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December 10, 1985

Attn: Mr. Edward A. Raleigh, P.E.
Project Engineer

Re: Soil Testing
Bridges on the Bulldog Floodway
Section 7, T1N, R8E
Pinal County, Arizona

Job No. 2185J030

In accordance with your request, this firm has provided field investigation and laboratory analysis services for the proposed bridges to be located along Meridian Road and Ironwood Drive in Pinal County (Section 7, T1N, R8E). This report is a summary of our field investigation and laboratory analyses. The results are presented in Appendix A and organized as follows:

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A rotary auger drill was used to drill four borings, two to a depth of 25 feet and two to a depth of 30 feet. The boring locations are shown on the site plan.

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FINANCE	
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During the drilling program, soils were visually examined, classified, and sampled at selected depth intervals for further analysis in the laboratory. The following tests were performed on representative samples:

- moisture content
- in-situ dry density
- sieve analysis
- Atterberg limits

Soil Conditions: The soils encountered in the four borings were dense silty sands, silty clayey sands, and clayey sands with variable gravel contents (7% to 40%). Calcite cementation was encountered in the four borings. The degree of cementation increased with depth to moderate or heavy levels.

This report completes our present assignment for this project. It has been a pleasure working with your agency. Should any questions arise regarding this report, please contact us.

Respectfully submitted,
WESTERN TECHNOLOGIES INC.
Geotechnical Exploration

Gabriel R. Escamillo, Jr.

Gabriel R. Escamillo, Jr.
Manager

jh

Copies to: Addressee (3)



DEFINITION OF TERMINOLOGY

ALLOWABLE SOIL BEARING CAPACITY ALLOWABLE FOUNDATION PRESSURE	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
BACKFILL	A specified material placed and compacted in a confined area.
BASE COURSE	A layer of specified material placed on a subgrade or subbase.
BASE COURSE GRADE	Top of base course.
BENCH	A horizontal surface in a sloped deposit.
CAISSON	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
CONCRETE SLABS-ON-GRADE	A concrete surface layer cast directly upon a base, subbase or subgrade.
CRUSHED ROCK BASE COURSE	A base course composed of crushed rock of a specified gradation.
DIFFERENTIAL SETTLEMENT	Unequal settlement between or within foundation elements of a structure.
ENGINEERED FILL	Specified material placed and compacted to specified density and/or moisture conditions under observation of a representative of a soil engineer.
EXISTING FILL	Materials deposited through the action of man prior to exploration of the site.
EXISTING GRADE	The ground surface at the time of field exploration.
EXPANSIVE POTENTIAL	The potential of a soil to expand (increase in volume) due to the absorption of moisture.
FILL	Materials deposited by the action of man.
FINISHED GRADE	The final grade created as a part of the project.
GRAVEL BASE COURSE	A base course composed of naturally occurring gravel with a specified gradation.
HEAVE	Upward movement.
NATIVE GRADE	The naturally occurring ground surface.
NATIVE SOIL	Naturally occurring on-site soil.
ROCK	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
SAND AND GRAVEL BASE	A base course of sand and gravel of a specified gradation.
SAND BASE COURSE	A base course composed primarily of sand of a specified gradation.
SCARIFY	To mechanically loosen soil or break down existing soil structure.
SETTLEMENT	Downward movement.
SOIL	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
STRIP	To remove from present location.
SUBBASE	A layer of specified material placed to form a layer between the subgrade and base course.
SUBBASE GRADE	Top of subbase.
SUBGRADE	Prepared native soil surface.



METHOD OF SOIL CLASSIFICATION (ASTM D 2487)

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE:
Coarse grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limit less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILTY-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid Limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

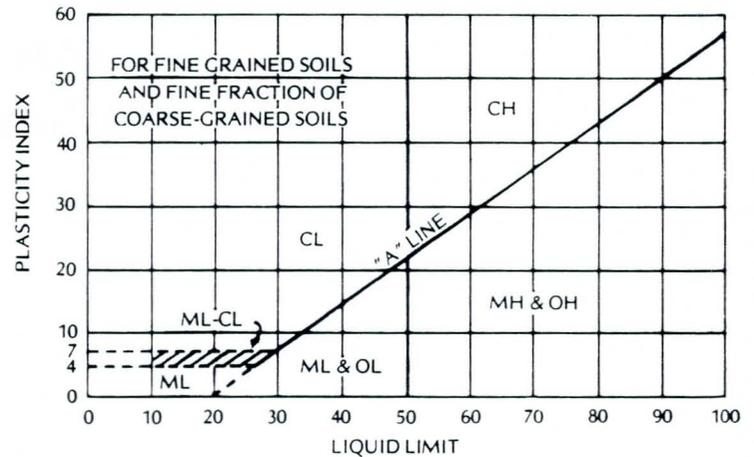
NOTE:
Fine grained soils receive dual symbols if their limits plot in the hatched zone on the Plasticity Chart (ML-CL)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	¾ in. to 3 in.
Fine	No. 4 to ¾ in.
SAND	No. 200 to No. 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*FINES (Silt or Clay)	BELOW No. 200

NOTE:
Only sizes smaller than three inches are used to classify soils.

