

CORRESPONDENCE/MEMORANDUM \_\_\_\_\_ STATE OF WISCONSIN

**DATE:** April 20, 1995

**TO:** George McLeod, P.E., District Chief Materials Engineer  
Transportation District #6

**FROM:** Bruce J. Pfister, P.E.  
Chief Geotechnical Engineer

**SUBJECT:** Site Investigation Report  
Project I.D. 1530-00-01  
USH 10 & Front Street  
Split-Block Wall  
Pierce County

Attached is the Site Investigation Report for the subject project.

By:

*ark*  
A. Ray Kumapayi  
Geotechnical Engineer

ARK:SBW  
Attachments

cc: District 6 (orig. +3)  
C.O. Bridge (2)  
C.O. Files  
C.O. Design  
J.E. Haverberg  
Geotechnical File ✓

**SITE INVESTIGATION REPORT  
PROJECT I.D. 1530-00-01  
USH 10 & FRONT STREET  
SPLIT-BLOCK WALL  
PIERCE COUNTY**

**1. GENERAL**

The subject site is located on USH 10 and Front Street in Pierce County. A roadway embankment adjacent to bridge structure B-47-40 on the east abutment is proposed to be retained. A soils report was sent dated March 23, 1995 addressing the Drilled Caisson retaining wall. This report will address the re-use of the split-block walls at their existing location.

**3. ANALYSIS**

The existing split-block retaining wall is fatigued and is no longer able to support the lateral pressures being exerted by the roadway and backfill. Consolidation of the wall backfill suggests active hydrostatic pressures. A Drilled-Caisson type wall has been designed to retain the roadway. However, active lateral pressures from the backfill will inevitably cause the split-block wall to fail.

To ensure stability of the split-block wall and maintain the aesthetics desired, we offer the following:

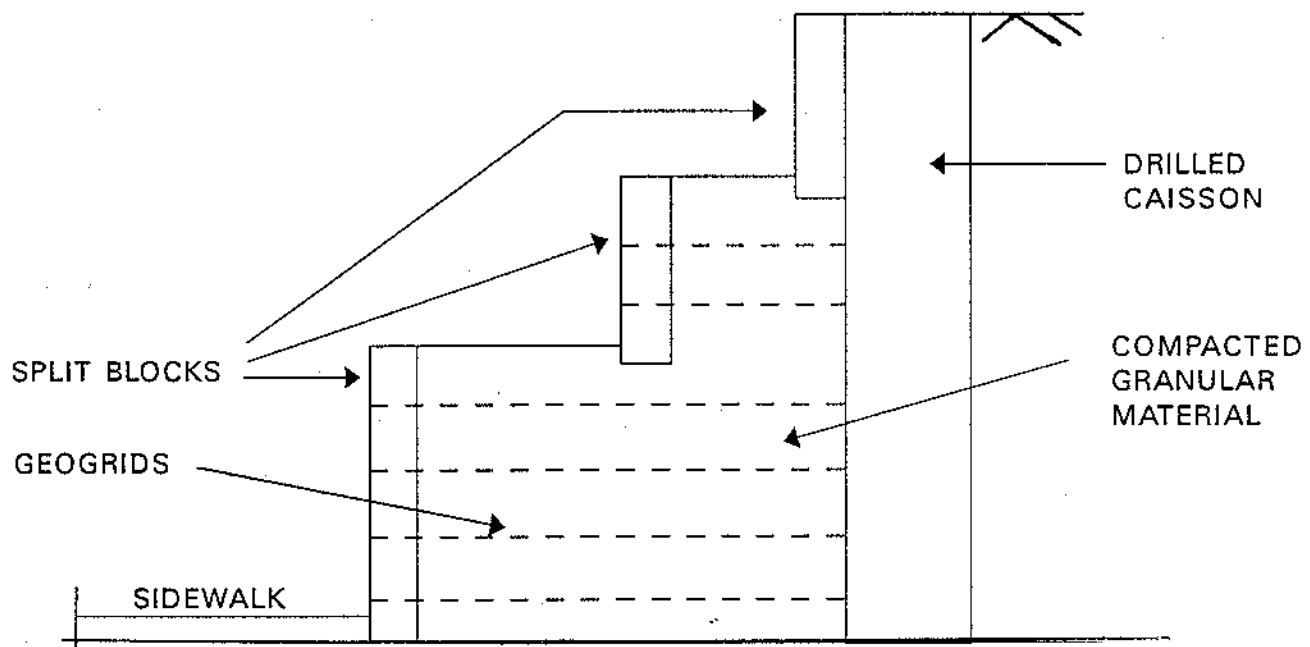
- The two lower walls will require geogrid reinforcement for stability
- For the lowest wall (6-ft. wall), the first layer of geogrid should be placed 16 inches above level pad elevation of  $697 \pm$ . Subsequent layers should also be 16 inches apart. A total number of four (4) layers of geogrid will be required for this wall
- For the middle wall (3 ft. above the lowest wall), two layers of geogrid spaced 12 inches apart will be required. The first should be 12 inches above the new level pad or footing elevation of  $702 \pm$
- The upper wall should only serve as facing to the drilled caisson. The level pad elevation should be at  $705 \pm$
- All geogrid layers should extend from the split-block face to the drilled caisson wall face
- A wall batter of 1 in./ft. is recommended
- A Grade 2 (min.) granular backfill is recommended. Compaction should be between each lift as required

