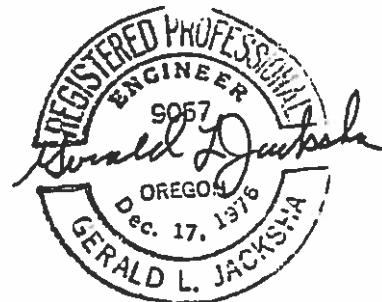


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GEOTECHNICAL EXPLORATION  
for the  
TRI-CITY SEWAGE TREATMENT PLANT  
CLACKAMAS COUNTY, OREGON  
Prepared for  
TRI-CITY SERVICE DISTRICT  
CLACKAMAS COUNTY, OREGON



by  
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PORTLAND, OREGON 97201

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Project No. P15600.A5



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GEOTECHNICAL EXPLORATION  
TRI-CITY SEWAGE TREATMENT PLANT

INTRODUCTION

Purpose and Scope

This report presents the findings of our geotechnical exploration for the Tri-City Sewage Treatment Plant in Clackamas County, Oregon.

The scope of our work included:

- Conducting a drilling program consisting of 14 soil borings
- Performing laboratory testing on selected soil samples collected from soil borings
- Preparing this report summarizing our findings

Site Description

The project site is located in Clackamas County, Oregon, as shown on Figure 1. The site is approximately 16 acres in area and is bordered by the Clackamas River to the north, Agnes Avenue to the east, and a vacant lot to the west and south. The site topography varies between elevation 40 and 50 feet, National Geodetic Vertical Datum of 1929 (NGVD).

Project Description

The proposed plant will consist of the following facilities: two secondary clarifiers, an aeration basin, odor control facilities, blower building, primary sedimentation basin and grit chamber, plant pump station, screening building, chlorine contact basin, two digesters, flotation thickener building, chlorine building, shops, administration building, and miscellaneous galleries.

