit Weight* of 92.0 pcf was determined from a Boring No. 5 sample, 5½ feet below grade. The material consolidated 6½% when saturated with water under a stress of 2280 psf.

A *Swell* test was also conducted on the same material and obtained 1% expansion when the material was subjected to 100 psf surcharge load.

An *Unconfined Compressive Strength* test was performed from Boring No. 4, at the depth of 5 feet to 8 feet below grade. The compressive strength was 79 psi or 5.7 tsf.

The *pH and Resistivity* tests were performed from Boring No. 1 and No. 3 material, at depths up to 15 feet below grade. The results of the Resistivity tests were between 4000 and 6800 ohms/cm^3. The pH ranged from 8.9 to 8.0 respectively.

In addition, a *Field Percolation* test was performed in Boring No. 11, located at the Auto Park Basin. The test depth was 10 feet below grade. The percolation rate obtained averaged 3 MPI (minutes per inch).

7.0 DISCUSSIONS AND RECOMMENDATIONS

Installation and construction of the storm drain should be performed in accordance with Maricopa Association of Governments (MAG) "Uniform Standard Specifications for Public Works Construction"- Section 601", applicable City of Phoenix Supplements and the Arizona Division of Occupational Safety and Health "Construction Standard for Excavations" (29 CFR Part 1926.650-652, Subpart P). The storm drain system will consist of a combination of 36" to 57" diameter pipe between 56th and 64th Streets.

Thereafter, a 2-cell box culvert with varying widths will be constructed, with the single cell widths varying from 7 feet to 9.5 feet.

Resistivity test results were performed on two borings to define areas of low resistivity. A reading below 1500 ohms per cubic centimeter is considered an indication of corrosive soil, requiring concrete pipe, plastic pipe or special liners for metal pipe. The lowest reading recorded was 4050 at a depth of 5 feet below grade in Borehole No. 3, indicating that the corrosion should not effect metal pipe, if used.

In general, the use of the moisture sensitive and plastic native material should be limited to backfill around the haunches of the pipe and over the pipe, to within 12 inches of the top of subgrade. Compaction of pipe bedding and backfill material should conform to MAG requirements as re-stated in Section 8.0 of this report.

The percolation results for the soil in the area of the detention basin averaged 3 MPI. This figure may be used to determine if the retention requirements are met by the in-situ soils. Rates may be reduced by increasing compaction of the existing material and by adding more clay. As indicated by Boring No. 11 samples, the material contains clayey fines which decrease permeability but they may have to be supplemented in order to achieve the minimum rate required.

Trench paving sections should conform to the existing pavement. However, the boring logs indicated a wide variation in pavement sections. For estimating purposes, ATL suggests that a pavement section of 4 inches of asphaltic concrete over 8 inches of aggregate base course be specified. A MAG C¾ mix is suggested, place in two lifts, with a cationic emulsion used between layers at a rate of 0.07 gal/yd^2.

Equivalent fluid pressures, based on an average soil unit weight of 92 pcf for material from Boring No. 5, assuming a friction angle for this clayey sand of 35°, are as follows:

At Rest	**-**	**45 psf/ft**
Active	**-**	**29 psf/ft**
Passive	**-**	**391 psf/ft**

These values may be useful when designing trench support systems used during excavation and when designing the thickness of the box culvert walls. As indicated by the

unconfined compressive strength, the material encountered generally conforms to a "type A" as defined by OSHA in Appendix A, Subpart P of CFR 1926. It is our recommendation, that the contractor evaluate each location to insure that the 3/4h to 1v slope allowed by OSHA is safe for the specific area that will be excavated.

ATL performed a check of allowable bearing capacity for settlements not to exceed 0.5 inches. The results were:

Allowable Bearing Capacity	**=**	**4000 psf**
Maximum Differential Settlement	**=**	**0.5 inches**

Note that the above values assume that the specified compaction of the subsoil, bedding material, or ABC will be no less than the minimum required in Section 8.0 of this Report.

8.0 CONSTRUCTION RECOMMENDATIONS

8.1 Excavation

and CH

Guidelines presented in section 206 of MAG should be followed. As indicated in Section 7.0, the in-situ CL and SC material is not suitable as backfill over the pipe.

Not consistent w/ 7.0

In excavating for the storm drain, the slopes of the side walls must be maintained such that they remain stable. Note that OSHA provides specific stabilization requirements based on material type. Trench boxes, sheeting and shoring systems, and other systems may be utilized to maintain stable cuts.

8.2 Compaction

MAG Section's 601 should be followed, using either AASHTO T-99 or ASTM D698 procedures, with in-place densities of the pipe backfill conforming to the requirements of Table 601-2; no less than 90% of the maximum laboratory dry density and within ±2% of the optimum moisture content to within 2 feet of the top of subgrade and 95% thereafter.

Please note that water jetting is not an acceptable means of compaction for this project.

8.3 Borrow

Borrow is anticipated for the top 12 inches of the trench backfill, under the pavement section. The borrow (import) should conform to the following criteria:

Sieve Size	Percent Passing
3"	100
No. 4	30 - 75
No. 30	10 - 40
No. 200	0 - 20

Plasticity Index ≤ 8.

In addition, the borrow shall contain no "chunks" of clay, organic matter, tree limbs, excess moisture and stones larger than 3 inches.

8.4 Aggregate Base Course

The aggregate base course (ABC) material used under trench sections should conform to Section 702 of MAG as follows:

Sieve Size	Percent Passing
1 ½	100
No. 4	38 - 65
No. 8	25 - 60
No. 30	10 - 40
No. 200	3 - 12

Plasticity Index ≤ 5.

8.5 Pipe Bedding

ATL recommends that pipe bedding conform to the following specifications as excerpted from the Arizona Department of Transportation:

Sieve Size	Percent Passing
1½	100
1	90 -100
#8	35 - 80
#200	0 - 8

The plasticity index should not exceed 8 and shall have a resistivity value greater than 1500 ohm-cm. Water jetting for compaction of this material will not be allowed.

8.6 Asphaltic Concrete

MAG requirements for C¾ mix should be used for the trench paving. ATL recommends that an AC-20 bitumen be utilized and estimates that the bitumen content will be between 5.0 and 5.5% by weight of total mix. Compaction requirements should be based on a 75-blow Marshall and the mix design developed accordingly.

ATL suggests that SuperPave Mix Designs not be accepted for trench paving due to their coarseness.

9.0 LIMITS OF SERVICES

The Geotechnical Engineer may be retained to provide testing services during the excavation, backfill, and storm drain installation phases of the work. Construction testing, including field and laboratory evaluation of backfill, should be performed by a competent, certified laboratory. ATL, Inc. is highly qualified to provide these additional services.

The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the location of test borings may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranty, express or implied, is made. We prepared the report as an aid in design of the proposed project.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, and environmental assessment of the site or identification of contaminated or hazardous materials or conditions.

If there are questions concerning this report, do not hesitate to contact the author.

10.0 REFERENCES

- ***Arizona Materials Inventory Aggregate Sources and Geology of Maricopa County***.
- ***GeoPro 3.0 for Windows & GeoCal for Windows***, Data Surge.
- Arizona Department of Transportation, ***Standard Specifications for Road and Bridge Construction***, 1990.
- MAG, English and Metric (1997), ***Uniform Standard Specifications for Public Works Construction***.
- City of Phoenix ***Administration Procedure No. 13.***
- NAVFAC ***DM 7.1, Soil Mechanics***, September, 1986.
- NAVFAC ***DM 7.2, Foundations and Earth Structures***, September, 1986.

PLATES

GUIDELINES IN THE USE AND INTERPRETATION

OF THIS GEOTECHNICAL REPORT

ATL Job No. 198007

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The geotechnical report was prepared for the use of the Owner in the design of the subject facility and should be made available to potential contractors and/or the Contractor for information on factual data only. This report should not be used for contractual purposes as a warranty of interpreted subsurface conditions such as those indicated by the interpretive boring and test pit logs, cross sections, or discussion of subsurface conditions contained herein.

The analyses, conclusions and recommendations contained in the report are based on site conditions as they presently exist and assume that the exploratory borings, test pits, and/or probes are representative of the subsurface conditions of the site. If, during construction, subsurface conditions are found which are significantly different from those observed in the exploratory borings and test pits, or assumed to exist in the excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

The Summary Boring Logs are our opinion of the subsurface conditions revealed by periodic sampling of the ground as the borings progressed. The soil descriptions and interfaces between strata are interpretive and actual changes may be gradual.

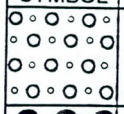
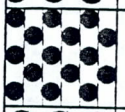
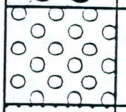
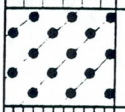
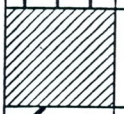
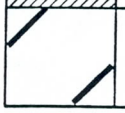
The boring logs and related information depict subsurface conditions only at these specific locations and at the particular time designated on the logs. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the soil conditions at these boring locations.

Groundwater levels often vary seasonally. Groundwater levels reported on the boring logs or in the body of the report are factual data only for the dates shown.

Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples, borings or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. It is recommended that the Owner consider providing a contingency fund to accommodate such potential extra costs.

This firm cannot be responsible for any deviation from the intent of this report including, but not restricted to, any changes to the scheduled time of construction, the nature of the project or the specific construction methods or means indicated in this report; nor can our firm be responsible for any construction activity on sites other than the specific site referred to in this report.

SOIL CLASSIFICATION & TERMINOLOGY

GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
	GW	Well graded gravels, gravel - sand mixtures, or sand - gravel - cobble mixtures.
	GP	Poorly graded gravels, gravel - sand mixtures, or sand - gravel - cobble mixtures.
	GM	Silty gravels, gravel - sand - silt mixtures.
	GC	Clayey gravels, gravel - sand - clay mixtures.
	SW	Well graded sands, gravelly sands.
	SP	Poorly graded sands, gravelly sands.
	SM	Silty sands, sand - silt mixtures
	SC	Clayey sands, sand - clay mixtures
	ML	Inorganic silts, clayey silts with slight plasticity
	MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

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

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

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

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

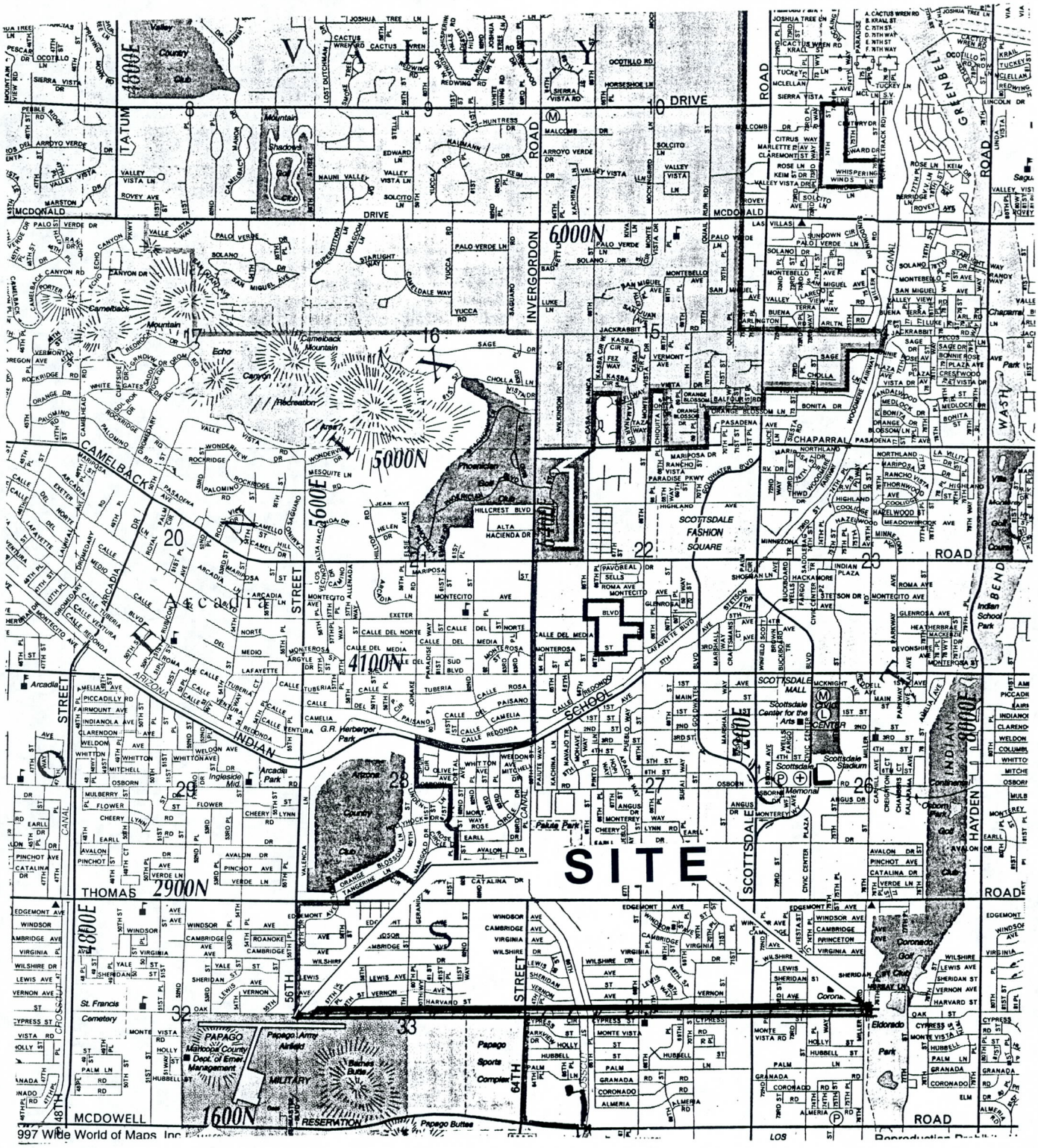
3. Relative Firmness. Terms for description of partially saturated and / or cemented soils which commonly occur the Southwest including clays, cemented granular materia silts and silty and clayey granular soils.