Please find attached, a dimensionless depiction of the project scope and the Geogrid Reinforcement Specifications.

Should you have any questions/comments, please contact OTS, Geotechnical Section.

SPLIT-BLOCK RETAINING WALL  
USH 10 & FRONT ST.  
PRESCOTT, PIERCE CO.  
DISTRICT 6

NOT TO SCALE



### Geogrid Reinforcement, Item 900xx

Description: This work shall consist of furnishing and installing geogrids ~~for~~<sup>for</sup> subgrade stabilization, base reinforcing, or pavement structure applications in accordance with the plans, specifications, and contracts.

Materials: The geogrid shall consist of a uniform rectangular grid of bonded, formed, or fused polymer tensile strands crossing with a nominal right angle orientation. The polymer shall consist of polyester, polypropylene, polyamide or polyethylene. The grid shall maintain dimensional stability during handling, placing, and installation. The geogrid shall be insect, rodent, mildew, and rot resistant.

The geogrid shall comply with the following physical properties:

<u>Test</u>	<u>Method</u>	<u>Value (1)</u>
Tensile Strength at 5% Strain	ASTM D-4585	
Machine Direction	(lb./ft.)	500 min.
Cross Machine Direction	(lb./ft.)	250 min.
Aperture Area (in. <sup>2</sup> )	Inside Measurement	5.0 Max.
Aperture Dimension (in.)	Inside Measurement	.5 Min.

(1) All numerical values represent minimum/maximum average roll values. (i.e., the averages minimum test results on any roll in a lot should meet or exceed the minimum specified value).

The geogrid shall be furnished in a wrapping which will protect the material from ultraviolet radiation and from damage due to stripping and hauling. The geogrid is to be kept dry until installed. The geogrid rolls shall be clearly marked to identify the material contained.

The contractor shall deliver to the engineer a sample of the geogrid material at least 10 days prior to its incorporation into the project. At the same time, the contractor shall furnish a manufacturer's Certified Report of Test or Analysis that the geogrid delivered from use in the work meets the above requirements. Samples of geogrid for testing will be obtained from the job site for each 10,000 square yards or portion thereof used on the contract.