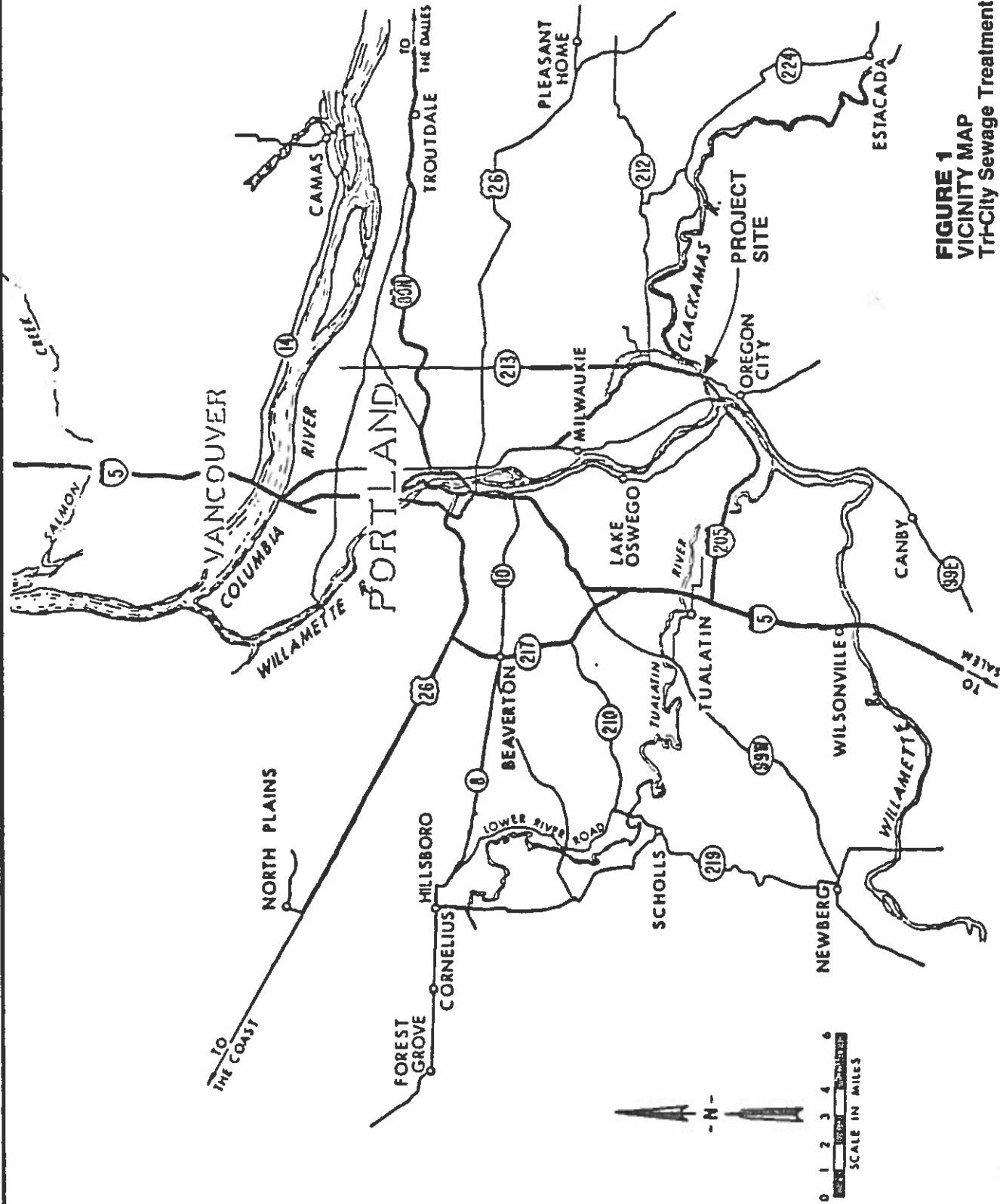
Limitations

This report has been prepared for the exclusive use of Tri-City Service District for specific application to the Tri-City Sewage Treatment Plant in accordance with generally accepted geotechnical engineering practice. No other warranty, expressed or implied, is made.

The findings contained in this report are based on the data obtained from 14 soil borings. Soil borings indicate soil conditions and groundwater levels only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect variations that may exist between boring locations.

CH2M  
HILL

FIGURE 1  
VICINITY MAP  
Tri-City Sewage Treatment Plant



CH2M HILL is not responsible for any claims, damages, or liability associated with interpretation of subsurface data, or for the reuse of subsurface data, without the express written authorization of CH2M HILL.

