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**Geotechnical Engineering Report  
New River Channel Bank Protection  
Grand Avenue to Skunk Creek  
Peoria, Arizona  
R.A.M. Project No. G09326**



**RICKER • ATKINSON • McBEE & ASSOCIATES, INC.**

*Geotechnical Engineering • Construction Materials Testing*

**A371.960**

**Geotechnical Engineering Report  
New River Channel Bank Protection  
Grand Avenue to Skunk Creek  
Peoria, Arizona  
R.A.M. Project No. G09326**

For:  
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8222 South 48<sup>th</sup> Street, Suite 135  
Phoenix, Arizona 85044

December 18, 2003

Attention: Jeff Holzmeister, P.E.

Subject: Geotechnical Engineering Report  
New River Channel Bank Protection  
Grand Avenue to Skunk Creek  
Peoria, Arizona

R.A.M. Project No. G09326

Attached to this letter is the Geotechnical Engineering Report for the New River Channel Bank Protection project to be located in Peoria, Arizona.

The project includes the installation of bank protection from just upstream of Grand Avenue to just downstream of the drop structure which is just south of the confluence of New River and Skunk Creek, and a short section of unprotected bank south of Bell Road on the west bank of New River. The results of our field explorations; laboratory testing; and engineering analysis, evaluation and recommendations are presented in the report.

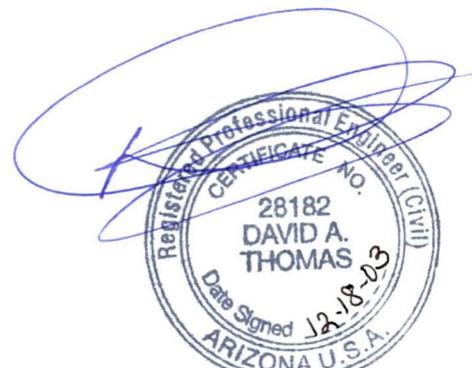
The attached report was prepared based on project and site data available at this time and was prepared in a manner and to the standards of local geotechnical engineering practice. Our services did not include evaluations for the presence of hazardous materials, area subsidence resulting from groundwater withdrawal or other geologic hazards.

If you have any questions, please do not hesitate to call.

Respectfully submitted,  
**RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.**



By: Kenneth L. Ricker, P.E.



Reviewed by: David A. Thomas, P.E.

/ces

Copies to: Addressee (12)

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# REPORT



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## **INTRODUCTION**

This report presents the results of our geotechnical engineering services for New River Channel Bank Protection project to be located in Peoria, Arizona. The scope of our services included performing a field exploration program, laboratory analysis and geotechnical engineering evaluation, analysis and recommendations. The geotechnical recommendations presented herein include those for anticipated excavation conditions, site development, and material use and requirements. We would be pleased to discuss with you any additional recommendations you may require. In addition, we are available to review project specifications and plans for conformance with our recommendations at no charge to you.

## **PROPOSED CONSTRUCTION**

The proposed Channel Bank Protection will extend from above anticipated high water line to just below anticipated scour line along both sides of New River from upstream of Grand Avenue to just downstream of the drop structure below the confluence of New River and Skunk Creek, in Peoria, Arizona. In addition, a short section of unprotected channel bank on the west side of the New River downstream of Bell Road was also included.

## **SITE CONDITIONS**

The existing channel banks along this part of New River are irregular in shape and contain a sparse to heavy growth of weeds, shrubs and trees. The site also contains numerous cobble sized materials on the surface of the slopes and on the channel bottom.

## **FIELD EXPLORATIONS**

Subsurface conditions at the site were explored by excavating 24 test pits to a depth of 10 feet at the locations shown on the Site Plans in Appendix A. The test pits were excavated with a John Deere 310E rubber tired backhoe using a 24-inch wide bucket. The equipment and crew were provided by D&S Drilling, Inc. The test pit locations were determined in the field by our field technician. During the field explorations representative disturbed samples were obtained, the field explorations logged and soils field-classified by our field technician, who also directed the excavation crew and visually estimated the percentage of plus 3-inch material present. The results of our field explorations and observations are presented in the Test Pit Logs in Appendix

A. In addition, twenty-five samples were obtained for agronomy testing from a depth of 18 to 24 inches in the upper one-third of the existing channel bank.

### **LABORATORY ANALYSIS**

Representative samples obtained during the field explorations were subjected to the following tests in our laboratory.

<u>Type of Test</u>	<u>Type of Sample</u>	<u>Number of Samples Tested</u>
Sieve Analysis & Plasticity Index	Representative	24
pH, Minimum Resistivity	Representative	24
Agronomy Tests	Representative	10*

\* Test results and recommendations prepared by IAS Laboratories and presented in Appendix B.

The results of the laboratory analysis are presented in Appendix B.

### **SUBSURFACE CONDITIONS**

The results of the test pits are presented in Appendix A in the Test Pit Logs. In the test pits the soils generally consisted of a mixture of sand, gravel and cobbles with various amounts and types of fines, with some areas containing less cobbles and some areas containing less gravel. The fines ranged from non-plastic to medium plasticity to elastic silt. The soils were medium dense to dense and contained various zones of light to heavy cementation. Soil moisture contents were described as nearly dry to moist throughout the depths explored. No groundwater was observed in the test pits during the field exploration.

### **SITE DEVELOPMENT RECOMMENDATIONS**

#### Channel Bank Protection and Slope:

The channel banks will be protected from scour by the installation of gabions. The gabions will extend from an elevation above the high flow to a depth below the scour line. Based on our slope stability analysis, the steepest recommended slope for the channel bank should be 1.5H:1V.

The existing bank will be reshaped and either cut or filled to final grades, a geotextile placed on the prepared slope surface and the gabions constructed. The channel bottom, where possible will remain in its existing condition.