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

4. Standard Penetration Tests (SPT) =

DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 inches
Gravel	3 inches to No. 4 sieve
Coarse gravel	3 inches to 3/4 inch
Fine gravel	3/4 inch to No. 4 sieve
Sand	No. 4 sieve to No. 200
Coarse	No. 4 sieve to No. 10
Medium	No. 10 sieve to No. 40
Fine	No. 40 sieve to No. 200
Fines (silt or clay)	Below No. 200 sieve

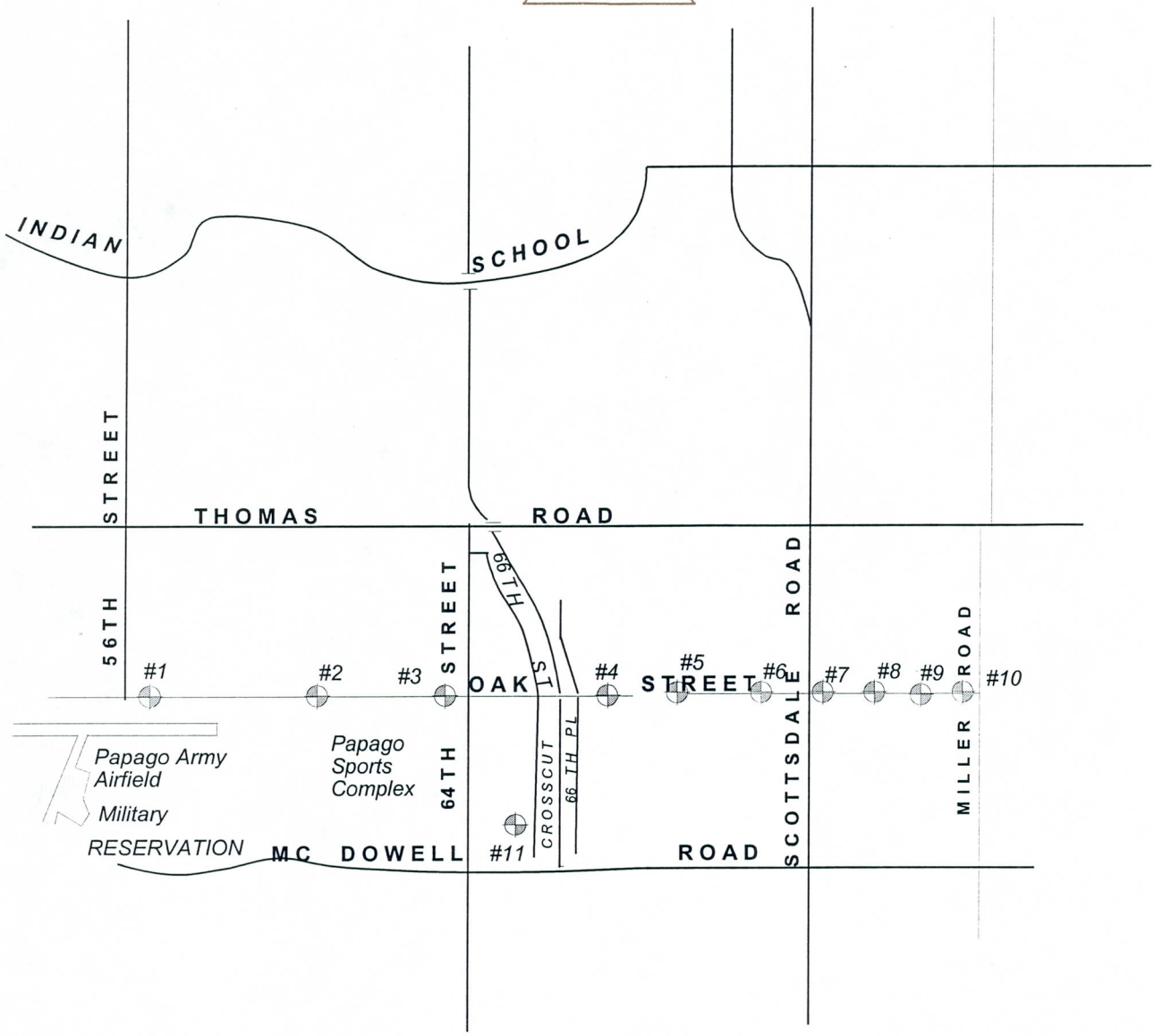


VICINITY MAP

OAK STREET STORM DRAIN, PHASE II DESIGN
FCD 97-39
Scottsdale, Arizona

ATL JOB NO. 198007

PLATE 3



BORING LOCATIONS

OAK STREET STORM DRAIN, PHASE II DESIGN
FCD 97-39
Scottsdale, Arizona

ATL JOB NO. 198007

PLATE 4

APPENDIX A

BORING LOGS

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 1

Boring Location: *20 feet east of 58th st., south edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/5/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		6" Asphaltic Concrete				
		Dark brown, clayey SAND(SC) with gravel, moist *Weak cementation observed from 6" to 2' below grade*				
		Light brown, silty SAND(SM) with gravel and some boulders, slightly moist *Strong cementation observed from 2' to the bottom of boring*				
	5	*Changed color to tan starting at 5 feet below grade*	*50 / 3"*			
	10		*50 / 1"*			
		(Boring stopped at 12 1/6 feet)				
	15					
	20					
	25					

Boring Stopped at 12 1/6 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 2

Boring Location: *50 feet east of 60th st., south edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/5/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		6" Asphaltic Concrete, 6" aggregate Base				
		Red silty, clayey SAND(SC-SM),, slightly moist *Strong cementation observed from 2' to the bottom of boring*				
	5	*Boulder was encountered at 4' below grade* *Hard drilling at 4' to 5' below grade*	*50 / 0"*			
		Softer drilling was encountered at 8' to 10' below grade				
	10	*Harder drilling was encountered at 10' to 13' below grade*	*50 / 1"*			
		Drilling real soft material at 13' to 15' below grade				
	15		*50 / 6"*			
		(Boring stopped at 15 1/2 feet)				
	20					
	25					

Boring Stopped at 15 ½ Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A2

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 3

Boring Location: *20 feet east of 61st place, south edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/5/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		6" Asphaltic Concrete				
		Light brown, silty SAND(SM), slightly moist				
		Moderate cementation observed from 1' to 3' below grade				
		Red, silty, clayey SAND(SC-SM), slightly moist				
		Weak cementation observed from 3' to 10' below grade				
	5		*50 / 5"*			
	10	*Rock contact at 10' below grade*	*50 / 3"*			
		Strong cementation observed from 10' to 15' below grade				
	15	*(Auger Refusal at 15 feet)*	*50 / 0"*			
	20					
	25					

Boring Stopped at 15 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A3

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

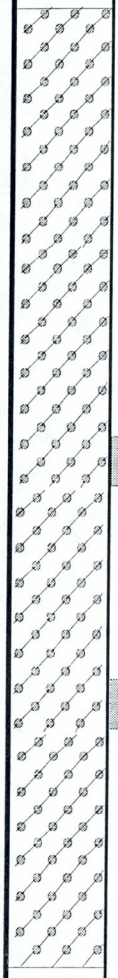
Boring No.: 4

Boring Location: *6625 East Oak street south side*

Equipment used: *Mobile B-50 with 8" diameter auger*

Date of Work: *6/15/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*



Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
	3" Asphaltic Concrete, 9" Aggregate Base				
	Light brown, clayey SAND(SC) with gravel, slightly moist				
	Strong cementation was observed from 1' to the bottom of the boring				
5		*92 / 10"*			
10		*64*	*87 / 11"*		
		78			
15			*72 / 11"*		
		42			
20		*50 / 5 1/2"*			
	(Boring stopped at 21 feet)				
25					

Boring Stopped at 21 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A1

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 5

Boring Location: *68th Place, centerline, south edge of Oak street*

Equipment used: *Mobile B-50 with 8" diameter auger*

Date of Work: *6/15/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		3" Asphaltic Concrete, 9" Aggregate Base				
		Light brown, clayey SAND(SC) with gravel, slightly moist				
		Strong cementation observed from 1' to the bottom of boring				
	5			44		
			30			
	10			82		
			69			
	15					
		Changed color to dark brown, moist from 16 feet to the bottom of boring	27			
	20					
			37			
		(Boring stopped at 21 ½ feet)				
	25					

Boring Stopped at 21 ½ Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A5

ATL, INC.
CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

January 8, 1998

Mr. Mark Gavin, P.E., R.L.S.
EEC/MKE
3501 N. 16th Street
Phoenix, Arizona 85016-7702

Re: Geotechnical Proposal
Flood Control District of Maricopa County
Oak Street Storm Drain, Phase II Design
Proposed Contract No. FCD 97-39
ATL Proposal No. P97332

Dear Mark:

ATL, Inc. (ATL) is pleased to be included as part of the EEC/MKE team submitting its qualifications for the subject Flood Control District of Maricopa County (FCD) project for the final design of the Oak Street Storm Drain System from 56th Street to Miller Road in Scottsdale, Arizona.

ATL's engineering, drilling and technician staff have years of experience in providing geotechnical services for storm drain, box culvert and channel construction. Attached is a list of representative projects that ATL has completed within the past five (5) years for the FCD as well as other municipalities. Attached is a Standard Form 255 for ATL, along with resumes of the following key personnel:

David P. Hayes, P.E.	Project Manager
Ammi Osorio	Project Engineer
James Cowell	Drilling Supervisor

Also attached are manhour and cost estimates for ATL's geotechnical design tasks. Note that we have excluded the cost of materials testing services during construction, although ATL is well-qualified to provide these services if required.

The following sections contain ATL's portion of the first five (5) items of the required proposal format structure; specifically, the "Firm's Capabilities", "Staff Qualifications," "Experience on Similar Projects", "Project Understanding", and "Project Approach". For your information, ATL is a Maricopa County Certified D/MBE firm, No. 99-97.

2912 W. CLARENDON
PHOENIX, AZ 85017
TELEPHONE (602) 241-1097
FAX (602) 277-1306

820 E. 47TH STREET, SUITE B-1
TUCSON, AZ 85713
TELEPHONE (520) 623-4547
FAX (520) 623-4603

1400½ N. BROAD
GLOBE, AZ 85502
TELEPHONE (520) 425-8999
FAX (520) 425-9597

1855 W. KAIBAB LANE SUITE 6
FLAGSTAFF, AZ 86001
TELEPHONE (520) 773-9614
FAX (520) 773-9522

3002-A RIGEL AVENUE
LAS VEGAS, NV 89102
TELEPHONE (702) 871-0492
FAX (702) 871-3643

Firm's Capabilities

ATL, Inc. (ATL) has been providing, geotechnical, environmental, construction materials testing and non-destructive testing services in Arizona since 1967. The firm has undergone several management changes since than, the latest being in December, 1992 when Frank C. Rivera and David P. Hayes, P.E. purchased ATL from Gutierrez-Palmenberg, Inc.