## EXPLORATION

### Geologic Setting

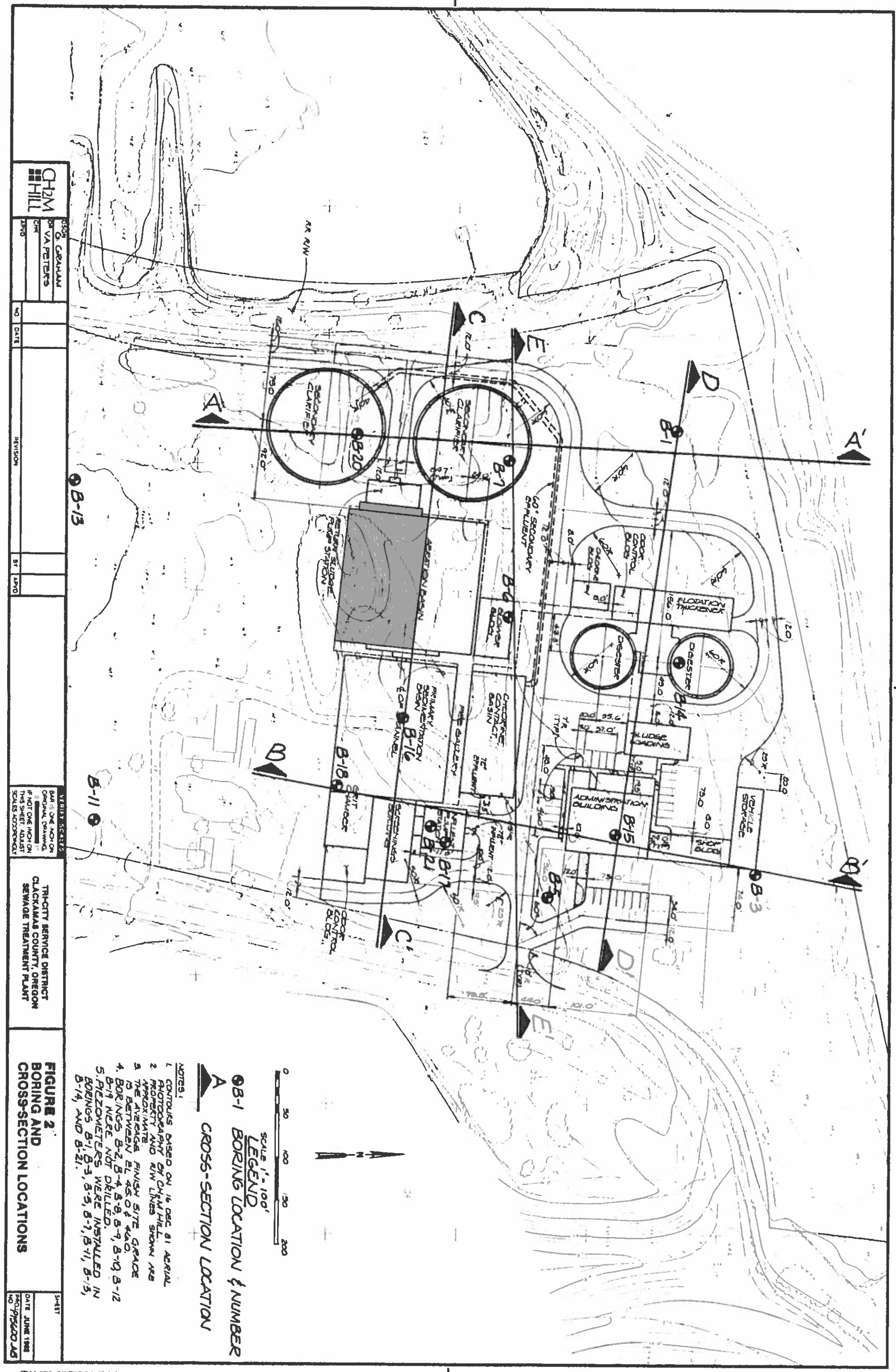
The proposed sewage treatment plant is located in an area of low relief near the confluence of the Willamette and Clackamas Rivers. The uppermost geologic unit is alluvium deposited by the Willamette and Clackamas Rivers. The alluvium is composed of unconsolidated silt, sandy silt, and sand. The alluvium is underlain by deltaic sandy gravel that was deposited during torrential flooding about 13,500 years ago.

The Troutdale and Sandy River Mudstone Formations and the Columbia River Basalt, respectively, underlie the sandy gravel in the vicinity of the proposed treatment plant. The Troutdale Formation is comprised of siltstone, sandstone, and cemented gravel. The Sandy River Mudstone typically consists of indurated, well-layered fine sand and silt, with occasional gravel lenses. The Columbia River Basalt, the oldest geologic unit in the project area, is comprised of extensive lava flows that underlie the entire Tri-City area.

During Pliocene time (2 to 5 million years ago), the Troutdale Formation, Sandy River Mudstone, and Columbia River Basalt were folded into a gently sloping, northwest trending downwarp. The shallow fold produced lowlands that, in the project area, eventually became filled with the younger deltaic gravels and alluvium. (Information from Schlicker and Finlayson, 1979.)

### Field Exploration

Our field exploration program consisted of 14 soil borings. The locations of borings are shown on Figure 2, and boring logs are presented in Appendix A. The borings ranged in depth from 26.5 to 76.5 feet, with most being about 50 feet deep. The exploration program was observed in the field by a CH2M HILL engineering geologist. Soil borings were drilled by Don Kenner Drilling of Oregon, Inc., of Sherwood, Oregon. Borings B-1 and B-3 were drilled between December 21 and 23, 1981, using a CME-55 rotary drilling rig. The remaining 12 borings were drilled using a CME-75 rotary drill rig between December 28 and 29, 1981, January 11 and 13, 1982, May 18 and 20, 1982, and on May 24, 1982. Bentonite drilling mud was used in all borings except B-21 to remove cuttings and to prevent sidewalls from collapsing. Boring B-21 was drilled with water as the drilling fluid and the hole was cased. Boring locations and elevations were determined by surveying