Construction Methods: Prior to placement of the geogrid, the subgrade shall be brought to required lines and dimensions as shown on the plan. The surface shall be smoothed and shaped to eliminate clods, rocks, roots, or other detrious items which may damage the geogrid. The geogrid shall be placed on the prepared surface at the locations and to the limits as shown on the plan. The geogrid shall be placed with the machine direction perpendicular to the centerline of the roadway. After placement, the geogrid shall be

pulled taut and shall be secured with pens, clips, or other means to prevent movement or displacement. Parallel strips of geogrid shall be tightly joined by the use of ties, straps, clips or other devices approved by the engineer. Butt joints between roll ends shall be lapped a minimum of 18 inches and shall be manually joined with devices approved by the engineer. No traffic or construction equipment shall be permitted to operate directly on the geogrid.

Small rips, tears, or defects in the geogrid shall be covered with an additional section of geogrid which shall overlap the damaged area by at least 3 feet in all directions. Geogrid sections with large rips, tears, defects or other damage shall be removed and replaced at the direction of the engineer. All costs to repair or replace damaged or defective geogrid shall be the responsibility of the contractor.

Crushed Aggregate Base Course, Gradation No. 3, shall be placed over the geogrid to the depths shown on the plans and in accordance with provisions Section 304 of the Standard Specifications, except that the initial lift on the geogrid must be at least 4 inches. Placing, spreading, and compacting operations shall be conducted so that the geogrid is not displaced or damaged. The engineer may require changes in equipment and/or operations to prevent such damage or displacement.

Method of Measurement. Geogrid Reinforcement shall be measured by the square yard of surface area upon which the geogrid has been placed and accepted.

Basis of Payment. Geogrid Reinforcement measured as provided above shall be paid for at the contract unit price per squared yard. This unit price shall be full compensation for furnishing, transporting and installing the geogrid; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

CORRESPONDENCE/MEMORANDUM \_\_\_\_\_ STATE OF WISCONSIN

**DATE:** March 13, 1995

**TO:** George McLeod, P.E., District Chief Materials Engineer  
Transportation District #6

**FROM:** Bruce J. Pfister, P.E.  
Chief Geotechnical Engineer

**SUBJECT:** Site Investigation Report  
Project I.D. 1530-00-01  
USH 10 & Front Street  
RW-47-XX  
Pierce County

Attached is the Site Investigation Report for the subject project.

By:

*ARK*  
A. Ray Kumapayi  
Geotechnical Engineer

ARK:RW  
Attachments

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C.O. Bridge (2)  
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**SITE INVESTIGATION REPORT  
PROJECT I.D. 1530-00-01  
USH 10 & FRONT STREET  
RW-47-XX  
PIERCE COUNTY**

**1. GENERAL**

The subject site is located on USH 10 and Front Street in Pierce County. A roadway embankment adjacent to bridge structure B-47-40 on the east abutment is proposed to be retained as the existing split-block retaining wall system needs replacement.

**2. SUBSURFACE CONDITION**

Three borings were made on site to determine the subsurface conditions for the proposed structure. These borings were made in compliance with AASHTO T-206 Method for Standard Penetration Tests and were utilized to determine soil parameters for foundation design, estimate relative density, and obtain samples for textural classification. The soil identifications and textures on the boring logs are those made by the driller in the field with verification by Central Office Geotechnical staff.

All the borings had similar textures and layering within the soil strata: from surface elevation, about a foot of dark silty topsoil; 8 to 10 feet of loose sands with some silts and/or gravel; 10 to 12 feet of firm, brown sand; a 3 to 4-foot layer of weathered rock followed by hard limestone bedrock to refusal.

At auger refusal (21 feet in boring #2), a 10-foot rock-core was advanced with 90% recovery. The RQD(Rock Quality Designation) is however, 50%, suggesting fragmentation in the core. A visual inspection of the core confirms upper layer fragmentation due to sandstone seams.

At the time of drilling (February 23, 1995), the soil strata was damp to moist from surface elevation to completion. No groundwater was observed.

**3. ANALYSIS**

The existing split-block retaining wall is fatigued and is no longer able to support the lateral pressures being exerted by the roadway and backfill. Consolidation of the wall backfill suggests active hydrostatic pressures. A wall system that is able to support the roadway is therefore necessary. The split-block wall may then be rebuilt for aesthetics.