The corporate offices are located in Phoenix, Arizona. ATL has branch offices located in Flagstaff, Tucson, Globe and Cottonwood, Arizona, as well as Las Vegas, Nevada. Our current staff size for all offices is 67 with the majority located in Phoenix. The geotechnical division is located in Phoenix, along with the company's engineering staff.

ATL has its own in-house drilling capability. We own four (4) drill rigs; a Mobil B-56 auger rig, a B-30 trailer rig, a Joy HD-12 rock drill and a portable Minute-Man rig. Depending on the material encountered, the maximum depth capacity is 130 feet with a 4-inch auger. A driller's utility truck is used at every site and contains an on-board portable welder, extra auger, sample storage section, patching materials, and miscellaneous tools. Field resistivity equipment is also available when the 4-terminal method is required. ATL also has a down hole "packer" used for specific projects. For drilling in sand, gravel and cobble material, ATL owns an ODEX 90 System that maintains the hole during drilling. For material that won't collapse during drilling, our HALCO down-hole hammer.

ATL's AASHTO Certified Phoenix Laboratory (No 96-296), will perform the assigned testing. Results are evaluated using traditional analysis in conjunction with several computer programs, including ***GeoPro 3.0 for Windows*** and ***GeoCal for Windows***, both by DataSurge. To evaluated field N values and corresponding settlement/allowable bearing capacity, Tap Software's ***GeoSuite 3.0*** is utilized. From time to time, the McGraw-Hill's, ***Civil Engineer's Solutions Suite,*** CD-ROM is utilized for confirmatory analysis.

For communicating between the office and the field, a combination of pagers and mobile telephones are utilized. To minimize down-time due to mechanical failure, all vehicles are leased and are generally less than 2 years old. A towing and vehicle replacement policy is also in force so that loss time due to vehicle failure is minimized.

Staff Qualifications

ATL's staff has years of experience in the various areas of expertise required for this type of project. While its informative to know that ATL has been in business for 30 years, it is more important to know that the current key staff members have been working together for a significant period of time.

David P. Hayes, P.E. is a part owner and Executive Vice President of ATL. He has been working in the geotechnical and materials testing field for thirty (30) years, both domestically and internationally, 10½ of which have been spent with ATL in Arizona. Mr. Hayes is a registered professional engineer in Arizona and Maryland, is an instructor for the Arizona Technical Institute, and holds a Hazardous Waste Operations 40-hour Certification. While in Arizona, he has completed over 500 geotechnical/environmental projects, involving pavement design, shallow and deep foundation design, open channel design using slope stability analysis, earth dam design, pipe and box culvert foundation design, and construction material usage determinations. Specific knowledge areas include subgrade design using soil cement, cement stabilized alluvium and lime stabilization techniques, roller-compacted concrete designs, asphalt stabilization options, rigid and flexible pavement design for roadways and airports. Past clients include, MCDOT, FCDMC, ADOT, City of Phoenix, City of Glendale, City of Tucson, City of Flagstaff, private industry, developers, consultants, architects, mining companies, etc.

James Cowell is a native Arizonian from Quartzite. He worked as a Materials Technician and Civil Engineering Tech III for ADOT during his 22-year tenure, evaluating potential borrow sources throughout the State, sampling these locations, determining the representative geology for each area and overseeing the testing program to obtain physical parameters. Mr. Cowell joined ATL in 1983 as a Senior Driller. Since than, he has assumed the rolls of Field Supervisor and Drilling Supervisor on over 1000 projects, for the same mix of clients indicated above for Mr. Hayes. Mr. Cowell has a total of 36 years of experience in drilling, geology identification, soils classification and behavior. He is a Certified Well Driller (No. 561) and Hazardous Waste Operations Certified. Mr. Cowell is also Schools Certified for Asbestos sampling and testing.

Ms. Ammi Osorio is the Project Engineer that oversees the laboratory testing, developing of the final boring logs and writes a portion of the final report. Ms. Osorio has 15 years of domestic and international experience as a Civil Engineer, Inspector and Estimator. For the past 15 months, Ms. Osorio has participated in developing, analyzing and designing pavements and foundations for over 90 projects. Her primary role is to insure that the laboratory testing and reporting schedules are met and that the testing conforms to the designated standard.

Another key member of the staff is the Division's Administrative Assistant, Barbara Cole. She prepares the draft and final report documents , assembles the final reports, coordinates directly with the client to insure that requested number of reports is provided on the date requested. Ms. Cole has been providing professional secretarial and administrative services for over 15 years and has been involved with consulting engineers for over 3 years.

Experience on Similar Projects

The attached project lists present a few examples of ATL's involvement in providing pavement design for MCDOT. For your information, we have attached a copy of utility design projects completed since 1992, as well as a list of FCD projects completed during the same time frame. Mr. Hayes and Mr. Cowell worked on all of these projects, with Ms. Osorio and Ms. Cole having participated on all the 1997 projects and a portion of the 1996 projects. ATL has provided data in both Metric and English formats and our staff is comfortable working in either system.

Project Understanding

This is a joint project between the Flood Control District of Maricopa County, the City of Phoenix and the City of Scottsdale, with the FCD acting as the design lead agency. The stated scope of work for this project is to provide all professional engineering services necessary for the final design, preparation of Plans, Special Provisions, and cost estimates for construction of the Oak Street Storm Drain, Phase II and required utility relocations. Phase I of the this system has already been designed and will be under construction as the final design for Phase II begins.

Phase II includes design of the storm drain along Oak Street, from the Indian Bend Wash to 66th Street, from 64th Street to 58th Street along Oak Street, and the modification of the Autopark detention basin. Sediment basins/traps must also be designed for the inlets on the west side of 64th Street. The estimated length of storm drain is 2 miles.

There was a pre-design study entitled "Scottsdale, Tempe, Phoenix (STP Papago Park Regional Watershed Study" performed by Kimley-Horn and Associates, Inc. for the FCD and a final design for Phase I performed by Entellus Engineering for the City of Scottsdale. The information from these reports should be used in the final design of Phase II.

Project Approach

The overall investigation shall be conducted in accordance with the latest version of NAVFAC DM-7.1. Design parameters shall be computed in general accordance with the latest version of NAVFAC DM-7.2. and the report sealed by an Arizona registered Professional Engineer.

The purpose of performing a geotechnical investigation for the construction of a storm drain system is conducted primarily to determine the different soil classifications that are present within the construction zone and their physical characteristics. Soils boring provide information concerning in-situ conditions such as the height of the water table, the moisture condition of the subsoil at the time the investigation took place, and the density of the soil within the proposed construction zone. When box culverts and/or pipe sections are to be constructed in place, equivalent fluid pressures are needed to design vertical wall and shell thicknesses. Allowable bearing capacities and anticipated settlements must also be determined to avoid detrimental cracking due to the movement of the supporting soils. Corrosivity potential of the soils surrounding the storm drain structures must be determined in order to present effective pipe material alternates.

It is important that the design team consider the constructability of the proposed system. The depth of construction, the unconfined compressive strengths of the soils that will form the trench walls, the presence of water and rock within the construction zone, and the suitability of the soils to be excavated for re-use as backfill, are all parameters that will effect the cost of the project and its duration. Part B of the OSHA requirements presented in CFR 40 must be adhered to by the contractor. The design teams's awareness of the data required by the contractor to insure conformance is critical to the methods he will use to construct the system.

For underground utilities, it is common to space soil borings at an interval of 1,320 feet. At box culvert locations, one boring will be drilled at the inlet and one boring at the outlet for boxes less than 500 feet in length. For each increase in length of 1000 feet, one additional boring will be drilled. Each boring depth will generally be 3 feet below the planned invert. Based on the Phase I proposed structure types and depths, the following drilling program is planned:

1. From Indian Bend Wash and Miller Road, west to Scottsdale Road, four (4) borings, 15 feet deep each will be drilled for the proposed box culvert construction.
2. From Scottsdale Road west to 68th Street, two (2) borings, 15 feet deep each will be drilled for the proposed pipe.

3. From 68th Street west to the Cross Cut Canal, one (1) boring will be drilled to a depth of 20 feet.
4. From 64th Street west to the end of the project, three (3) borings will be drilled to an average depth of 14 feet each.
5. One boring, 5 feet in depth, will be drilled at the Autopark basin location south of 66th Street.

A total of eleven (11) borings totaling 147 feet of drilling will be completed in the field with field resistivity readings taken at each boring location. Both bulk samples off the auger flights and ring samples will be taken and "N" values or blow counts per foot determined at 5-foot depth intervals in each boring. Laboratory testing will consist of:

Sieve Analysis	Moisture	Plasticity Index
Standard Proctor	Unit Weight	Swell
Consolidation	Unconfined Compression	

In order to assess the corrosivity potential of the soil below and around the proposed box culvert and storm drain pipes, field resistivity readings shall be obtained at each boring, beginning at Miller Road. The "In-place, 4-terminal" method will be employed to determine in-situ resistivity levels. When resistivity values fall below 2,000 ohms/cm^3, additional readings shall be made at intervals of not less than 25 nor more than 100 feet from the borehole until the area of low resistance soils is fully defined.

Prior to finalizing the boring and testing plan, ATL will review plans for similar projects, particularly of the storm drain section from 64th Street to 66th Street at the Cross Cut Canal. The contract for this project has been awarded and should be under construction at the time of our investigation. By viewing their open cuts, we will obtain valuable information about the soil profile that can be used in ATL's evaluation of the subsoil.

Upon approval of ATL's proposed boring plan, the borings will be located in the field as presented above, "Blue Stakes" notified and a drilling date confirmed. Field drilling and resistivity readings will take 2 days to complete. Laboratory testing will take approximately 10 working days to complete and the report will take 10 additional working days to generate. Estimated total manhours, excluding laboratory testing, is 102 . The estimated total cost, including labor, overhead, profit, laboratory testing and direct expenses is $6,683.00.

ATL plans to perform all geotechnical, testing and reporting work out of the Phoenix corporate office. Currently, we are completing Camelback Ranch Levee, Alma School Road, Meridian Road , and Bullard Wash projects for the FCD. For three of the projects, the reports have been submitted and ATL is responding to a few comments on each. The Camelback Ranch Levee Phase II report will be completed before February 1, 1998.

ATL looks forward to working with EEC/MKE and FCD on this important project in the Scottsdale area.

Very truly yours,

David P. Hayes, P.E.
Executive Vice President

DPH/brc
Attach.
cc: F. Rivera

OAK STREET STORM DRAIN, PHASE II DESIGN
Maricopa County, Arizona
FCD 97-39

ATL Job No. 198007

Boring No.: 6

Boring Location: *50 feet west of 71st street, north side of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/16/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		4" Asphaltic Concrete, 10" Aggregate Base				
		Brown, sandy fat CLAY(CH), moist *Strong cementation observed from 14 inches to the bottom of boring*				
	5		*41*			
	10		*70 / 11"*			
	15		*50 / 4"*			
		(Boring stopped at 15 1/3 feet)				
	20					
	25					

Boring Stopped at 15 1/3 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

OAK STREET STORM DRAIN, PHASE II DESIGN
Maricopa County, Arizona
FCD 97-39

ATL Job No. 198007

Boring No.: 7

Boring Location: *200 feet east of Scottsdale Rd. North edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/16/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		2" Asphaltic Concrete, 10" Aggregate Base				
		Dark brown, sandy fat CLAY(CH), moist				
		Strong cementation observed from 1' to the bottom of boring				
		Changed color to light brown 3' to the bottom of boring, slightly moist				
	5		*19*			
	10		*81 / 10"*			
	15		*50 / 4"*			
		(Boring stopped at 15 5/6 feet)				
	20					
	25					

Boring Stopped at 15 5/6 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

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OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 8

Boring Location: *7302 east Oak street, north edge*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/5/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		4" Asphaltic Concrete, 4" Aggregate Base				
		Light brown, clayey SAND(SC), slightly moist				
		Moderate cementation observed from 2' to the bottom of boring				
	5		*60*			
	10		*37*			
		(Boring stopped at 12 feet)				
	15					
	20					
	25					