CH2M HILL		DESIGN G. GRAHAM DR. VA. PETERS CMM	APVO	NO.	DATE	REVISION	REV. LEARN
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VERIFY SERVICE

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**TRICITY SERVICE DISTRICT**  
**CLACKAMAS COUNTY, OREGON**  
**SEWAGE TREATMENT PLANT**

**FIGURE 2**  
BORING AND  
CROSS-SECTION LOCATIONS

DATE JUNE 1982  
PROJ. NO. 00752643

## **PRELIMINARY**

methods. Elevations are based on the National Geodetic Vertical Datum (NGVD).

Representative samples of materials encountered in the borings were generally obtained at 2.5-foot or 5-foot intervals with a standard 2-inch outside diameter split-spoon sampler, following the requirements of the Standard Penetration Test (ASTM D 1586). This test is used to characterize the consistency or density of in-place soil by measuring penetration resistance expressed as "blow counts," or "N-value." The blow count is the number of blows required to advance a standard split-spoon sampler 6 inches with a 140-pound hammer falling 30 inches. The sampler is driven 18 inches, and the blow count is recorded for each 6-inch increment. The sum of the second and third increments is referred to as the N-value. Low N-values indicate soft or loose deposits, while high N-values are evidence of hard or dense materials. After the sampler has been driven and the blow counts recorded, the sampler is withdrawn from the boring to recover a disturbed soil sample.

Soil samples were examined in the field and visually classified in approximate accordance with the visual-manual procedure for description of soils (ASTM D 2488). Sampling intervals and classification of soil samples are presented in the boring logs. Field soil boring logs were revised as necessary based on laboratory testing and office examination.

Shelby tube samples were recovered from some borings. The tube samples provided relatively undisturbed soil samples that are suitable for laboratory testing. The samples were obtained using 3-inch-diameter, thin-walled, seamless steel tubes that are 30 inches long (ASTM D 1587). The tubes were pushed 24 inches into the undisturbed soil in one continuous stroke without rotation with the hydraulic drive head of the drill rig. Intervals where tube samples were recovered are shown on the boring logs.

Open standpipe piezometers were installed at borings B-1, B-3, B-5, B-7, B-11, B-13, B-14, and B-21 to permit monitoring of water levels. Piezometers consist of a slotted PVC tip, 1-1/2 inches in diameter and 18 inches long, connected to a 3/4-inch inside diameter PVC riser pipe. The annular space around the piezometer tips and riser pipes was gravel-packed with 3/8-inch-diameter pea gravel to within at least 15 feet from the ground surface. The zone of gravel-packing was then sealed with bentonite and backfilled to the ground surface. The position of the piezometer tips and the zone of gravel pack are described on the boring logs in Appendix A.

Falling head permeability tests were performed in boring B-21 at depth intervals of 8 to 10 feet, 18 to 20 feet, and 28 to 30 feet. The two shallow tests were performed in sandy silt and the deepest test was performed in sandy gravel.

Results indicate a permeability range of  $10^{-4}$  to  $10^{-5}$  cm/sec for the sandy silt. Test results for the sandy gravel were inconclusive. However, studies performed by CH2M HILL in the sandy gravel beneath locations adjacent to Rossman's Landfill indicate permeability values in the range of  $10^{-1}$  to  $10^{-2}$  cm/sec (unpublished report).

#### Laboratory Testing

Selected samples of the silt were tested in CH2M HILL's Portland laboratory for natural moisture content, liquid limits, and plastic limits. Grain size analysis and direct shears were also performed on selected samples. The results of these tests are shown in Appendix B. Classification of selected samples was also performed in the laboratory to confirm our visual field classification of the soils.

Consolidation tests were performed on relatively undisturbed samples of the silt layer to determine the compressibility of the soil. The results of these tests are shown in Appendix B.