Several retaining wall systems were looked at to determine the best way to stabilize this roadway embankment. Issues such as cost, structural integrity, constructability and aesthetics were of concern.

*Cost:* A least cost-effective method (design and construction) was essential.

*Aesthetics:* A "Look-Out" area at roadway level was to be maintained and the existing split-block wall facia also.

**Constructability:** A variety of wall systems require more work-space than is available. Some wall systems require retaining the roadway during their construction. To do this, sheet-piles would have to be driven. Driving sheet piles to temporarily retain the roadway could not be accomplished as the bedrock is shallow and the vibratory effects of the driving would adversely affect the stability of the existing wall which is barely holding up.

## RECOMMENDATIONS

Drilled caissons are the choice of retention system. The drilling equipment is much quieter than pile drivers and does not cause massive ground vibrations that can adversely affect adjacent piles or existing wall systems.

The following soil parameters were used in the analysis of the wall:

Soil Description	Unit Weight (pcf)	Friction Angle (degrees)	Soil Cohesion (psf)
Loose Brown Sand	110	30	0
Firm Brown Sand	120	30	0
Weathered Limestone	140	40	2500
Limestone Bedrock	145	45	3000

*\*Please refer to the boring logs for the location of each soil matter.*

24-inch diameter steel-reinforced concrete drilled caissons are recommended. The maximum bending moment anticipated is 68,448.00 lbs-ft.

Our design indicates socketing the caissons a minimum of three feet into competent bedrock. Competent bedrock appears to begin at elevation 683±. This should be inspected for its competency as the weathered region above this elevation may be deceiving. The minimum depth of penetration into the rock and the inspection criteria should be adhered to.

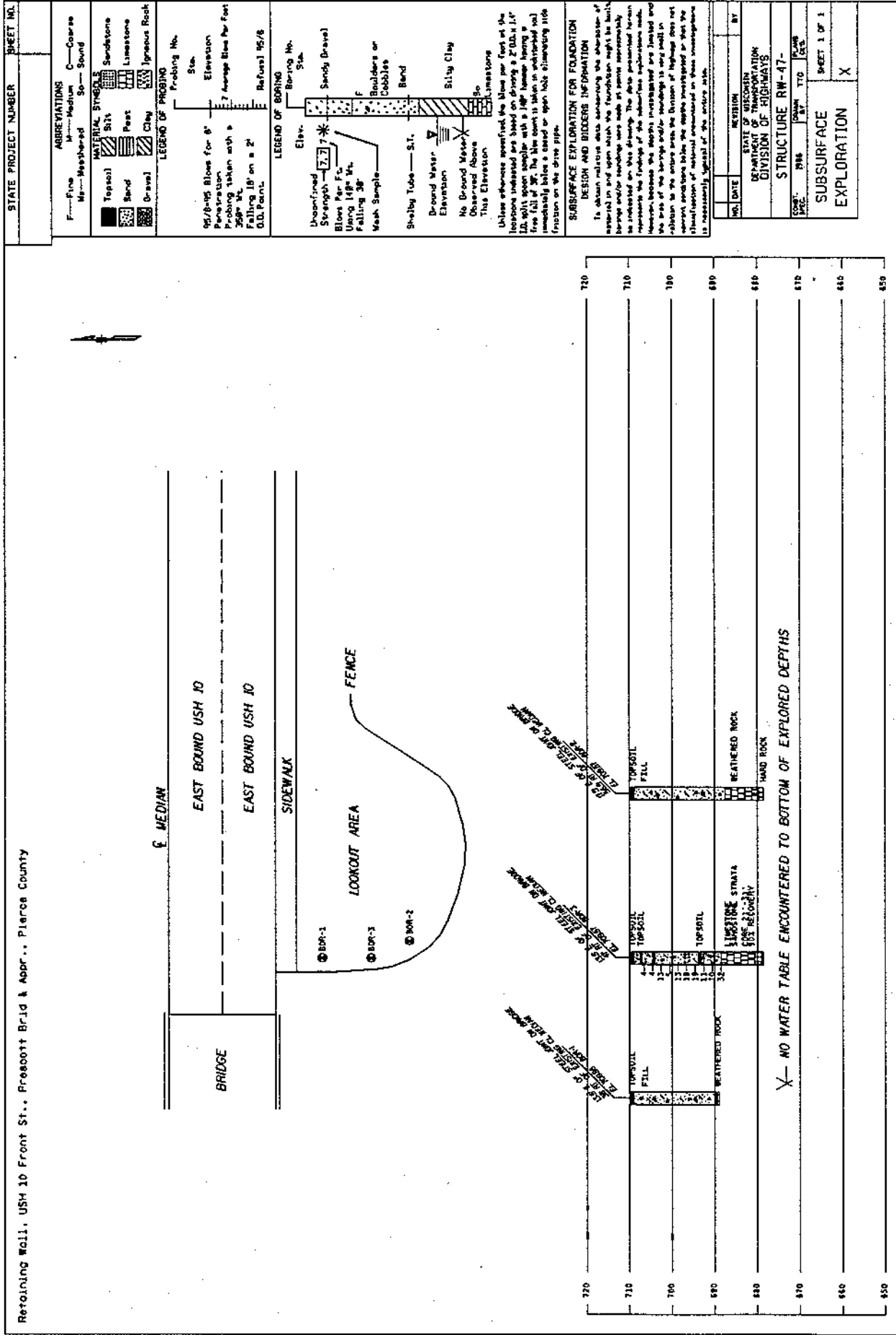
The caissons should span the length (at existing railing location), beginning from the abutment wall to where the existing three vertical split-block walls become two. The caissons should overlap or be staggered for group effect. A slurry mix or protective casing may be required during drilling to prevent the soil from caving in.