Material generated from slope cuts and scour toe downs may be screened to generate a part of the required plus 3-inch material to be used as gabion fill.

Earthwork Factors:

Earthwork losses due to ground height losses and shrinkage were estimated based on past experience in the area and the laboratory test data. The estimated ground height losses due to subgrade compaction are as follows for previously upgraded areas:

Ground Height Loss \*

Slope areas and trail/maintenance Road – 0.1 ft.

\* Based on compaction to 95 percent of maximum dry density (ASTM D698), dry densities obtained from samples, and achieving a 10-inch deep compacted zone without stripping natural surface zones

The estimated shrinkage losses from cut to fill zones are as follows for naturally occurring soils:

Estimated Percent Shrinkage \*

Slope areas and trail/maintenance Road – 5 to 10%

\* Based on compaction to 95 percent of maximum dry density (ASTM D698), dry densities obtained from samples of natural undisturbed soils from the near surface zone and local experience.

Excavatability:

The excavatability of site materials is difficult to evaluate based only on the exploration equipment used during this design report. Therefore, we recommend that the contractor evaluate the excavatability of site materials by performing test excavations with the size and type of

equipment the contractor plans on using at the site. For design purposes the following paragraph presents our best analysis as to the excavatability of site soils.

The near surface soils to a depth of at least 10 feet can be removed with conventional excavating equipment. Excavations penetrating the heavily cemented soils will be slower and more difficult. Some caving may occur in the cleaner granular soils. OSHA requires all excavations over five feet in depth, in which personnel are to enter, be either braced or sloped in accordance with OSHA regulations.

Workability:

Wetting site soils such that moisture contents are at or above optimum could result in some soil pumping under dynamic loadings such as heavy construction equipment driving over the area.

Corrosion Potential:

As part of this investigation, laboratory pH and Minimum Resistivity testing of site soils were conducted. Based on these results, there appears to be a moderate potential for corrosion to buried metal structures and pipelines. The results of the laboratory testing are included in Appendix B.

Trail/Maintenance Roads:

The following asphalt concrete pavement sections are based on anticipated trails and for infrequent maintenance vehicle traffic types and frequencies, and site soil conditions. Therefore, any material imported to the site and placed in pavement areas should have support characteristics the same as or better than the site soils.

<u>Area of Use</u>	<u>Pavement Section</u>	
	<u>Asphalt Concrete</u>	<u>Base Material</u>
Trails	2.0 inches	4.0 inches
Maintenance Vehicles	2.0 inches	6.0 inches

These sections are minimal and will require periodic maintenance (seal coats, overlays or patching) where proper drainage is provided and maintained. Should moisture penetrate to the subgrade soils or ponding occur on or adjacent to the pavement section, a significant reduction in pavement life could occur along with increased maintenance. Therefore, good surface drainage on and adjacent to the pavement is essential to achieving the desired pavement life.

## **MATERIALS SUITABILITY AND REQUIREMENTS**

### Site Materials:

The near surface soils may be used as fill and backfills along slopes and in pavement areas, provided these soils are free of organic materials, debris and rubble.

### Base Material:

Base material used below pavement should conform to the requirements of Maricopa Association of Governments (MAG) Specifications for aggregate base (Section 702).

### Asphalt Concrete Pavement:

Asphalt concrete pavement materials should conform to the requirement of Section 321 of the MAG Specifications.

## **SITE PREPARATION AND GRADING PROCEDURES**

### Slope Preparation and Pavement Areas:

Recommendations presented in the previous sections of this report are based upon the following site preparation and grading procedures. Therefore, all earthwork should be accomplished with observation and testing by a qualified technician under the direction of a registered geotechnical/materials engineer. The following apply to the areas within and extending 5 feet beyond slope areas and in pavement areas.

1. Clear and grub the site by removing and disposing of all vegetation, any trash and debris, any rubble and remnants of former developments.

2. Moisture condition and place all fill and backfill materials required to achieve specified grades. Fill materials should be moisture conditioned, placed and compacted in horizontal lifts of thicknesses compatible with the compaction equipment being used.
3. Compact subgrade, fill, backfill, subbase fill or base material to the following minimum percent compaction of the ASTM D698 maximum dry density in each lift:

<u>Material</u>	<u>Minimum Percent Compaction</u>
Soil	
Below pavement sections and in slope areas -----	95
Outside of pavement and slope areas -----	90
Base Material:	
Below pavement sections -----	100

4. Moisture content of soil and base materials at the time of compaction should be:

<u>Type</u>	<u>Area of Use</u>	<u>Moisture Content</u>
On-site	Slope Areas	Optimum plus or minus 3%
On-Site	Pavements	2% below optimum or lower
Import	Slope Areas	Optimum plus or minus 3%
Import	Pavements	2% below optimum or lower
Base Material	Pavements	Optimum plus or minus 3%

5. Place asphalt concrete in accordance with MAG Specifications Section 310 and 702, as applicable, using materials which comply with Section 321 of the MAG Specifications.