#### FINDINGS

##### Subsurface Conditions

The generalized subsurface conditions at the site, described from the ground surface downward, are as follows:

- Silt: Generally the silt is of low plasticity, with 5 to 15 percent fine sand. The silt is brown and is typically soft to very soft. Thickness varies from 1 to about 24 feet, and increases with distance from the Clackamas River. N-values range from 1 to 5, but are usually 2 or 3. A 6- to 12-inch layer of topsoil was apparent at the surface of the silt layer.
- Sandy silt and silty sand: Alternating, discontinuous layers of brown sandy silt and silty sand were found in the upper part of each boring. These materials appear at the surface in the northern third of the site along the Clackamas River and are found beneath silt (described above) in the southern two-thirds of the site. The sandy silt is non-plastic with 15 to 50 percent fine sand. Consistency is typically soft. N-values range from 2 to 8, but are usually about 3. The silty sand is loose to very loose, and has from 15 to 50 percent fines. N-values range from 3 to 9. Collectively, the layers of sandy silt and silty sand form a unit that varies in thickness from 1 to about 30 feet. The thickest deposits occur along the northern part of the site nearest to the

Clackamas River. A 6- to 12-inch layer of topsoil was apparent at the surface of the sandy silt and silty sand layer.

- Sandy gravel: The gravel is poorly graded with well-rounded cobbles and gravel, 15 to 30 percent fine-to-coarse sand, 5 to 10 percent non-plastic fines. Sand lenses occur in the unit and the entire deposit is poorly cemented. Thickness of the sandy gravel varies from 12 to 29 feet, and color is brown and black. N-values range from 44 to greater than 100 in sandy gravel and are about 25 in sand lenses.
- Highly weathered siltstone (present only in boring B-1): This siltstone is highly weathered to a soil that is moderately plastic with 5 to 10 percent fine sand in the uppermost part. The highly weathered siltstone is at least 13 feet thick, and color is dark grayish-green with reddish and yellowish mottling. An N-value of 27 was obtained from this material.
- Siltstone: This deposit consists of weathered and oxidized siltstone composed of particles of silt, clay, and fine sand. A relict texture of decomposed medium and coarse sand grains is locally present. The weathered rock is known to be at least 26 feet thick at boring B-5. Color is typically gray but is locally light blue-gray with dark gray, orange-brown, blue-green, or whitish mottling. N-values range from 70 to greater than 100. It is not clear whether this siltstone or the highly weathered siltstone described above are part of the Troutdale or Sandy River Mudstone Formations.

The generalized subsurface profile is presented on the cross-sections in Appendix C.

#### Groundwater Conditions

Groundwater levels were monitored in all borings where a piezometer was installed. A table and plot of groundwater levels versus time are presented in Appendix A. The plot shows that groundwater levels at the plantsite fluctuate with the seasons, generally ranging between elevations 10 and 18 feet. Approximately 250 feet south of the plant, the groundwater levels of Borings B-11 and B-13 were generally 4 to 13 feet higher than at the plant.

During floods, the elevation of both the Clackamas River and the groundwater level will probably rise. According to the

Corps of Engineers, Portland District, the following flood elevations can be expected:

<u>Recurrence Interval</u>	<u>River Elevation</u>
500 year	52.6 feet
100 year	44.3 feet
50 year	41.1 feet
10 year	34.0 feet

During the 1964 flood event, the Clackamas River at the treatment plantsite rose above elevation 30 feet for a period of 8 days. The maximum elevation during this 8-day period was 44 feet.



## REFERENCES

Schlicker, H.G. and C.T. Finlayson. 1979. Geology and geologic hazards of northwestern Clackamas County, Oregon. Oregon Department of Geology and Mineral Industries Bulletin 99, 79 pp., map scale 1:24,000.