For drainage, a granular backfill for the split-block wall is recommended.

Should you have any questions/comments, please contact the Geotechnical Unit.



Retaining Wall, USH 10 Front St., Precast Brd & Appr., Pierce County







# FIELD BORING LOG

EL3(S). 385

State of Wisconsin/Department of Transportation

Boring No. 3 Structure PRESOTT PEABRIDGE County PIERCE Sheet 1 of 1

Project 0616-06-00 Road USH "10"

Station	13.5' E OF STEEL JOINT Offset ON BRIDGE	47.5' RT of MEDIAN	Surface Elevation	709.57
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## GROUND WATER OBSERVATIONS

While drilling \_\_\_\_\_ Time after drilling \_\_\_\_\_

Before casing removal \_\_\_\_\_ Depth to water \_\_\_\_\_

After Boring Completed \_\_\_\_\_ Depth to cave-in \_\_\_\_\_

**Cave In** \_\_\_\_\_ **Water Notes** \_\_\_\_\_

MOISTURE		DRILLING METHOD			Start <u>02-23-95</u> Unit <u>4</u>
D = Damp	HS = Hollowstem	ST = Shelby tube	A = Auger	E = Easy	Finish <u>03-23-95</u> Chief <u>Anderson</u>
M = Moist	WA = Washahead	SS = Split spoon	C = Coring	M = Medium	
W = Wet	RB = Rockbit	DM = Drilling mud	W = Wash	H = Hard	

Start 02-23-95 Unit 4  
Finish 02-23-95 Chief Anderson

[illegible]

Checked by	Final	Boring No.
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## Final

Boring No.