Boring Stopped at 12 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 9

Boring Location: *20 feet west of 74th way, north edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/16/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		3" Asphaltic Concrete, 12" Aggregate Base				
		Dark brown, sandy lean CLAY(CL), moist				
		Strong cementation observed from 13" to the bottom of boring				
	5		*10*			
	10		*13*			
		(Boring stopped at 12 feet)				
	15					
	20					
	25					

Boring Stopped at 12 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 10

Boring Location: *300 feet west of Miller Rd., north edge of Oak st.*

Equipment used: *Mobile B-50 with 4" diameter auger*

Date of Work: *6/16/98* **Elevation of Boring:** *Existing grade*

Drilled by: *K. Phillips* **Logger:** *K. Phillips* **Reviewed By:** *A. Osorio*

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		3" Asphaltic Concrete, 13" Aggregate Base				
		Brown, sandy fat CLAY(CH), moist *Strong cementation observed from 16" to the bottom of boring*				
	5	*Brown, c layey SAND(SC) with gravel, slightly moist*	*17*			
	10	*Hard drilling starting at 10 ½ feet below grade*	*50 / 1"*			
		(Boring stopped at 12 feet)				
	15					
	20					
	25					

Boring Stopped at 12 Feet below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

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OAK STREET STORM DRAIN, PHASE II DESIGN

Maricopa County, Arizona

FCD 97-39

ATL Job No. 198007

Boring No.: 11

Boring Location: 50 feet south of 65th st. Edge of pavement
100 feet east of 65th st. Centerline

Equipment used: Mobile B-50 with 4" diameter auger

Date of Work: 6/2/98 **Elevation of Boring:** Existing grade

Drilled by: K. Phillips **Logger:** K. Phillips **Reviewed By:** A. Osorio

Graphical Log	Depth (Feet)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	% Passing No. 200	Plasticity Index
		Light brown, clayey SAND(SC) with gravel, slightly moist Strong cementation observed from 0 to the bottom of boring				
	5	Changed color to dark brown, moist starting at 5 feet to the bottom of boring	92 / 11"			
	10	(Boring stopped at 10 1/3 feet)	50 / 4"			
	15					
	20					
	25					

Boring Stopped at 10 1/3 Feet below Existing Grade	Groundwater	Initial Depth	Hour	24 Hour Depth
		None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A11

APPENDIX B

LABORATORY TEST RESULTS

SUMMARY OF LABORATORY ANALYSIS

CLIENT: EEC/MKE DATE: 06/25/98

PROJECT: OAK STREET STORM DRAIN, PHASE II DESIGN

LOCATION: 56TH STREET TO MILLER ROAD, SCOTTSDALE, ARIZONA

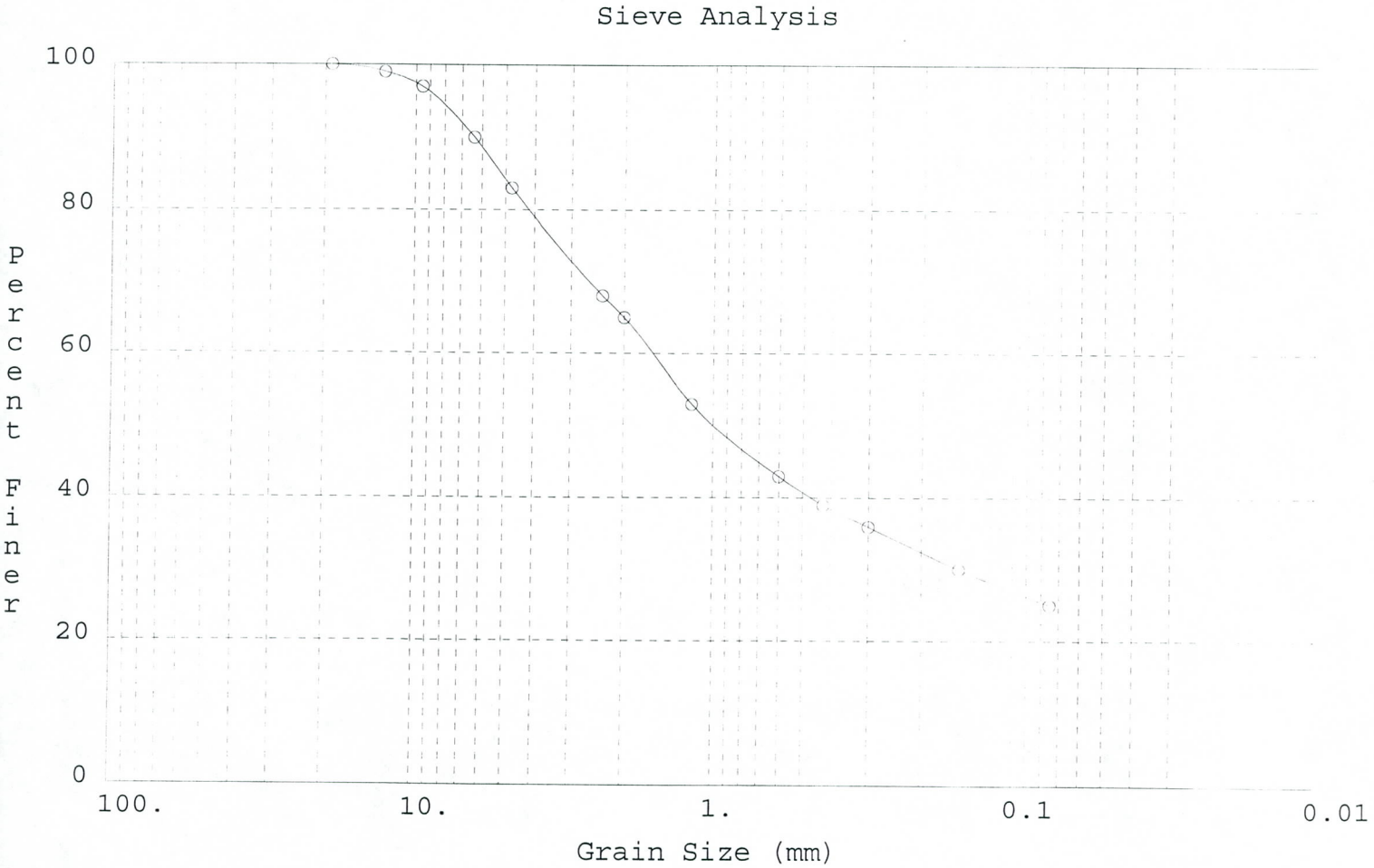
MATERIAL: See Below SAMPLING DATE: 6/03,05,15 AND 16/98

REQUESTED BY: David Hayes ATL JOB NO: 198007

BORING No.	DEPTH (Feet)	IN-SITU Moist %	USCS	LL	PI	SIEVE ANALYSIS - PERCENT PASSING											
						200	100	50	40	30	16	10	4	3/8	3/4	1.5	3.0
1	5 - 12	7.4	SM	46	15	24.7	30	36	39	43	53	65	83	97	100	-	-
2	10 - 13	1.9	SC-SM	19	4	21.2	26	33	38	44	58	73	93	98	100	-	-
3	10 - 15	2.4	SC-SM	22	6	29.2	37	45	49	55	67	80	95	100	-	-	-
4	5 - 10	12.5	SC	57	27	41.0	45	48	50	52	58	66	81	95	99	100	-
5	1 - 16	11.7	SC	45	19	34.4	40	45	47	50	57	66	77	93	100	-	-
6	5 - 10	14.5	CH	58	30	52.3	59	62	63	65	70	74	86	96	99	100	-
7	10 - 15	15.3	CH	54	37	59.7	67	72	74	77	83	87	94	98	99	100	-
8	0.33 - 5	10.2	SC	46	25	35.8	43	48	50	53	60	75	91	98	100	-	-
9	5 - 10	9.2	CL	34	16	51.2	61	68	71	74	80	85	91	97	100	-	-
11	5 - 10	11.8	SC	67	28	24.1	30	35	37	41	48	58	79	93	99	100	-

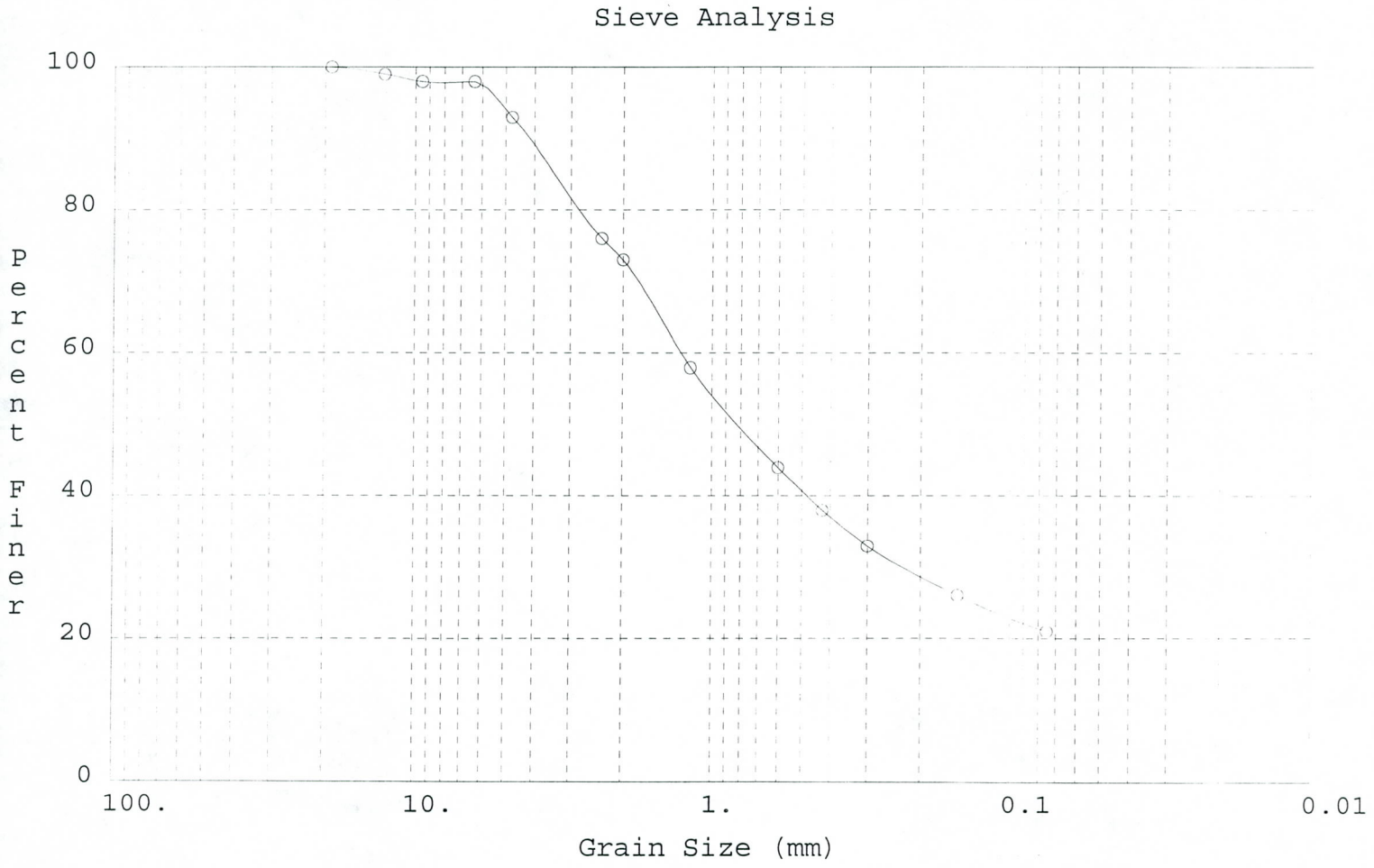
Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/12/98
Tested By = D. Johnson
Boring Number = 1
Depth = 5' - 12'
Sample Number = 98-0579
Description = Tan, silty SAND(SM) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	10.00	1.00	1.00	99.00
3/8"	9.500	20.00	2.00	3.00	97.00
1/4"	6.350	70.00	7.00	10.00	90.00
#4	4.750	70.00	7.00	17.00	83.00
#8	2.360	150.00	15.00	32.00	68.00
#10	2.000	30.00	3.00	35.00	65.00
#16	1.180	120.00	12.00	47.00	53.00
#30	0.600	100.00	10.00	57.00	43.00
#40	0.425	40.00	4.00	61.00	39.00
#50	0.300	30.00	3.00	64.00	36.00
#100	0.150	60.00	6.00	70.00	30.00
#200	0.075	50.00	5.00	75.00	25.00
Pan	0.000	0.00	0.00	75.00	25.00