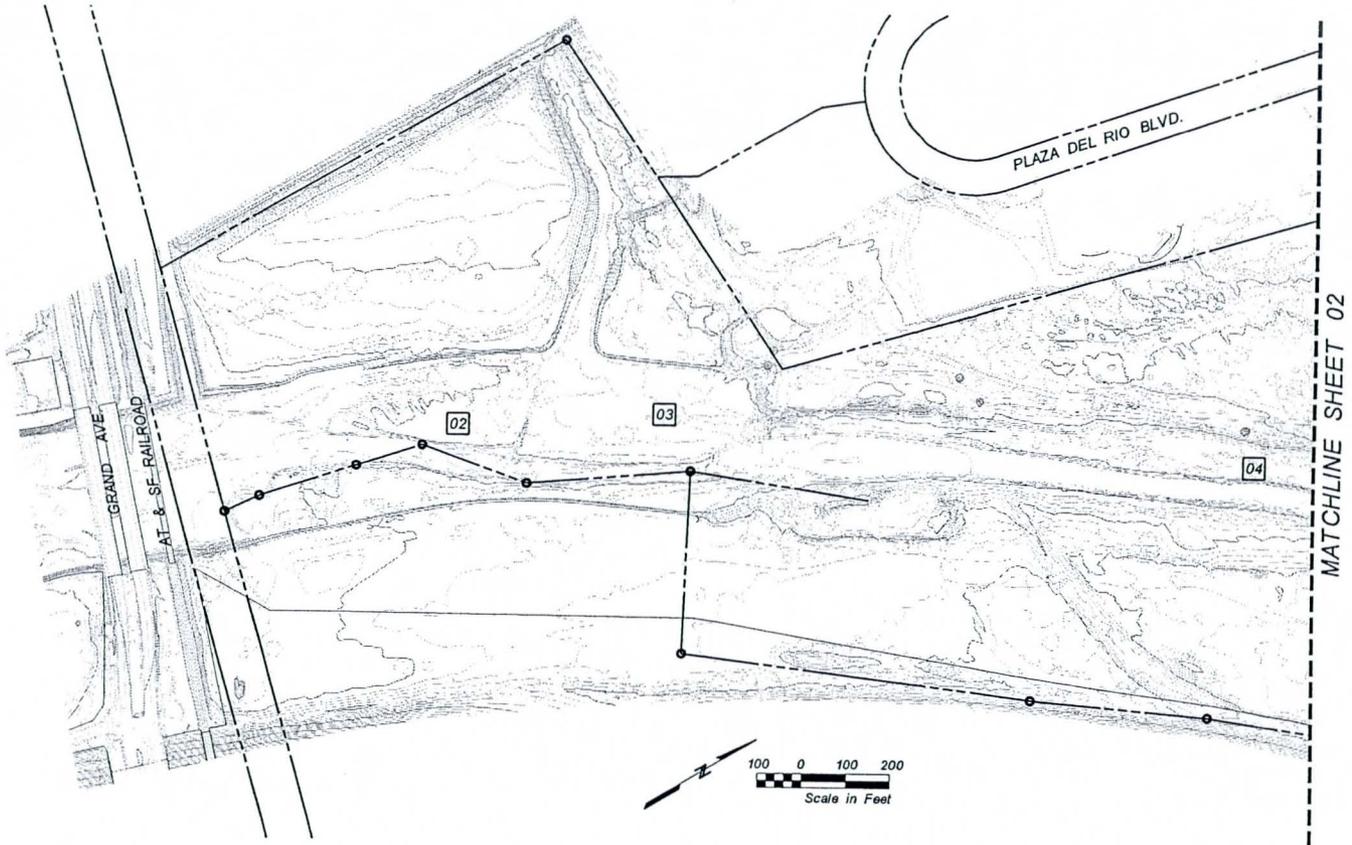
**APPENDIX A  
FIELD EXPLORATIONS**



Test Pit Location

*Not To Scale*

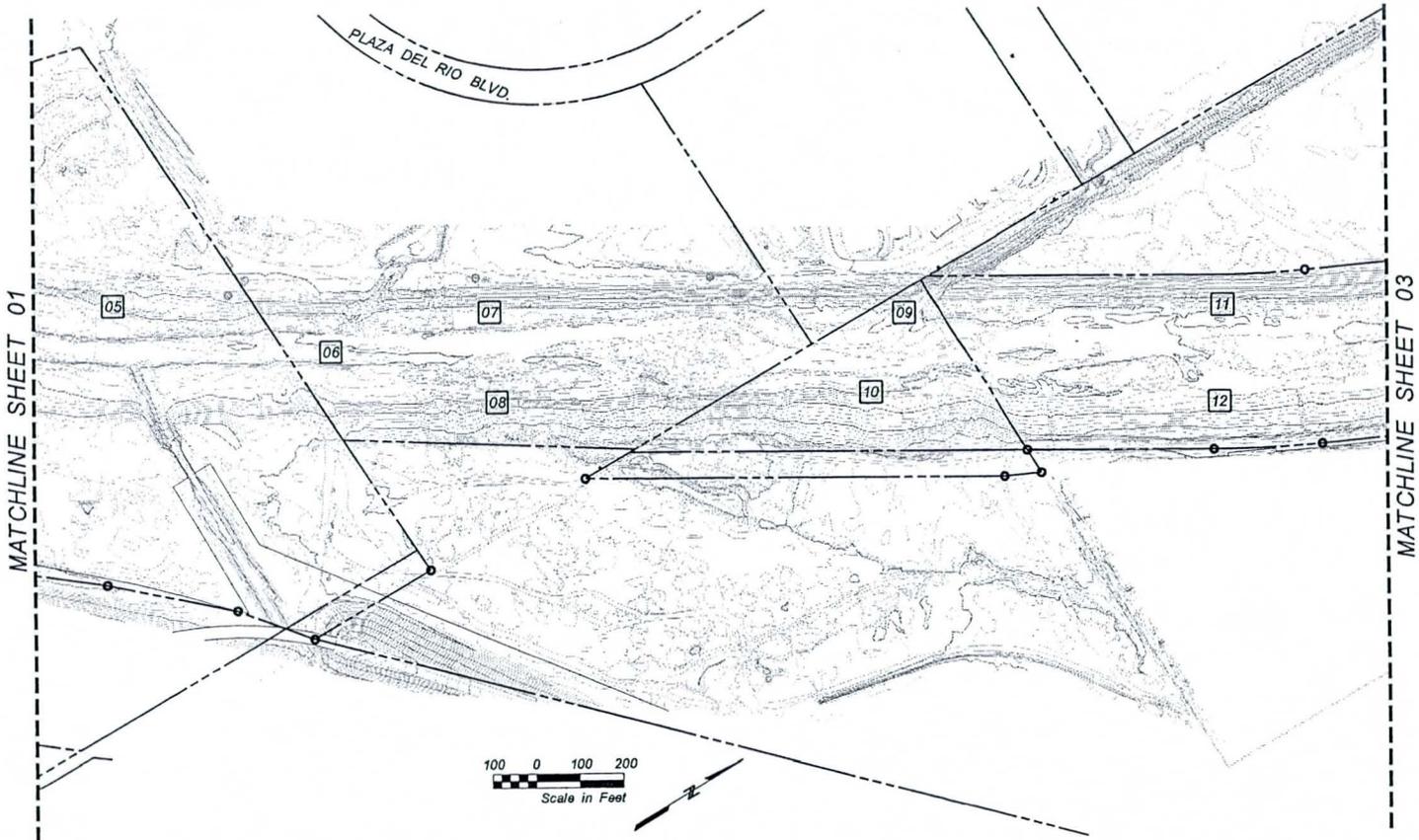
SITE PLAN



Test Pit Location

Not To Scale

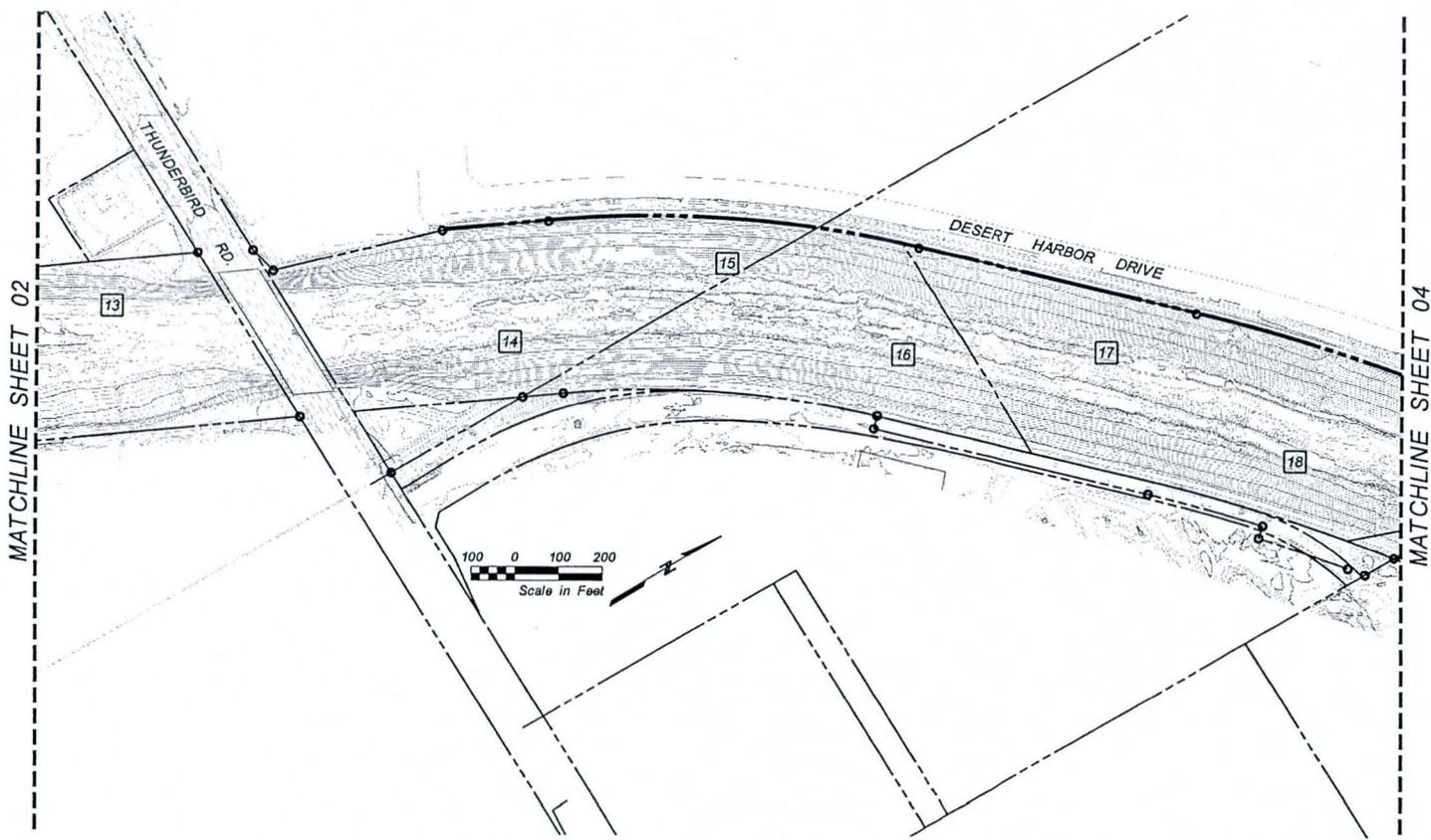
SITE PLAN

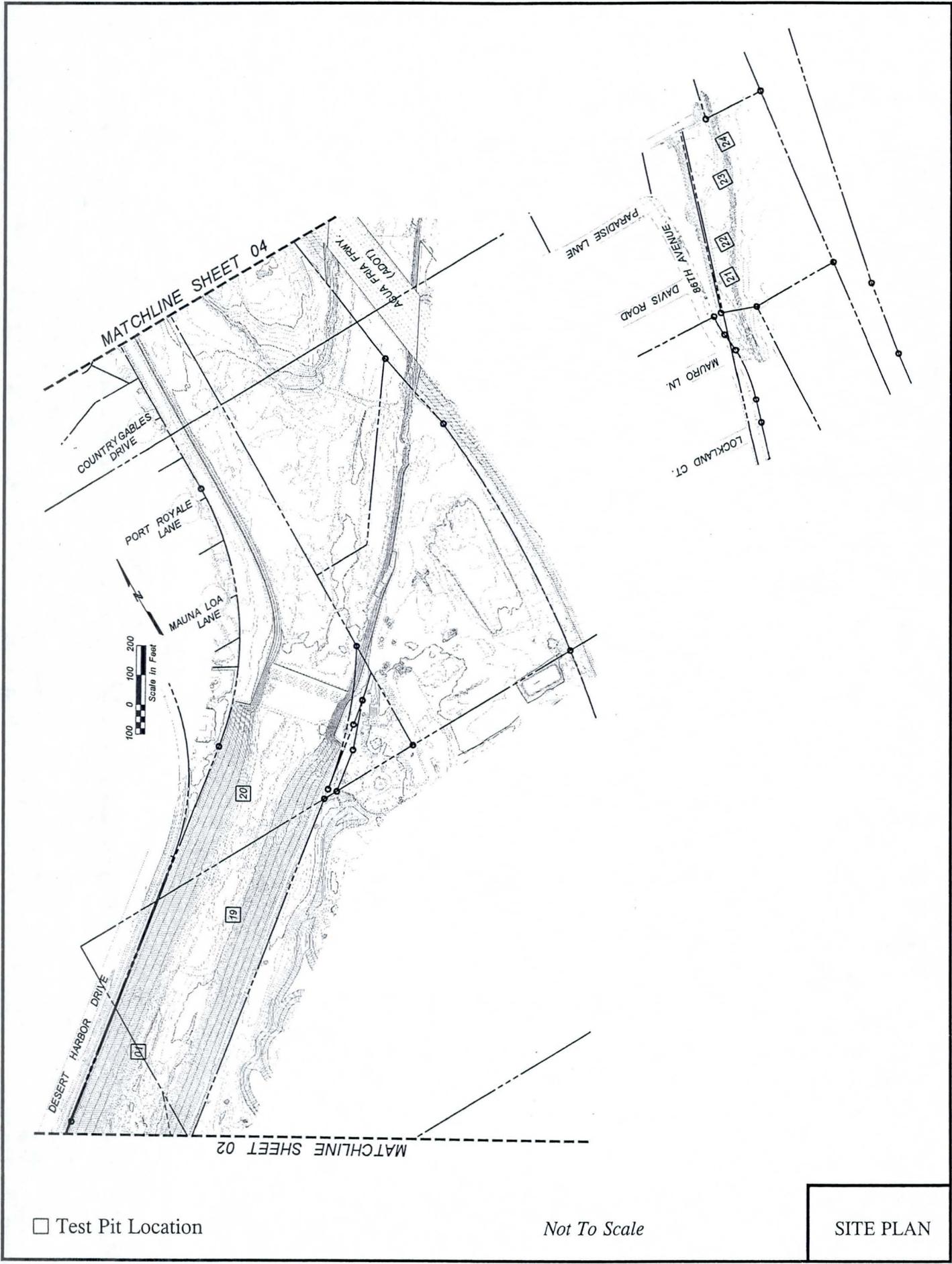


Test Pit Location

*Not To Scale*

SITE PLAN





□ Test Pit Location

Not To Scale

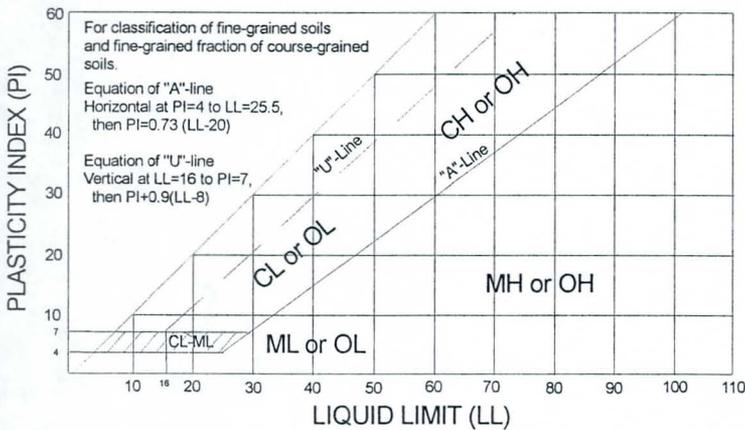
SITE PLAN

# LEGEND

## CLASSIFICATION OF SOILS

ASTM Designation: D2487-83  
(Based on Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				Soil Classification		
				Group Symbol	Name	