3

## FIELD BORING LOG

EL35 985

State of Wisconsin/Department of Transportation

Boring No. 1 Structure Retaining Wall County Pierce Sheet 1 of 2  
Project D616-06-00 Road USH 10 City of Prescott  
Station 13.5 E. of E. Abut. Offset 47' Rt E Surface Elevation \_\_\_\_\_

## GROUND WATER OBSERVATIONS

While drilling \_\_\_\_\_ Time after drilling \_\_\_\_\_  
Before casing removal \_\_\_\_\_ Depth to water \_\_\_\_\_  
After Boring Completed \_\_\_\_\_ Depth to cave-in \_\_\_\_\_  
Cave In \_\_\_\_\_ Water Notes \_\_\_\_\_

## MOISTURE

D = Damp  
M = Moist  
W = Wet

HS = Hollowstem  
WA = Washahead  
RB = Rockbit

## DRILLING METHOD

ST = Shelby tube  
SS = Split spoon  
DM = Drilling mud

A = Auger  
C = Coring  
W = Wash

E = Easy  
M = Medium  
H = Hard

Start 2-3-95 Unit 3  
Finish \_\_\_\_\_ Chief Horszma

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Blows on		
							Casing Size	Probe Size	Drilling Method
	M			BI TOPSOIL					
				Br. SAND little gravel to silt					
				1'	1'				
				2'	2'				
		1		BI TOPSOIL					
1	M	2		W. loose Br. SAND little gravel to silt					
		2		3'	3'				
		3		4'	4'				
		2							
2	M	2		5'	5'				
		2		Loose Br. SAND little silt & gravel					
		3		6'	6'				
		6		Firm Br. SAND little gravel to silt little silt					
3	M	7		7'	7'				
		6							
		6		8'	8'				
		2		Loose					
4	M	2		9'	9'				
		3							
		2		10'	10'				
		2							
5	M	3		11'	11'				
		10		Firm					
		7		12'	12'				
		5		Thin layer gravel					
6	M	8		13'	13'				
		10		Thin layer gravel					
		10		14'	14'				

Checked By \_\_\_\_\_

Final \_\_\_\_\_

Boring No. 1

## FIELD BORING LOG

EL35 985

State of Wisconsin/Department of Transportation

Boring No. 1 Structure Retaining Wall County Pierce Sheet 2 of 2Project 0616-06-00 Road USH 10 City of PrescottStation 13.5 E. of E. Abut. Offset 47' Rt & Surface Elevation \_\_\_\_\_

## GROUND WATER OBSERVATIONS

While drilling \_\_\_\_\_ Time after drilling \_\_\_\_\_

Before casing removal \_\_\_\_\_ Depth to water \_\_\_\_\_

After Boring Completed \_\_\_\_\_ Depth to cave-in \_\_\_\_\_

Cave In \_\_\_\_\_ Water Notes \_\_\_\_\_

## MOISTURE

D = Damp  
M = Moist  
W = Wet

## DRILLING METHOD

HS = Hollowstem  
WA = Washahead  
RB = RockbitST = Shelby tube  
SS = Split spoon  
DM = Drilling mudA = Auger  
C = Coring  
W = WashE = Easy  
M = Medium  
H = HardStart 2-3-95 Unit 3Finish \_\_\_\_\_ Chief Harstman

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	VISUAL FIELD CLASSIFICATION AND REMARKS	Unclassified Strength	Boulders	Blows on		
							Casing Size	Probe Size	Drilling Method
		14		14 Firm Br. SAND little gravel + silt 14					55
7	M	14		15	15				
		5							
		5							
		3		2/6 Bl TOPSOIL	16				
		4		loose grey silty SAND tr gravel					
8	M	7		3/7	17				
		9		Firm Br. silty SAND tr gravel					
		8		4/8	18				
9	M	5		5/9	19				
		8		Firm Br. SAND tr gravel + silt					
		12		6/20	20				
10	M	20		Thin layer gravel Thin layer Br. silty sand N.S.S. refusal					
		60 1/2		7/21	21				
				lt Br. LIMESTONE					A
				8/22	22				H
				9/23 Auger refusal	23				
				10/24	24				
				11/25	25				
				12/26	26				
				13/27	27				
				14/28	28				

Checked By \_\_\_\_\_

Final \_\_\_\_\_

Boring No. 1