**Appendix A**  
**BORING LOGS AND GROUNDWATER LEVELS**

## BORING LOG LEGEND:

### SAMPLE TYPE:

S - SPLIT-BARREL (ASTM D1586 UNLESS OTHERWISE NOTED)  
ST - SHELBY TUBE  
W - WASH SAMPLE  
OT - OSTERBERG TUBE  
NX - DIAMOND CORE BARREL

### STANDARD PENETRATION TEST:

BLOWS - THE NUMBER OF BLOWS FOR THREE 6-INCH INCREMENTS REQUIRED FROM A 140-LB HAMMER FALLING 30 INCHES TO DRIVE A STANDARD 2-INCH O.D. SPLIT-BARREL SAMPLER (ASTM D1586).

"N" - THE SUM OF BLOWS FOR THE SECOND AND THIRD 6-INCH INCREMENTS. IF THE SAMPLER IS DRIVEN LESS THAN 18 INCHES, THEN "N" IS THE NUMBER OF BLOWS FOR THE LAST TWO 6-INCH INCREMENTS.

### UNIFIED SOIL CLASSIFICATION SYMBOL:

GROUP SYMBOL AS PER ASTM D 2487

## NOTES:

1. BORINGS WERE DRILLED BY DON KENNER OF OREGON, INC. OF SHERWOOD, OREGON. BORINGS B-1 AND B-3 WERE DRILLED IN DECEMBER, 1981, USING A TRUCK-MOUNTED CME-55. THE REMAINDER OF THE BORINGS WERE DRILLED WITH A TRUCK-MOUNTED CME-75 IN DECEMBER, 1981, AND IN JANUARY AND MAY, 1982.
2. ENGINEERING PROPERTIES OF SUBSURFACE MATERIALS ARE OPINION OF THE ENGINEERING GEOLOGIST, EXCEPT WHERE LABORATORY TESTING WAS CONDUCTED.
3. THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS.
4. TRANSITIONS BETWEEN SOIL TYPES MAY BE GRADUAL AND ARE APPROXIMATELY AT THE ELEVATIONS SHOWN.
5. STANDARD PENETRATION TESTS WERE TAKEN IN APPROXIMATE ACCORDANCE WITH ASTM D1586.
6. SAMPLES WERE EXAMINED IN THE FIELD AND VISUALLY CLASSIFIED IN APPROXIMATE ACCORDANCE WITH ASTM 2488.
7. OPEN STANDPIPE PIEZOMETERS WERE INSTALLED IN BORINGS B-1, 3, 5, 7, 11, 13, 14, AND 21. ALL PIEZOMETERS CONSISTED OF A PVIOUS PVC TIP THAT IS 18-INCHES LONG, 1.5-INCH INSIDE DIAMETER, AND HAS NOMINAL 0.010-INCH SLOTTED OPENINGS WITH 1/4-INCH SPACINGS. ALL TIPS WERE PACKED WITH 3/8-INCH PEA GRAVEL. RISER PIPE CONSISTS OF 3/4-INCH PVC PIPE, WITH APPROXIMATELY 0.5 FEET OF STANDPIPE ABOVE THE GROUND SURFACE. SEE INDIVIDUAL BORING LOGS FOR POSITION OF PVIOUS TIP, ZONE OF GRAVEL-PACKING, AND LOCATION OF BENTONITE SEAL(S).

MAJOR DIVISION	LETTER DESIGNATION	GRAPHIC SYMBOL	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOIL	GW	Well-graded gravel or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel or gravel-sand mixtures, little or no fines
		GM	Silty gravel, gravel-sand-silt mixtures
		GC	Clayey gravel, gravel-sand-clay mixtures
	SAND AND SANDY SOIL	SW	Well-graded sand or gravelly sand, little or no fines
		SP	Poorly graded sand or gravelly sand, little or no fines
		SM	Silty sand, sand-silt mixtures
		SC	Clayey sand, sand-silt mixtures
FINE GRAINED SOILS	SILTS AND CLAYS OF LOW PLASTICITY	ML	Inorganic silt of low to medium plasticity, gravelly silt, sandy silt, clayey silt
		CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay
		OL	Organic silts of low plasticity
		MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity
		OH	Organic clay and silt of medium to high plasticity
	HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils
	FILL		Fill, variable composition
	ROCK		Siltstone

GRAPHIC COLUMN LEGEND



## SOIL BORING LOG

PROJECT TR. CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, CME-55

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON, INC.