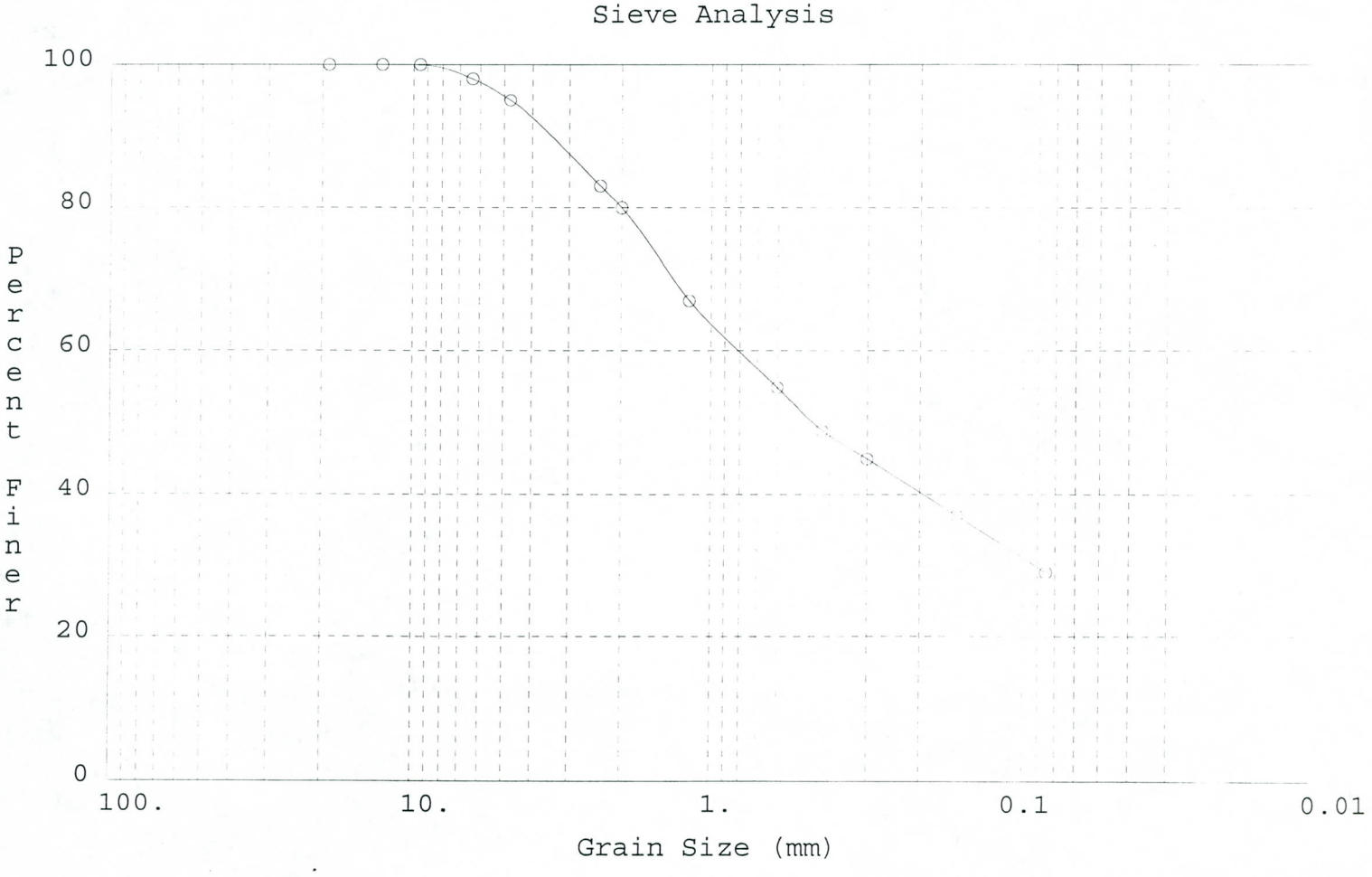
Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/12/98
Tested By = D. Johnson
Boring Number = 2
Depth = 10' - 13'
Sample Number = 98-0580
Description = Red,silty, clayey SAND(SC-SM)
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	10.00	1.00	1.00	99.00
3/8"	9.500	10.00	1.00	2.00	98.00
1/4"	6.350	0.00	0.00	2.00	98.00
#4	4.750	50.00	5.00	7.00	93.00
#8	2.360	170.00	17.00	24.00	76.00
#10	2.000	30.00	3.00	27.00	73.00
#16	1.180	150.00	15.00	42.00	58.00
#30	0.600	140.00	14.00	56.00	44.00
#40	0.425	60.00	6.00	62.00	38.00
#50	0.300	50.00	5.00	67.00	33.00
#100	0.150	70.00	7.00	74.00	26.00
#200	0.075	50.00	5.00	79.00	21.00
Pan	0.000	0.00	0.00	79.00	21.00



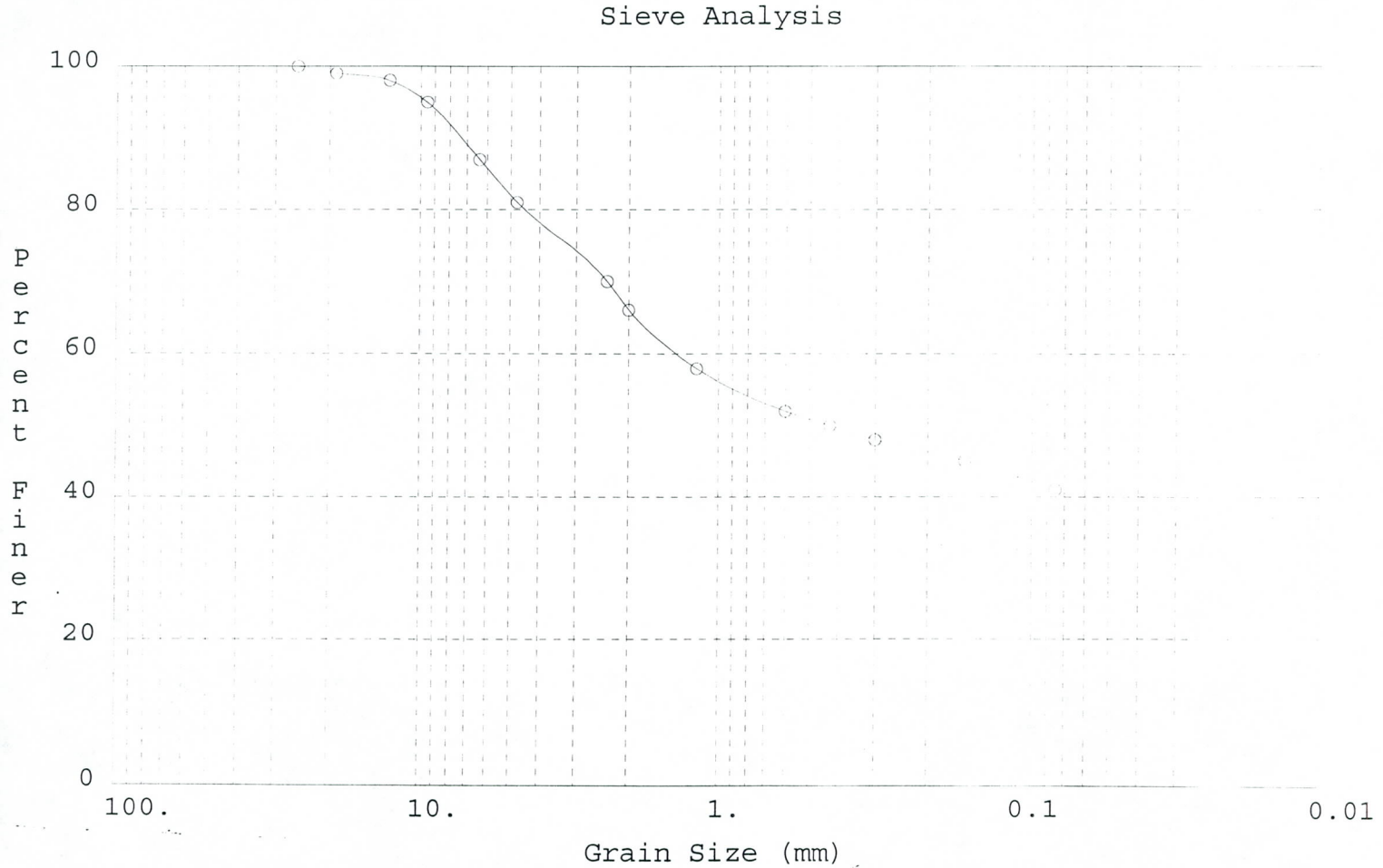
Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/12/98
Tested By = D. Johnson
Boring Number = 3
Depth = 10' - 15'
Sample Number = 98-0581
Description = Red, silty, clayey SAND(SC-SM)
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	0.00	0.00	0.00	100.00
3/8"	9.500	0.00	0.00	0.00	100.00
1/4"	6.350	20.00	2.00	2.00	98.00
#4	4.750	30.00	3.00	5.00	95.00
#8	2.360	120.00	12.00	17.00	83.00
#10	2.000	30.00	3.00	20.00	80.00
#16	1.180	130.00	13.00	33.00	67.00
#30	0.600	120.00	12.00	45.00	55.00
#40	0.425	60.00	6.00	51.00	49.00
#50	0.300	40.00	4.00	55.00	45.00
#100	0.150	80.00	8.00	63.00	37.00
#200	0.075	80.00	8.00	71.00	29.00
Pan	0.000	0.00	0.00	71.00	29.00



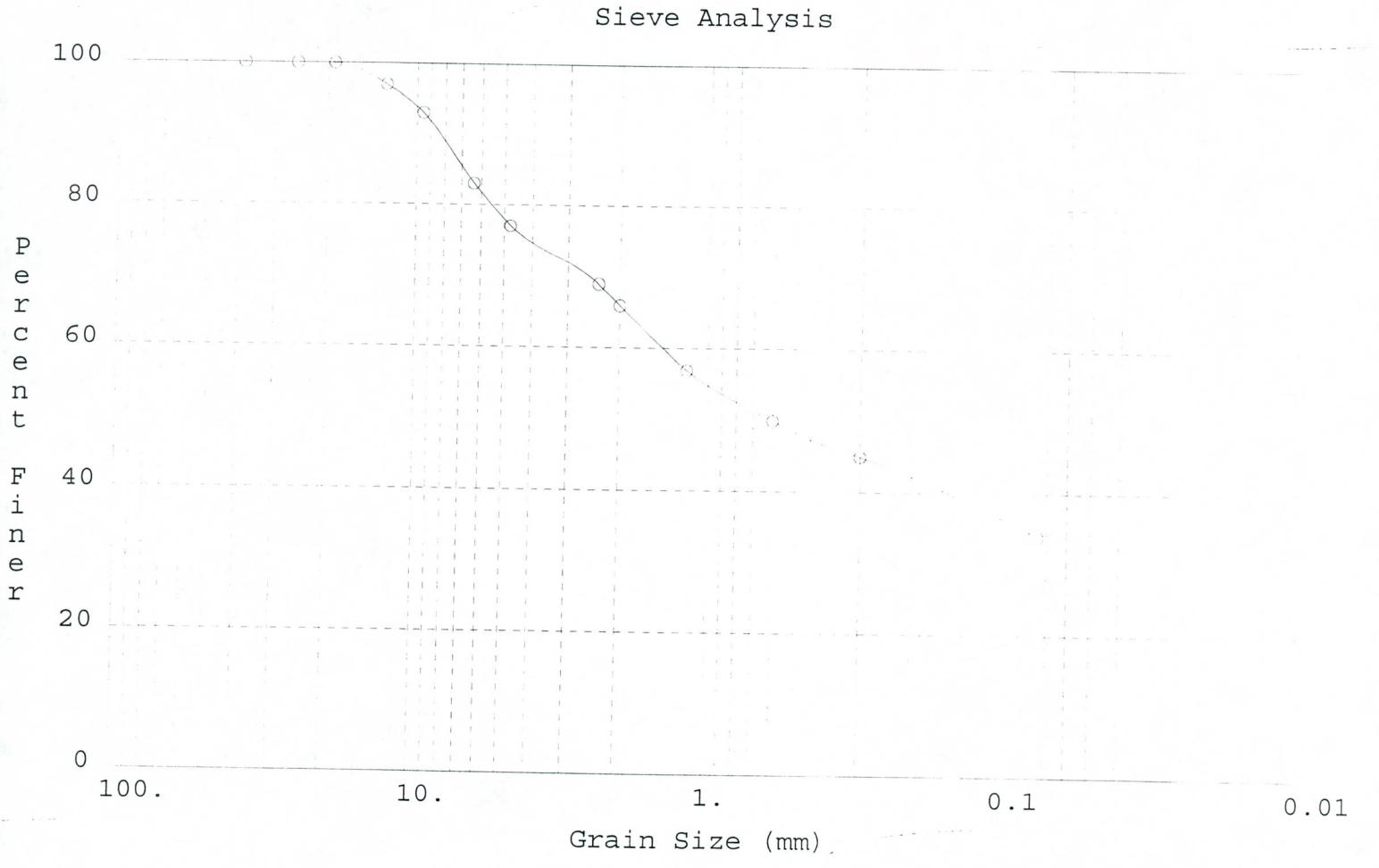
Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/24/98
Tested By = D. Johnson
Boring Number = 4
Depth = 5' - 10'
Sample Number = 98-0598
Description = Light brown, clayey SAND(SC) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1"	25.400	0.00	0.00	0.00	100.00
3/4"	19.050	10.00	1.00	1.00	99.00
1/2"	12.700	10.00	1.00	2.00	98.00
3/8"	9.500	30.00	3.00	5.00	95.00
1/4"	6.350	80.00	8.00	13.00	87.00
#4	4.750	60.00	6.00	19.00	81.00
#8	2.360	110.00	11.00	30.00	70.00
#10	2.000	40.00	4.00	34.00	66.00
#16	1.180	80.00	8.00	42.00	58.00
#30	0.600	60.00	6.00	48.00	52.00
#40	0.425	20.00	2.00	50.00	50.00
#50	0.300	20.00	2.00	52.00	48.00
#100	0.150	30.00	3.00	55.00	45.00
#200	0.075	40.00	4.00	59.00	41.00
Pan	0.000	0.00	0.00	59.00	41.00