PLASTICITY CHART



BORING LOG NOTES

The number shown in "LOG OF BORING NO." refers to the approximate location of the same number indicated on the "Site Plan" as positioned in the field by the client.

"TYPE/SIZE BORING" refers to the exploratory equipment used in the boring wherein HSA = hollow-stem auger.

"N" in "Blows/Foot" refers to the number of blows of a 140-pound weight, dropped 30 inches, required to advance a two-inch-outside-diameter split-barrel sampler a distance of 1 foot, Standard Penetration Test (ASTM D1586). Refusal to penetration is defined as more than 100 blows per foot.

"R" in "Blows/Foot" refers to the number of blows of a 140-pound weight, dropped 30 inches, required to advance a 2.42-inch-inside-diameter ring sampler a distance of 1 foot. Refusal to penetration is considered more than 50 blows per foot.

"Sample Type" refers to the form of sample recovery, in which N = Split-barrel sample, R = Ring sample, and G = Grab sample.

"Dry Density, pcf" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol "NR" indicates that no sample was recovered. The symbol "*" indicates that determination of dry density was not possible.

"Water Content, %" refers to the laboratory-determined moisture content in percent (ASTM D2216).

"Unified Classification" refers to the soil type as defined by "Method of Soil Classification". The soils were classified visually in the field and, where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and soil characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

In general, terms and symbols on the boring logs conform with "Standard Definitions of Terms and Symbols Relating to Soil and Rock Mechanics" (ASTM D653).



LOG OF BORING NO. 1

Project Flood Control Bulldog Floodway Job No. 2185J030
 Elevation Not Determined Datum _____
 Type/Size Boring 7" HSA Rig Type CME 75
 Groundwater Conditions Auger filled with water Date 11/21/85

Depth, feet	Blows/Foot		Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description
	C	N/R					
			G			SC	GRAVELLY SAND; with clay, red-brown, dense
5		100	N G		8.6	SM- SC	SAND; with gravel, silt, and clay, tan, dense, light to moderate cementation
10		100+	N	NR		SM	GRAVELLY SAND; with silt, tan, dense, moderate to heavy cementation
15		50/2"	G R	NR			
20		100+	G N	NR		SM	GRAVELLY SAND; with silt, gray-brown, dense, heavy cementation
25			N		7.8		
							Stopped @ 25 feet
30							



LOG OF BORING NO. 2

Project Flood Control Bulldog Floodway Job No. 2185J030
 Elevation Not Determined Datum _____
 Type/Size Boring 7" HSA Rig Type CME 75
 Groundwater Conditions Auger filled with water Date 11/21/85

Depth, feet	Blows/Foot		Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5		100+	G N G		15.0	SM SC	SILTY SAND; with gravel, gray-brown, dense, light to moderate cementation CLAYEY SAND; with gravel, gray-brown, dense, moderate to heavy cementation
10		50/6"	G R	108	7.1	SM	GRAVELLY SAND; with silt, gray-brown, dense, moderate to heavy cementation
15		100+	G N		9.4	SM/ SC	SAND AND GRAVEL; with silt, gray-brown, dense, moderate to heavy cementation SILTY CLAYEY SAND; with gravel, gray-brown, dense, moderate to heavy cementation
20		100+	N	NR			
25		100+	N		7.7		
30		100+	G/N	NR			

Stopped @ 30 feet



LOG OF BORING NO. 3

7

Project Flood Control Bulldog Floodway Job No. 2185J030
 Elevation Not Determined Datum _____
 Type/Size Boring 7" HSA Rig Type CME 75
 Groundwater Conditions Auger filled with water Date 11/22/85

Depth, feet	Blows/Foot		Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description
	C	N/R					
5		32	G N		5.3	SM-SC	SILTY CLAYEY SAND; with gravel, brown, dense, none to moderate cementation
10		50/5"	G R	117	11.8	SC	CLAYEY SAND; some gravel, gray-brown, dense, heavy cementation
15		100+ 100+	G N		8.8	SM	SILTY SAND; some gravel, gray-brown, dense, heavy cementation
20		100+	N		7.2		
25		100+	N		8.0		
30		100+	N		4.2	SM	GRAVELLY SAND; with silt, gray-brown, dense, heavy cementation