ELEVATION 42.51 FEET

BORE HOLE: B-1

WATER LEVEL SEE TEXT DATE:

START: 12/21/81

FINISH: 12/22/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5.0									
7.0	ST-1	21		---	-	SAND, SIMILAR TO S-1 (SEE BELOW)			START DRILLING AT 11:25  LANDOWNER NOTES FILL MIGHT HAVE BEEN DUMPED ON SITE DURING CONST- RUCTION OF I-205
8.5	S-1	7	2-2-2	4		SAND, FINE SAND WITH LESS THAN 5% NON-PLASTIC FINES, BROWN, MOIST, VERY LOOSE.		SP	BEGIN WITH DRAG BIT CHANGE TO ROLLER BIT AT 24.9 FT.
10.0						SAND, SAME AS S-1		SP	
11.5	S-2	7	2-1-2	3				SP	
15.0						SAND, SAME AS S-1		SP	
16.5	S-3	7	2-3-5	8				SP	
20.0						SILTY SAND, SIMILAR TO S-1 EXCEPT 20-25% NON-PLASTIC FINES		SM	
21.5	S-4	17	2-2-2	4					
25.0						SANDY GRAVEL, POORLY GRADED, WELL ROUNDED GRAVEL AT LEAST TO 1 1/4 INCH, 20% FINE-TO- COARSE SAND, MOSTLY MEDIUM, ABOUT 5% NON-PLASTIC FINES, WET, BROWN AND BLACK, VERY DENSE.		GP	DRILLER NOTES HARD DRILLING AT 24.9 FT. MIX MORE MUD AT 25 FT.
26.5	S-5	14	26-46-46	92					
									SLOW ROUGH DRILLING TO 46 FT.

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-55

DRILLERS &amp; EQUIPMENT DON KENNER (OREGON, INC.)

ELEVATION 42.51 FEET

BORE HOLE: B-1

WATER LEVEL SEE TEXT DATE: START: 12/21/81 FINISH: 12/22/81 INSPECTOR CWH

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
30	30	S-6	8	55-60 <sup>1/6</sup>	105/ <sup>12</sup> "	SANDY GRAVEL, SIMILAR TO S-5, WITH ABOUT 30% GRAVEL		GP	LOST CIRCULATION AT 31.5 FT, 32 AND 35 FT, REQUIRED MIXING MORE MUD.
35	35.0	S-7	0	60 <sup>1/5</sup> "	60/ <sup>5</sup> "	NO RECOVERY			SAME COARSE ANGULAR SAND CUTTINGS IN SAMPLE TUB. DRILLER NOTES SAND LENS AT 37-38 FT.
40	40.0	S-8	0	60 <sup>1/3</sup> "	60/ <sup>3</sup> "	NO RECOVERY			SAMPLER BOUNCED DURING SPT LOSE CIRCULATION AT 43 FT. VERY HARD, SLOW DRILLING, ADD NEW TRI CONE BIT AT 43 FT.
45	45.0	S-9	0	60 <sup>1/4</sup> "	60/ <sup>4</sup> "	NO RECOVERY			DRILLER NOTES CHANGE IN DRILLING RATE (UP) AT 46 FT. SAMPLE SS-10 PROBABLY FELLDOWN OF TUBE ON TRIP UP. SILTY SAND CAKED ON SAMPLER
50	50.0	S-10	18	7-11-16	27	SILTSTONE, HIGHLY WEATHERED PLASTICITY, 5-10% FINE-TO-MEDIUM SAND IN UPPER 9 INCHES, DARK GRAYISH-GREEN WITH ORANGE BROWN AND YELLOWISH MOTTLING, MOIST, VERY STIFF.		ML	
55	55.0	ST-2	12	--	-	SILT, SAME AS S-10			
58.5	58.5	SS-11	18	5-11-16	27	END BORING AT 58.5 FEET		ML	FINISHED DRILLING AT 1:00
60									



PROJECT NUMBER	P15600.A5
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## SOIL BORING LOG