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/24/98
Tested By = D. Johnson
Boring Number = 5
Depth = 1' - 16'
Sample Number = 98-0602
Description = Light brown, clayey SAND(SC) with gravel
Dry Sample Weight (g) = 1000

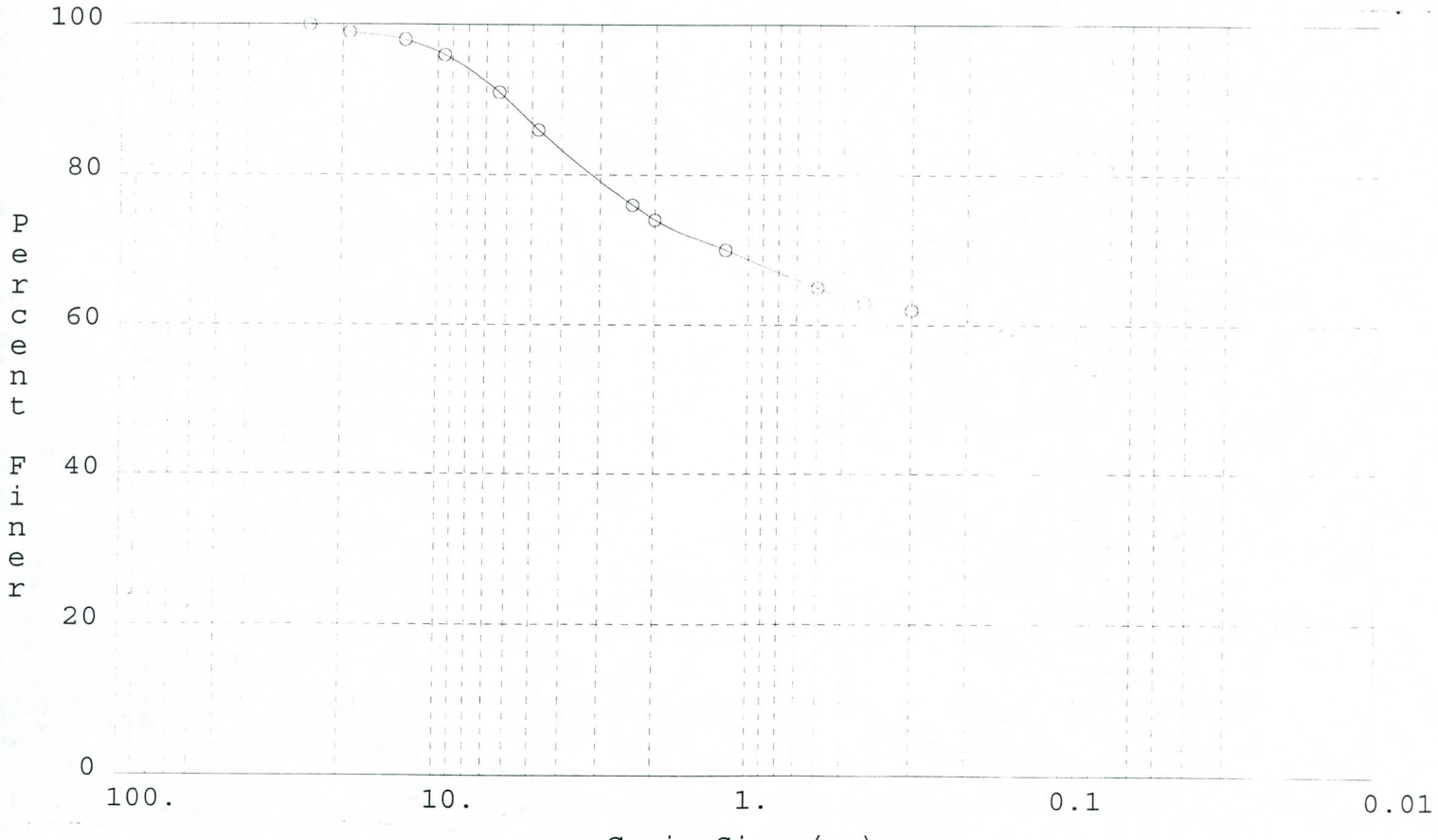
SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1 1/2"	38.100	0.00	0.00	0.00	100.00
1"	25.400	0.00	0.00	0.00	100.00
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	30.00	3.00	3.00	97.00
3/8"	9.500	40.00	4.00	7.00	93.00
1/4"	6.350	100.00	10.00	17.00	83.00
#4	4.750	60.00	6.00	23.00	77.00
#8	2.360	80.00	8.00	31.00	69.00
#10	2.000	30.00	3.00	34.00	66.00
#16	1.180	90.00	9.00	43.00	57.00
#30	0.600	70.00	7.00	50.00	50.00
#40	0.425	30.00	3.00	53.00	47.00
#50	0.300	20.00	2.00	55.00	45.00
#100	0.150	50.00	5.00	60.00	40.00
#200	0.075	60.00	6.00	66.00	34.00
Pan	0.000	0.00	0.00	66.00	34.00



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/24/98
Tested By = D. Johnson
Boring Number = 6
Depth = 5' - 10'
Sample Number = 98-0604
Description = Brown, sandy fat CLAY(CH)
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1"	25.400	0.00	0.00	0.00	100.00
3/4"	19.050	10.00	1.00	1.00	99.00
1/2"	12.700	10.00	1.00	2.00	98.00
3/8"	9.500	20.00	2.00	4.00	96.00
1/4"	6.350	50.00	5.00	9.00	91.00
#4	4.750	50.00	5.00	14.00	86.00
#8	2.360	100.00	10.00	24.00	76.00
#10	2.000	20.00	2.00	26.00	74.00
#16	1.180	40.00	4.00	30.00	70.00
#30	0.600	50.00	5.00	35.00	65.00
#40	0.425	20.00	2.00	37.00	63.00
#50	0.300	10.00	1.00	38.00	62.00
#100	0.150	30.00	3.00	41.00	59.00
#200	0.075	60.00	6.00	47.00	53.00
Pan	0.000	0.00	0.00	47.00	53.00

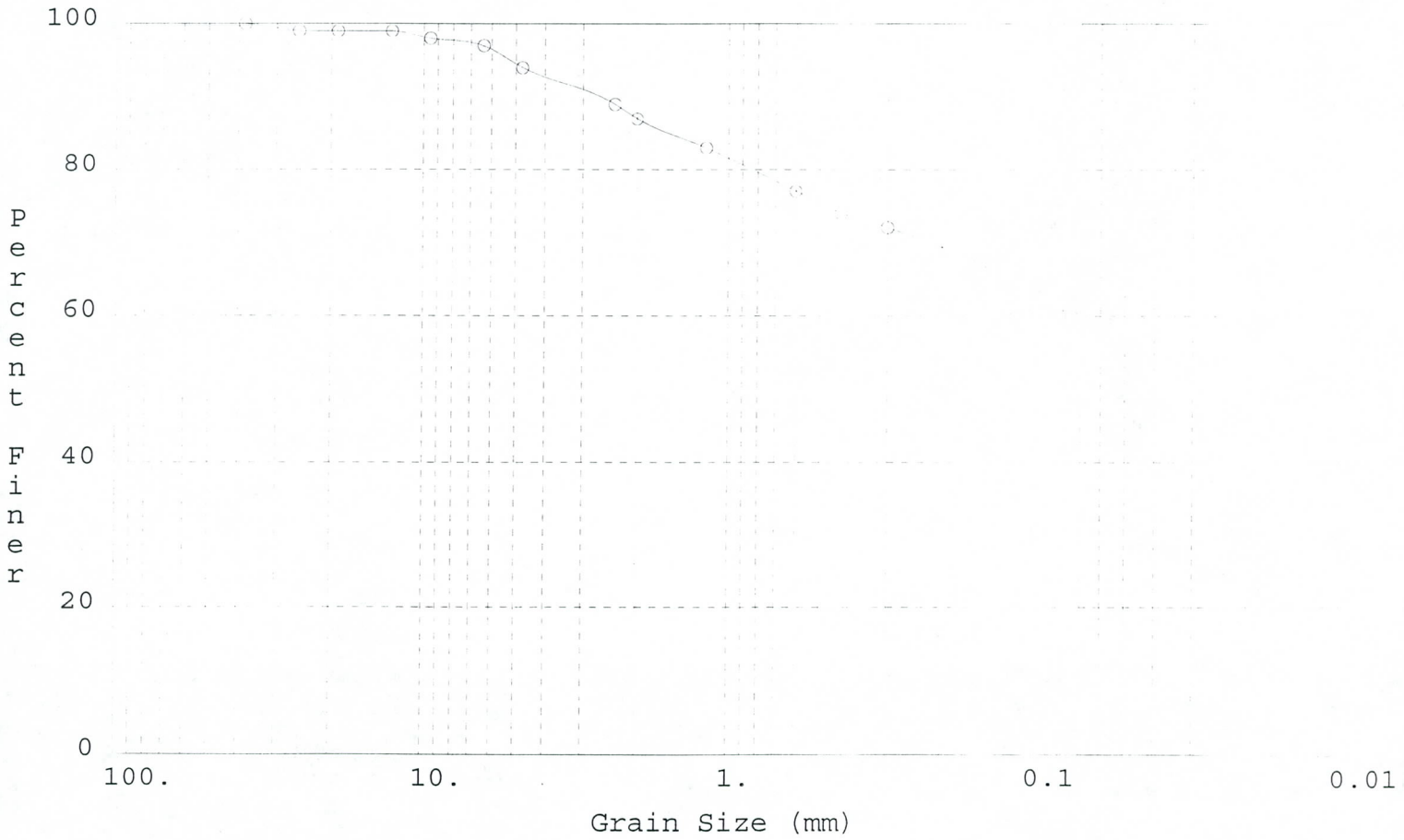
Sieve Analysis



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/24/98
Tested By = D. Johnson
Boring Number = 7
Depth = 10' - 15'
Sample Number = 98-0605
Description = Dark brown, sandy fat CLAY(CH)
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1 1/2"	38.100	0.00	0.00	0.00	100.00
1"	25.400	10.00	1.00	1.00	99.00
3/4"	19.050	0.00	0.00	1.00	99.00
1/2"	12.700	0.00	0.00	1.00	99.00
3/8"	9.500	10.00	1.00	2.00	98.00
1/4"	6.350	10.00	1.00	3.00	97.00
#4	4.750	30.00	3.00	6.00	94.00
#8	2.360	50.00	5.00	11.00	89.00
#10	2.000	20.00	2.00	13.00	87.00
#16	1.180	40.00	4.00	17.00	83.00
#30	0.600	60.00	6.00	23.00	77.00
#40	0.425	30.00	3.00	26.00	74.00
#50	0.300	20.00	2.00	28.00	72.00
#100	0.150	50.00	5.00	33.00	67.00
#200	0.075	70.00	7.00	40.00	60.00
Pan	0.000	0.00	0.00	40.00	60.00