Stopped @ 30 feet



LOG OF BORING NO. 4

Project Flood Control Bulldog Floodway Job No. 2185J030
 Elevation Not Determined Datum _____
 Type/Size Boring 7" HSA Rig Type CME 75
 Groundwater Conditions Auger filled with water Date 11/22/85

Depth, feet	Blows/Foot		Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description
	C	N/R					
			G			SM	SILTY SAND; some gravel, brown, dense
5		100+	G N		9.8	SC	CLAYEY SAND; some gravel, brown, dense, light to moderate cementation
10		100+	G N		11.6	SM- SC	SILTY CLAYEY SAND; with gravel, gray-brown, dense, heavy cementation
15		50/3"	G R	113	15.8	SM	SILTY SAND; with gravel and silt, gray-brown, dense, heavy cementation
			G			SM	SILTY SAND AND GRAVEL; gray-brown, dense, heavy cementation
20		100+	N		3.5	SM	SAND; with gravel and silt, gray-brown, dense, heavy cementation
25		100+	N	NR			
30							Stopped @ 25 feet



JOB NO. 2185J030

Date

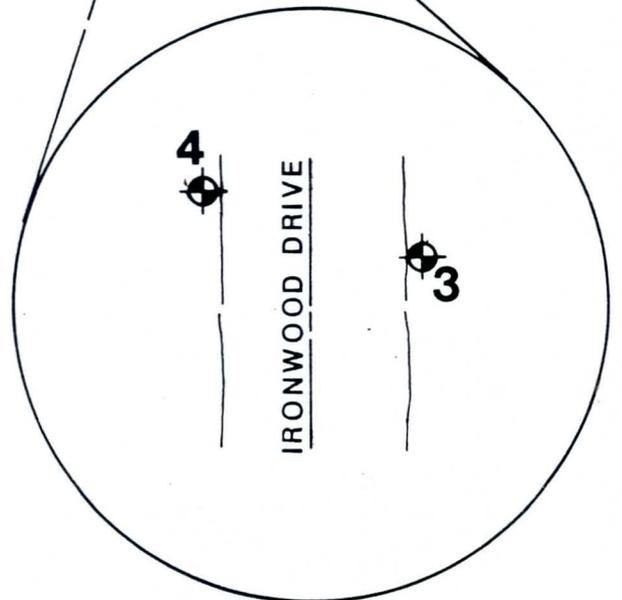
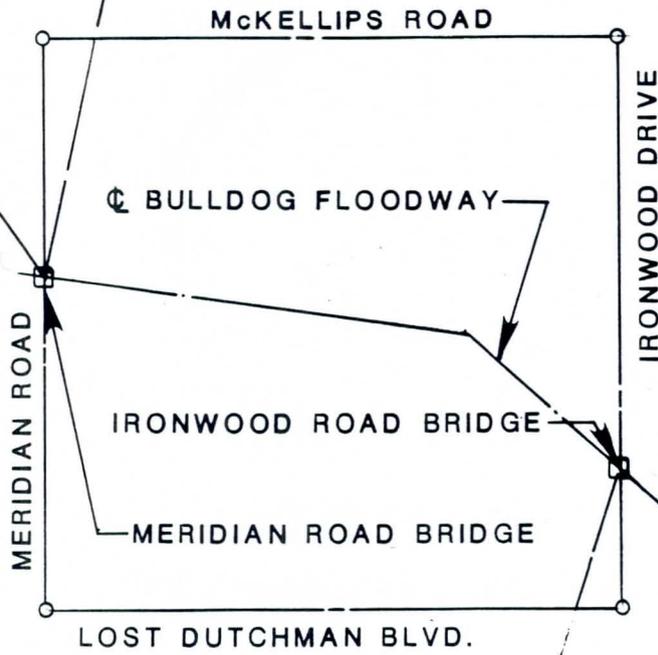
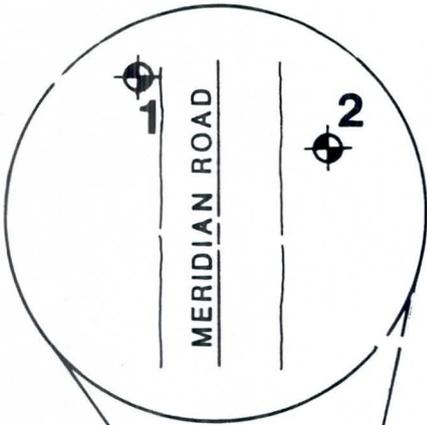
Checked By

12/11/85

Date

s.f.

Prepared By



 BORING LOCATION