COARSE-GRAINED SOILS More than 50% retained on No. 200 Sieve	Gravels More than 50% coarse fraction retained on No. 4 Sieve	Clean Gravels Less than 5% fines	$C_u > 4$ and $1 < C_c < 3$	GW	Well graded gravel	
			$C_u < 4$ and/or $1 > C_c > 3$	GP	Poorly graded gravel	
		Gravels with Fines More than 12% fines	Fines classify as ML or MH	GM	Silty gravel	
			Fines classify as CL or CH	GC	Clayey gravel	
		Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	$C_u > 6$ and $1 < C_c < 3$	SW	Well-graded sand
			$C_u < 6$ and/or $1 > C_c > 3$	SP	Poorly graded sand	
		Sands with Fines More than 12% fines	Fines classify as ML or MH	SM	Silty sand	
			Fines classify as CL or CH	SC	Clayey sand	
	FINE-GRAINED SOILS 50% or more passes the No. 200 Sieve	Silt and Clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line	CL	Lean clay
				$PI < 4$ or plots below "A" line	ML	Silt
Organic			$\frac{\text{Liquid Limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay Organic silt	
			$PI$ plots on or above "A" line	CH	Fat clay	
			$PI$ plots below "A" line	MH	Elastic silt Organic clay	
Silt and Clays Liquid limit 50 or more		Inorganic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic silt	
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor			PT	Peat	



### TEST BORING LOG & TEST PIT LOG DEFINITIONS

Blows per foot using 140 pound hammer with 30 inch free-fall.