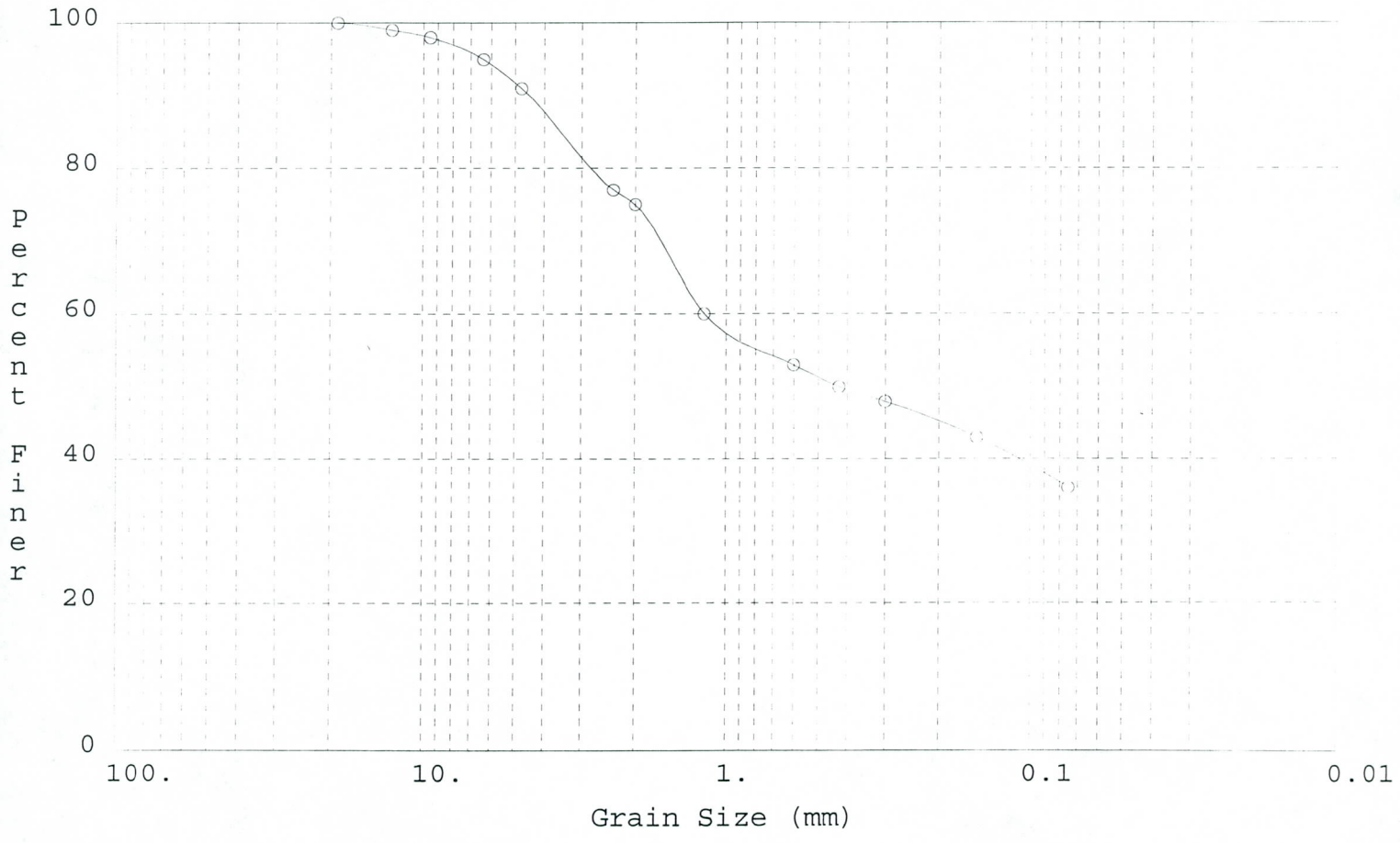
Sieve Analysis



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/12/98
Tested By = D. Johnson
Boring Number = 8
Depth = 1 1/3' - 5'
Sample Number = 98-0582
Description = Light brown, clayey SAND(SC)
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	10.00	1.00	1.00	99.00
3/8"	9.500	10.00	1.00	2.00	98.00
1/4"	6.350	30.00	3.00	5.00	95.00
#4	4.750	40.00	4.00	9.00	91.00
#8	2.360	140.00	14.00	23.00	77.00
#10	2.000	20.00	2.00	25.00	75.00
#16	1.180	150.00	15.00	40.00	60.00
#30	0.600	70.00	7.00	47.00	53.00
#40	0.425	30.00	3.00	50.00	50.00
#50	0.300	20.00	2.00	52.00	48.00
#100	0.150	50.00	5.00	57.00	43.00
#200	0.075	70.00	7.00	64.00	36.00
Pan	0.000	0.00	0.00	64.00	36.00

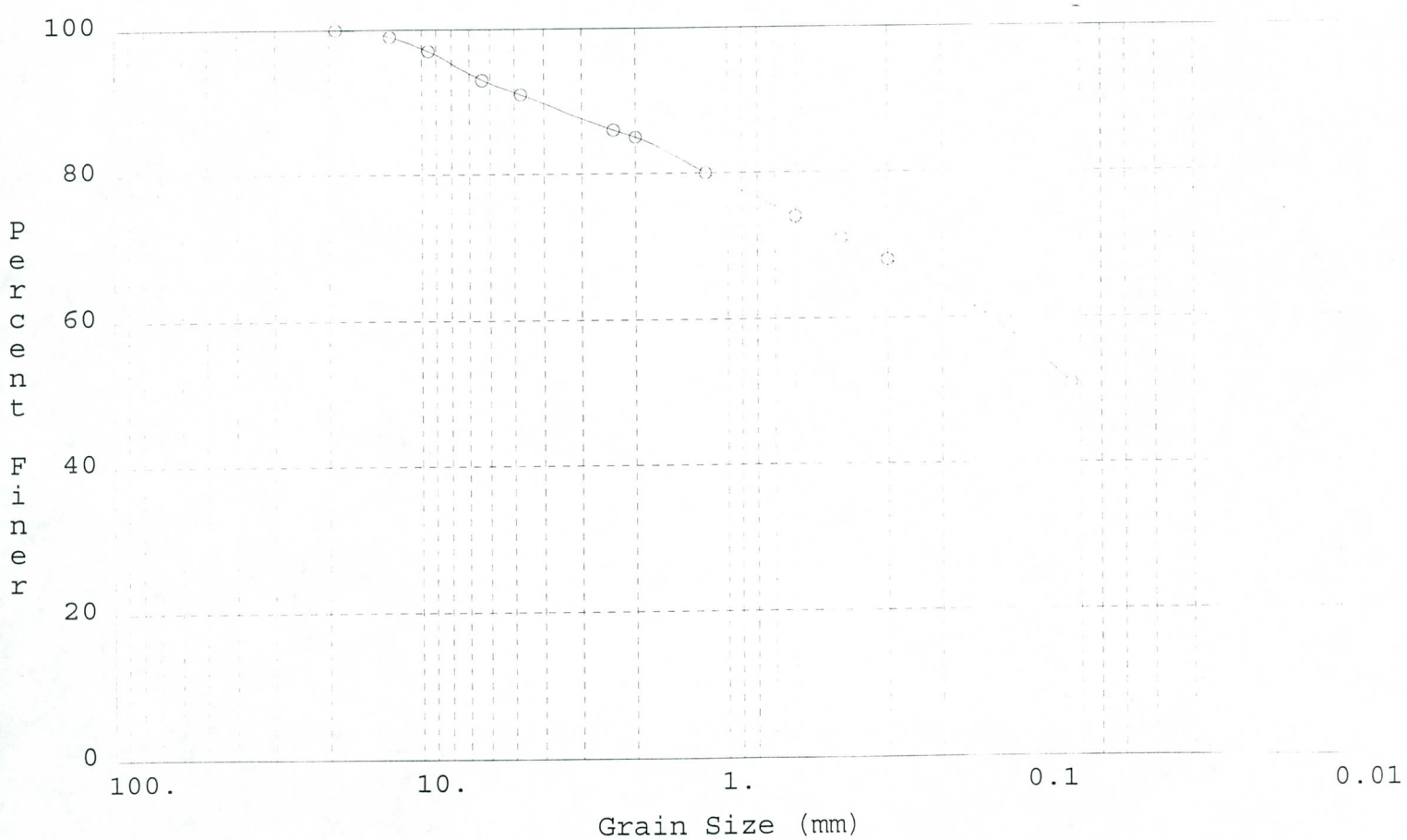
Sieve Analysis



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/24/98
Tested By = D. Johnson
Boring Number = 9
Depth = 5' - 10'
Sample Number = 98-0606
Description = Dark brown, sandy lean CLAY(CL)
Dry Sample Weight (g) = 1000

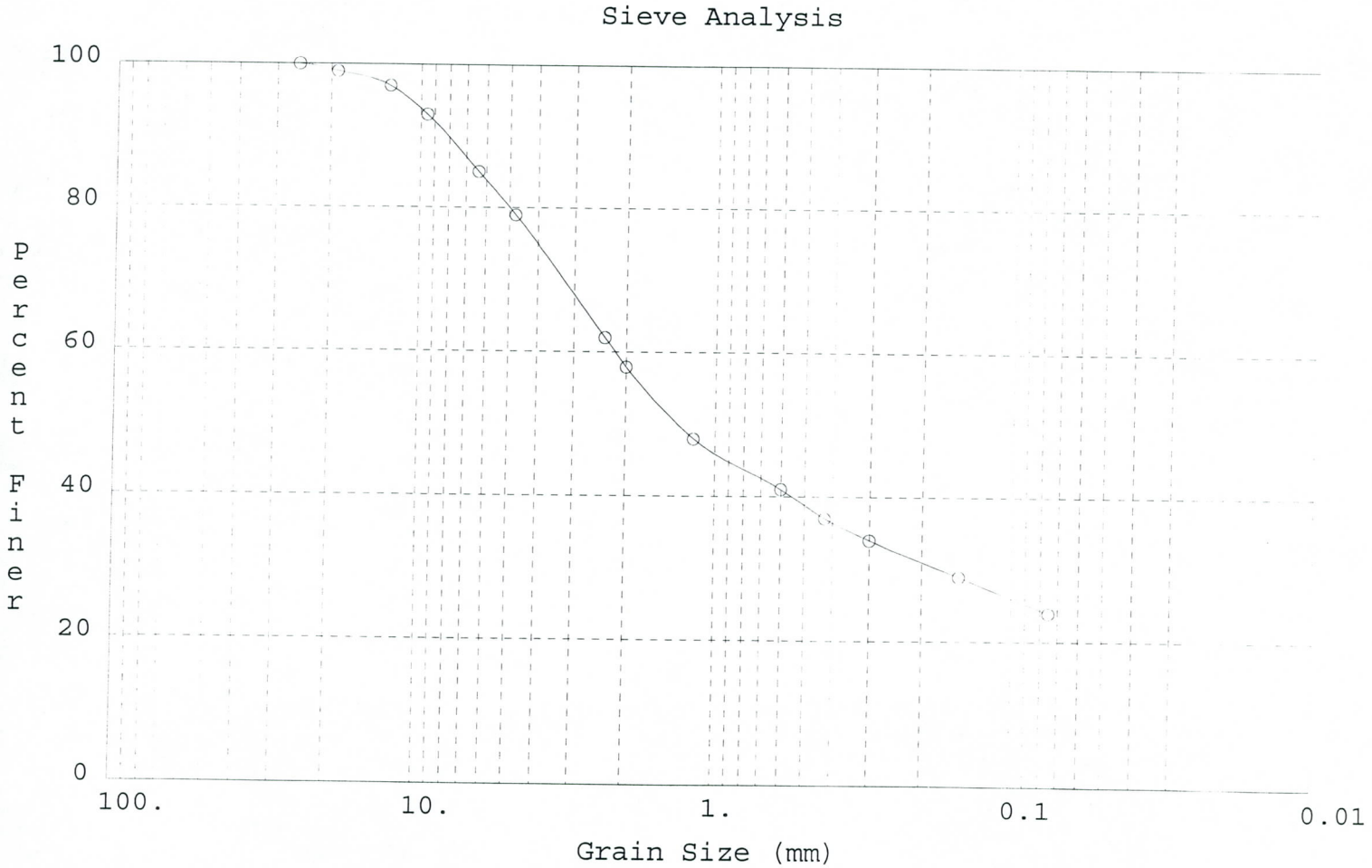
SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	19.050	0.00	0.00	0.00	100.00
1/2"	12.700	10.00	1.00	1.00	99.00
3/8"	9.500	20.00	2.00	3.00	97.00
1/4"	6.350	40.00	4.00	7.00	93.00
#4	4.750	20.00	2.00	9.00	91.00
#8	2.360	50.00	5.00	14.00	86.00
#10	2.000	10.00	1.00	15.00	85.00
#16	1.180	50.00	5.00	20.00	80.00
#30	0.600	60.00	6.00	26.00	74.00
#40	0.425	30.00	3.00	29.00	71.00
#50	0.300	30.00	3.00	32.00	68.00
#100	0.150	70.00	7.00	39.00	61.00
#200	0.075	100.00	10.00	49.00	51.00
Pan	0.000	0.00	0.00	49.00	51.00