Depth, feet	Blows/Foot		Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description
	C	N/R					

C = Continuous Penetration Resistance (2 inch diameter rod)  
N = Standard Penetration Resistance (ASTM D1586)  
R = Penetration Resistance (3 inch diameter ring line sampler)

SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	GRAIN SIZES				CLEAR SQUARE SIEVE OPENINGS		
	200	40	10	4	3/4"	3"	12"
	SAND			GRAVEL			
	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLES	BOULDERS

MOISTURE CONDITION (INCREASING MOISTURE → )

DRY      SLIGHTLY DAMP      DAMP      MOIST (Plastic Limit)      VERY MOIST      WET (SATURATED)      (Liquid Limit)

CONSISTENCY CORRELATION		RELATIVE DENSITY CORRELATION	
CLAYS & SILTS	BLOWS/FOOT*	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	VERY LOOSE	0-4
SOFT	2-4	LOOSE	4-10
FIRM	4-8	MEDIUM DENSE	10-30
STIFF	8-16	DENSE	30-50
VERY STIFF	16-32	VERY DENSE	OVER 50
HARD	OVER 32		

\*Number of blows of 140 lb hammer falling 30" to drive a 2" O.D. (1-3/8" I.D.) split-spoon sampler (ASTM D1586).

### TEST PIT LOG

Project:           New River Bank Protection           TEST PIT:           1            
 Elevation:           Not Determined           Datum:           ---           Date:           12-3-03          

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SM	Silty Sand, Some Gravel, Occasional Trace of Cobbles; brown, damp, medium dense, elastic silt fines.  0 to 2'    5% Plus 3" 4 to 6'    5% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

### TEST PIT LOG

Project:           New River Bank Protection           TEST PIT:           2            
 Elevation:           Not Determined           Datum:           ---           Date:           12-4-03          

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines.  20 to 30% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project:           New River Bank Protection           TEST PIT:           3            
 Elevation:           Not Determined           Datum:           ---           Date:           12-4-03          

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines.  35 to 60% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 4

Elevation: Not Determined Datum: ---

Date: 12-4-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, nearly dry, dense, low plasticity to non-plastic fines.  40 to 60% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection  
 Elevation: Not Determined Datum: ---

TEST PIT: 5  
 Date: 12-4-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Cobbles, Some Gravel, Trace Silt; brown, nearly dry, dense, non-plastic fines.  20 to 40% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 6

Elevation: Not Determined Datum: ---

Date: 12-4-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, moist, dense, elastic silt fines.  20 to 45% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection TEST PIT: 7  
 Elevation: Not Determined Datum: --- Date: 12-4-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines.  40 to 60% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

# TEST PIT LOG

Project: New River Bank Protection TEST PIT: 8  
 Elevation: Not Determined Datum: --- Date: 12-4-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines.  45 to 70% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

# TEST PIT LOG

Project: New River Bank Protection  
 Elevation: Not Determined Datum: ---

TEST PIT: 9  
 Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, moist, dense, elastic silt fines.  60% Plus 3"
10						GP-SC	Sand, Gravel, Cobbles, Some Clay; brown, moist, dense, medium plasticity fines.  35 to 40% Plus 3"
15							Stopped excavating at 10 feet. No Groundwater Observed.
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

### TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 10

Elevation: Not Determined Datum: ---

Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, nearly dry, dense, low plasticity to non-plastic fines.  40 to 50% Plus 3"
10						SP-GP	Sand, Cobbles, Some Gravel, Trace Silt; brown, nearly dry, dense, non-plastic fines, heavily cemented.  20 to 25% Plus 3"
15							Stopped excavating at 10 feet. No Groundwater Observed.
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 11

Elevation: Not Determined Datum: ---

Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SC	Sand, Gravel, Cobbles, Some Clay; brown, moist, dense, medium plasticity fines.  35 to 40% Plus 3"
10						SP-GP	Sand, Cobbles, Some Gravel, Trace Silt; brown, nearly dry, dense, non-plastic fines, heavily cemented.  25 to 35% Plus 3"
15							Stopped excavating at 10 feet. No Groundwater Observed.
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection TEST PIT: 12  
 Elevation: Not Determined Datum: --- Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SM-SC	Silty to Clayey Sand, Trace Cobbles; brown, moist, medium dense, moderate cementation below 2.5 feet and heavy cementation below 6 feet.  0 to 2' 15% Plus 3" 2 to 6' 5% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

# TEST PIT LOG

Project: New River Bank Protection TEST PIT: 13  
 Elevation: Not Determined Datum: --- Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines.  0 to 2' 60% Plus 3" 35 to 40% Plus 3" below 2'
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

# TEST PIT LOG

Project: New River Bank Protection TEST PIT: 14  
 Elevation: Not Determined Datum: --- Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SM-SC	Silty to Clayey Sand, Trace Cobbles; brown, moist, medium dense, moderate cementation below 2.5 feet and heavy cementation below 6 feet.  40% Plus 3"
10						GP-SC	Sand, Gravel, Cobbles, Some Clay; brown, moist, dense, medium plasticity fines, heavy cementation.  45 to 60% Plus 3"
15							Stopped excavating at 10 feet. No Groundwater Observed.
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection TEST PIT: 15  
 Elevation: Not Determined Datum: --- Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SC	Sand, Gravel, Cobbles, Some Clay; brown, moist, dense, medium plasticity fines.  0 to 4' 40 to 45% Plus 3" 4 to 10' 15 to 25% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection  
 Elevation: Not Determined Datum: ---

TEST PIT: 16  
 Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, nearly dry, dense, low plasticity to non-plastic fines.  0 to 2' 55% Plus 3" 20 to 30 % Plus 3" below 2'
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.



## TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 18

Elevation: Not Determined Datum: ---

Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, nearly dry, dense, low plasticity to non-plastic fines, heavy cementation below 2 feet.  10 to 20% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection TEST PIT: 19  
 Elevation: Not Determined Datum: --- Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines, moderate cementation below 1.5 feet.  0 to 2' 20% Plus 3"
10							
15							Stopped excavating at 10 feet. No Groundwater Observed.
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

## TEST PIT LOG

Project: New River Bank Protection TEST PIT: 20  
 Elevation: Not Determined Datum: --- Date: 12-3-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						SP-GP	Sand, Gravel, Cobbles, Some to Trace Clay; brown, moist, dense, medium plasticity fines, moderate cementation below 1.5 feet.  0 to 2' 5% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

# TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 21

Elevation: Not Determined Datum: ---

Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, moist, dense, elastic silt fines.  40 to 60% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

### TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 22

Elevation: Not Determined Datum: ---

Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, moist, dense, elastic silt fines.  20 to 65% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							
							This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.



## TEST PIT LOG

Project: New River Bank Protection

TEST PIT: 24

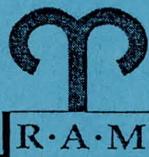
Elevation: Not Determined Datum: ---

Date: 12-2-03

Depth, feet	Blows/Foot		Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5						GP-SM	Sand, Gravel, Cobbles, Some to Trace Silt; brown, moist, dense, elastic silt fines.  30 to 55% Plus 3"
10							Stopped excavating at 10 feet. No Groundwater Observed.
15							
20							
25							

This test pit log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

**APPENDIX B**  
**LABORATORY ANALYSIS**



## LABORATORY TEST RESULTS

Date: 17-Dec-03

SAMPLE SOURCE: As noted below

TESTING PERFORMED: Sieve Analysis, Percent Passing No. 200 Sieve, Atterberg Limits  
(ASTM C136, D1140, D4318)

SAMPLED BY: RAM/Miller

**RESULTS:**

Sample Source	Atterberg Limits		Sieve Size - Accumulative Percent Passing											Soil Class.*
	LL	PI	200	100	50	30	16	8	4	3/4"	1"	2"	3"	
1 @ 0'-5'	45	16	36	47	61	74	81	85	86	87	87	100		SM
2 @ 0'-5'	38	19	7.8	9	17	30	41	50	58	79	84	100		SP-SC
3 @ 5'-10'	43	25	6.7	7	9	19	41	60	75	92	100			SP-SC
4 @ 0'-5'	N/A	NP	8.5	11	19	30	42	52	59	82	88	100		SP-SM
5 @ 5'-10'	N/A	NP	5.5	8	18	49	75	85	90	100				SP-SM
6 @ 0'-5'	52	20	8.1	11	15	23	37	50	61	81	100			SP-SM
7 @ 0'-5'	29	10	3.2	4	6	11	23	36	46	68	75	100		GP
8 @ 5'-10'	32	16	4.8	6	7	13	22	30	38	61	77	100		GP
9 @ 5'-10'	47	23	18	23	29	40	52	58	61	75	79	100		SC
10 @ 0'-5'	40	14	14	18	25	35	43	53	64	95	100			SM
11 @ 0'-5'	46	21	13	15	20	31	41	51	61	92	96	100		SC
12 @ 5'-10'	35	5	40	60	79	91	97	99	100					SM
13 @ 0'-5'	44	19	9.0	12	17	32	48	56	64	82	91	100		SP-SC
14 @ 0'-5'	45	20	10	14	20	33	51	63	72	87	89	100		SW-SC
15 @ 5'-10'	38	13	13	18	33	58	69	72	73	79	83	100		SM
16 @ 5'-10'	34	4	11	17	27	50	70	79	84	94	100			SW-SM
17 @ 0'-5'	50	14	35	51	63	76	85	90	93	95	95	100		SM
18 @ 5'-10'	44	6	9.9	15	23	36	52	63	71	86	89	100		SW-SM
19 @ 5'-10'	54	18	44	53	65	79	88	94	97	100				SM
20 @ 0'-5'	66	25	36	44	53	65	76	87	97	100				SM
21 @ 0'-5'	55	27	10	13	18	32	54	66	73	93	100			SW-SM
22 @ 5'-10'	67	33	11	14	19	33	55	65	71	86	90	100		SP-SM
23 @ 0'-5'	60	38	8.3	11	15	21	31	41	51	77	87	100		GP-GM
24 @ 5'-10'	59	29	11	15	21	28	37	46	56	88	90	100		SW-SC

NP = Non-Plastic

\* Unified Soil Classification System

Gradations do not include plus 3-inch materials

# LABORATORY TEST RESULTS

Date: 15-Dec-03

SAMPLE SOURCE: As noted below

TESTING PERFORMED: pH, Minimum Resistivity (ADOT 236a)

SAMPLED BY: RAM/Miller

## RESULTS:

<u>Sample Source</u>	<u>pH</u>	<u>Minimum Resistivity (ohm-cm)</u>
1 @ 0'-5'	7.6	990
2 @ 0'-5'	7.6	924
3 @ 5'-10'	7.6	3593
4 @ 0'-5'	8.0	814
5 @ 5'-10'	7.9	528
6 @ 0'-5'	7.8	1320
7 @ 0'-5'	7.9	3593
8 @ 5'-10'	7.7	1188
9 @ 5'-10'	7.5	1254
10 @ 0'-5'	7.8	1320
11 @ 0'-5'	7.7	1627
12 @ 5'-10'	8.0	881
13 @ 0'-5'	7.7	1452
14 @ 0'-5'	7.8	1386
15 @ 5'-10'	7.5	1220
16 @ 5'-10'	7.9	1584
17 @ 0'-5'	7.4	1085
18 @ 5'-10'	7.9	1386
19 @ 5'-10'	7.9	1452
20 @ 0'-5'	7.5	1085
21 @ 0'-5'	7.8	2102
22 @ 5'-10'	7.8	1424
23 @ 0'-5'	7.8	1763
24 @ 5'-10'	7.7	1288