Sieve Analysis



Project Number = 198007 Client: EEC/MKE
Location = Oak Street Storm Drain, Phase II Design
Date = 6/5/98
Tested By = M. Castillo
Boring Number = 11
Depth = 5' - 10'
Sample Number = 98-0551
Description = Dark brown, clayey SAND(SC) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1"	25.400	0.00	0.00	0.00	100.00
3/4"	19.050	10.00	1.00	1.00	99.00
1/2"	12.700	20.00	2.00	3.00	97.00
3/8"	9.500	40.00	4.00	7.00	93.00
1/4"	6.350	80.00	8.00	15.00	85.00
#4	4.750	60.00	6.00	21.00	79.00
#8	2.360	170.00	17.00	38.00	62.00
#10	2.000	40.00	4.00	42.00	58.00
#16	1.180	100.00	10.00	52.00	48.00
#30	0.600	70.00	7.00	59.00	41.00
#40	0.425	40.00	4.00	63.00	37.00
#50	0.300	30.00	3.00	66.00	34.00
#100	0.150	50.00	5.00	71.00	29.00
#200	0.075	50.00	5.00	76.00	24.00
Pan	0.000	0.00	0.00	76.00	24.00



ATL, INC.
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GEOTECHNICAL CONSULTANTS

PHOENIX – CORPORATE OFFICE
2912 W. Clarendon • Phoenix, AZ 85017
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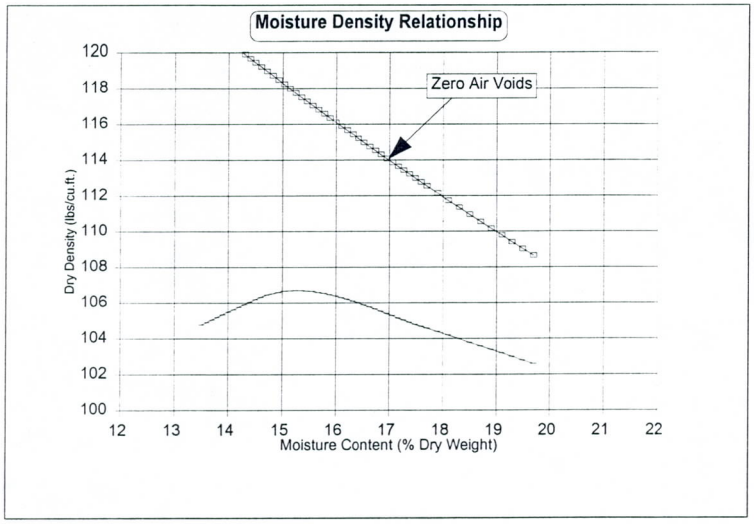
Summary of Moisture Density Relationship Tests

Client:	EEC/MKE 3501 N. 16th Street Phoenix, Arizona 85016-7702	**Job No.**	198007
		Lab No.	98-0599
		Type of Rammer:	Manual
Project:	Oak Street Storm Drain, Phase II Design Scottsdale, Arizona	**Test Date:**	06/24/98
		Material Description:	Light brown, clayey SAND(SC) with gravel
Test Designation:	ASTM D-698		
Test Method:	A	**Sample Source:**	Boring No.: 4 ; Depth: 10' - 15'



Specific Gravity Used For Zero Air Voids Curve: 2.65

Test No.	1	2	3	4
Dry Density (lbs/cu.ft.)	104.8	106.2	104.6	102.6
Moisture Content (%)	13.5	14.5	17.7	19.7

Maximum Dry Density (lbs/cu.ft.): **106.7**
Optimum Moisture Content (% of Dry Weight): **15.3**

Remarks:

Reviewed By:
Input By: AC

Respectfully Submitted:
Joseph B. Lopez, SET
Laboratory Supervisor

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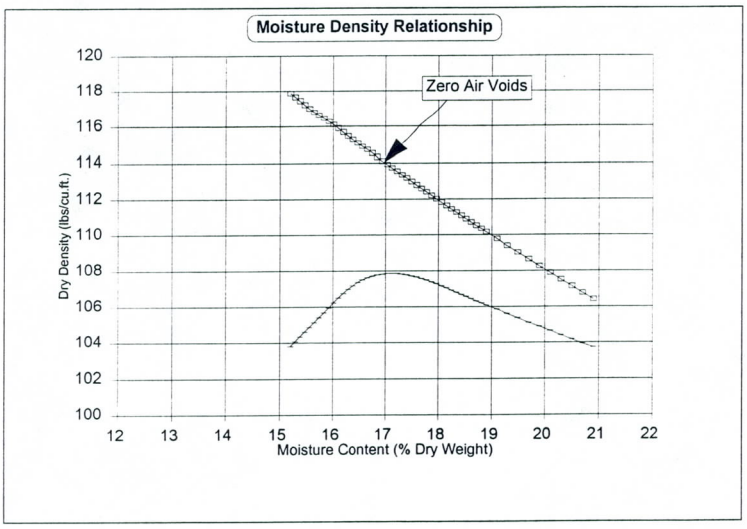
Summary of Moisture Density Relationship Tests

Client:	EEC/MKE 3501 N. 16th Street Phoenix, Arizona 85016-7702	**Job No.**	198007
		Lab No.	98-0713
		Type of Rammer:	Manual
Project:	Oak Street Storm Drain, Phase II Design Scottsdale, Arizona	**Test Date:**	07/17/98
		Material Description:	Dark brown, sandy fat CLAY(CH)
Test Designation:	ASTM D-698		
Test Method:	A	**Sample Source:**	Boring No.: 7 ; Depth: 0 - 15'



Specific Gravity Used For Zero Air Voids Curve: 2.65

Test No.	1	2	3	4
Dry Density (lbs/cu.ft.)	103.8	106.5	106.1	103.7
Moisture Content (%)	15.2	16.1	18.9	20.9

Maximum Dry Density (lbs/cu.ft.): **107.9**
Optimum Moisture Content (% of Dry Weight): **17.1**

Remarks:

Respectfully Submitted:

Reviewed By:
Input By: AO

Joseph B. Lopez, SET
Laboratory Supervisor

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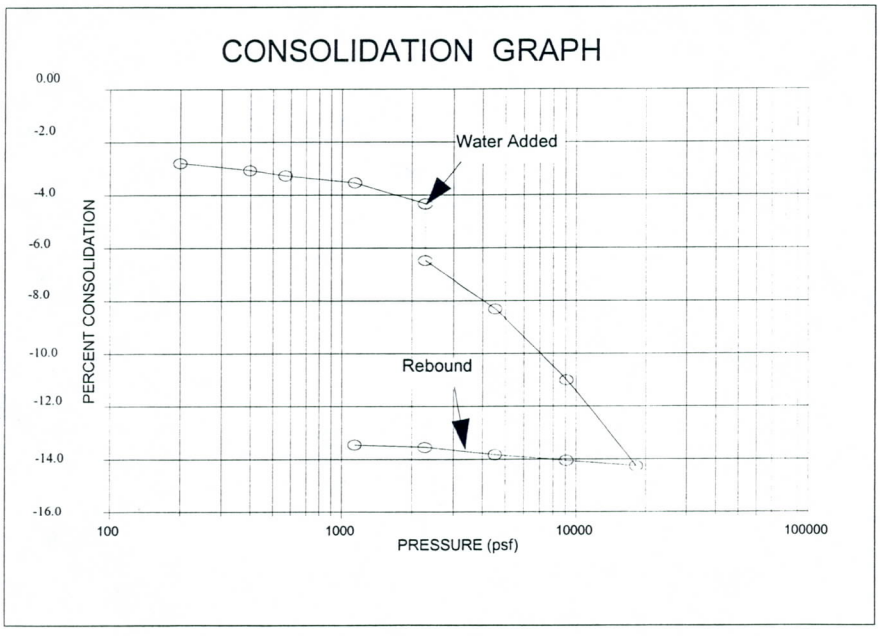
CONSOLIDATION TEST
(ASTM D-2435)

Client:	EEC/MKE, Inc.	**Lab No.:**	98-0603
Project Name :	Oak Street Storm Drain, Phase II Design	**Test Date:**	05/19/98
Project No. :	198007	**Sample Location:**	Boring No.: 5
Initial Reading:	0.2000		Depth:5 1/2' - 6'
Dry Density:	95.3 pcf	**Soil Description:**	Light brown, clayey SAND(SC) with gravel
Moisture Content:	Before: 10.6% After: 28.0%		

LOAD (tsf)	LOAD (psf)	DIAL READING	PERCENT CONSOLIDATION
0.05	100	0.2000	0.00
0.10	200	0.2279	-2.79
0.20	400	0.2306	-3.06
0.29	570	0.2327	-3.27
0.57	1140	0.2353	-3.53
1.14	2280	0.2433	-4.33
1.14	2280	0.2646	-6.46
2.28	4560	0.2830	-8.30
4.56	9120	0.3098	-10.98
9.12	18240	0.3424	-14.24
4.56	9120	0.3404	-14.04
2.28	4560	0.3382	-13.82
1.14	2280	0.3354	-13.54
0.57	1140	0.3345	-13.45



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Fax (520) 773-9522

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1400½ N. Broad
Globe, AZ 85502
(520) 425-8999
Fax (520) 425-9597

COTTONWOOD
2646 Union Drive
Cottonwood, AZ 86326
(520) 646-7311
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Prescott Valley, AZ 86314
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Las Vegas, NV 89102
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OAK STREET STORM DRAIN, PHASE II DESIGN
56TH STREET TO MILLER ROAD
SCOTTSDALE, ARIZONA
ATL JOB NO. 198007

PERCENT SWELL TEST
(Surcharge = 100psf)

Boring No.	Sample Depth (ft)	USCS	Swell (%)	Dry Density (pcf)	Saturation Moisture (%)
5	5½ - 6	SC	1.0	100	28.0

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DRY UNIT WEIGHT

Boring No.	Lab No.	Sample Depth (ft)	Dry Unit Weight (pcf)
5	98-0603	5½ - 6	92.0

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UNCONFINED COMPRESSION TEST

Boring No.	Sample Depth (ft)	Core Height (in)	Average Diameter (in)	Dry Density (pcf)	Compressive Strength (psi)
4	5 - 8	4	2	183.9	79

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pH AND RESISTIVITY TESTS

Boring No.	Depth (Ft)	USCS	pH	Average Soil Resistivity (Ohms /cm^3)
1	5 - 12	SM	8.9	6710
3	10 -15	SC-SM	8.0	4026

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PERCOLATION TEST RESULTS

HOLE NO. 11

READING SEQUENCE	TIME	DROP (Inches)	RATE (MP)
No. 1	1:40 PM to 1:43 PM	1	3
No. 2	1:45 PM to 1:48 PM	1	3
No. 3	1:50 PM to 1:53 PM	1	3
No. 4	1:55 PM to 1:58 PM	1	3
No. 5	2:00 PM to 2:03 PM	1	3
AVERAGE			3

Average Rate in (cm/sec) = 1.4×10^{-2}