# IAS Laboratories

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



## SOIL ANALYSIS REPORT

Page 1

Today's Date: 12/10/2003  
 Grower: G09326  
 Submitted By: Ken Ricker  
 Send Report To: Ricker-Atkinson-McBee & Assoc.  
 Report Number: 6622189  
 Crop: Landscape  
 Date Received: 12/5/2003

VL = Very Low  
 L = Low  
 M = Medium  
 H = High  
 VH = Very High

Sender Sample Id	Depth	Lab #	pH	Calcium (Ca) PPM	Magnesium (Mg) PPM	Sodium (Na) PPM	Potash (K) PPM	Iron (Fe) PPM	Zinc (Zn) PPM	Manganese (Mn) PPM	Copper (Cu) PPM	Salinity (EC x K) dS/m	Nitrate Nitrogen (NO3-N) PPM	Phosphorus (Bicarb - Soluble P) PPM	Computed % Sodium (ESP)	Sulfur (SO4-S) PPM	Boron (B) PPM	Free Lime Level
A3	1.5	654	7.9	3100 VH	280 VH	50 L	180 H	4.6 M	3.8 VH	9.5 VH	.67 H	1.0 L	24.0 H	7.3 L	1.2	5.7 VL	.26 VL	High
A6	1.5	655	8.2	6800 VH	590 VH	130 M	220 H	4.6 M	96 M	13.0 VH	1.4 VH	.6 L	5.6 VL	6.6 L	1.4	12 M	.36 L	High
A2	1.5	656	8.5	970 H	110 M	34 L	55 L	5.2 H	24 L	1.7 H	24 M	.3 VL	3.2 VL	1.8 VL	2.4	.8 VL	.07 VL	Low
A9	1.5	657	8.0	1000 H	150 H	29 L	88 M	5.6 H	24 L	2.5 H	.22 M	4 VL	9.0 L	3.4 VL	1.9	2.1 VL	.10 VL	Low
A11	1.5	658	8.4	1100 VH	120 M	27 L	100 M	3.7 M	.26 L	4.4 VH	.20 L	4 VL	4.4 VL	4.9 VL	1.7	1.7 VL	.14 VL	Low
A16	1.5	659	8.0	1200 VH	190 H	33 L	92 M	5.4 H	.29 L	3.5 H	.35 M	2 VL	3.8 VL	3.5 VL	1.8	.6 VL	.12 VL	None
A17	1.5	660	7.6	2500 VH	520 VH	43 L	220 H	8.3 VH	.38 L	9.5 VH	.95 H	4 VL	6.3 L	6.6 L	1.1	1.8 VL	.19 VL	Low
A23	1.5	661	8.0	2100 VH	210 H	49 L	140 M	5.4 H	.38 L	6.1 VH	.58 M	5 VL	5.5 VL	4.6 VL	1.7	3.3 VL	.26 VL	Low
A24	1.5	662	7.9	3500 VH	480 VH	110 M	130 M	4.7 M	.14 VL	3.7 VH	.41 M	.6 L	6.3 L	.8 VL	2.1	13 M	.11 VL	None
A25	1.5	663	7.8	2500 VH	260 VH	52 L	170 H	8.2 VH	1.9 H	7.8 VH	2.9 VH	1.0 L	30.0 H	6.0 L	1.5	8.4 L	.16 VL	Low

Received Fax : Dec 10 2003 3:48PM Fax Station : RICKER ATKINSON MCBEE

12/10/2003 15:49 0

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PAGE 01



# IAS Laboratories

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

## SOIL FERTILITY RECOMMENDATIONS

Lb/1000 Sq Ft

Grower: G09326

Send To: Ricker-Atkinson-McBee & Assoc.

Report No: 6622189

Date: 12/5/2003

Page: 2

Sender Number	Crop	Nitrogen N	Phosphate P2O5	Potash K2O	Magnesium Mg	Sulfur S	Iron Fe	Zinc Zn	Manganese Mn	Copper Cu	Boron B	AMENDMENTS			Leaching of Excess Salts
												Elemental Sulfur	Gypsum	Lime	
A3	Landscape	1/2	2**								d				
A6	Landscape	2.5*	2**								d	10***			
A2	Landscape	2.5*	2.5*	2a				1/3c			d	10***			
A9	Landscape	2*	2.5*	1a				1/3c			d	5***			
A11	Landscape	2.5*	2.5*	1a				1/3c			d	10***			
A16	Landscape	2.5*	2.5*	1a				1/3c			d	5***			
A17	Landscape	2*	2*					1/3c			d				
A23	Landscape	2.5*	2.5*	1a				1/3c			d	5***			
A24	Landscape	2*	2.5*	1a				1/2c			d				
A25	Landscape	1/2*	2**								d				

Recommendations are in units of lbs/1000 Square Feet.

\*Broadcast and work into the soil.

\*\*If you use 16-20-0 at 12.5 pounds it will give you 2 pounds of N and 2.5 pounds of phosphate (as needed for A9 and A24).

\*\*\*Till S into the soil to reduce pH.

a. Broadcast and work into soil.

b. Since the amount needed is very small it would be best to use a fertilizer containing Cu. A product, such as Ironite, supplies some copper.

c. Use zinc sulfate, broadcast.

d. Check irrigation water to be sure it supplies adequate B. Water with 0.4 to 0.5 ppm B is adequate for landscape plants.

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P. 2  
Received Fax : Dec 10 2003 3:48PM  
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