PROJECT TRI CITY STP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD MUD ROTARY, CME-55 DRILLERS & EQUIPMENT D. KENNER OF OREGON, INC.  
 ELEVATION 4251 FT. BORE HOLE: B-1

WATER LEVEL SEE TEXT DATE: START: 12/21/81 FINISH: 12/22/81 INSPECTOR CWH

DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS  BLOWS      BPF 6''-6"-6"      "N"	SOIL DESCRIPTION  (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS  (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)					
					<u>PIEZOMETER INSTALLATION</u> <u>PLACEMENT OF PREVIOUS TIP:</u> <u>AT 40.0FT.</u> <u>GRAVEL PACK: FROM 58.5 FT</u> <u>BENTONITE SEAL: FROM 22.9</u> <u>RISER PIPE LENGTH: 40 FEET.</u>	(SEE TOP AT 38.5 FT, BOTTOM TO 24.9 FT. TO 24.9 FT.		NOTES, BORING LOG LEGEND)

## SOIL BORING LOG

PROJECT TRI CITY STP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD MUD ROTARY, CME-55 DRILLERS & EQUIPMENT DON KENNER OF OREGON, INC  
 ELEVATION 46.13 FT. BORE HOLE: B-3

WATER LEVEL SEE TEXT DATE: START: 12/22/81 FINISH: 12/23/81 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
	6"-6"-6"	"N"							
5.0									START DRILLING AT 2'35
6.5	S-1	8	1/2"-2	2		SANDY SILT, NON TO SLIGHTLY PLASTIC FINE, ABOUT 25% FINE SAND, BROWN, MOIST, VERY SOFT,		ML	BEGIN WITH DRAG BIT. CHANGE TO ROLLER BIT AT 25.3 FT.
7.0									
9.0	ST-1	21	---	-					
10.0						SANDY SILT, SIMILAR TO S-1, WITH 30-40% FINE SAND.			
11.5	S-2	8	2-2-2	4				ML	
15.0									
17.0	ST-2	19	---	-		SILTY SAND: FINE SAND WITH 15-20% NON TO SLIGHTLY PLASTIC FINE, BROWN, WET, VERY SOFT TO FIRM.		SM	
20.0						SILTY SAND: SIMILAR TO ST-2, WITH 10-15% FINES.		SM	
21.5	S-3	2	3-4-5	9				SM	DRILLER NOTES GRAVEL AT 23.5 FT.
24.5									
24.0	S-4	2	19-28-32	60		SANDY GRAVEL: POORLY-GRADED ROUNDED GRAVEL TO AT LEAST 1 1/4 INCH MAXIMUM SIZE, 5-10%, NON PLASTIC FINES, BROWN TO BLACK, WET, VERY DENSE.	GP-GM		SLOW, ROUGH DRILLING TO 485 FT
30.0									

## SOIL BORING LOG

PROJECT TRI CITY WWTP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD MUD ROTARY; CME-55 DRILLERS & EQUIPMENT D KENNER OF OREGON, INC.  
 ELEVATION 46.13 FEET BORE HOLE: B-3

WATER LEVEL SEE TEXT DATE: START: 12/22/81 FINISH: 12/23/81 INSPECTOR CWH

(FEET) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
30	30.0	S-5	3	24-18-16	44	SANDY GRAVEL, SAME AS S-4.	GP-GM	GP-GM	LAST 6" OF DRIVE FOR SS-5 MIGHT BE A SAND LENS.
	31.5								
35	35.0	S-6	0	60 1/2"	60 1/2"	NO RECOVERY	GP-GM	GP-GM	
	35.2								
40	40.0	S-7	3	60 1/4"	60 1/4"	SANDY GRAVEL, SAME AS S-4	GP-GM	GP-GM	
	41.3								
45	45.0	S-8	0	60 1/2"	60 1/2"	NO RECOVERY	GP-GM	GP-GM	DRILLER NOTES CHANGE IN DRILLING RATE (UP) AT 48.5 FT.
	45.2								
50	50.0	S-9	14	26-54-60 1/3"	114 1/9"	SILTSTONE: HIGHLY WEATHERED, 10-15% FINE TO MEDIUM SAND, MEDIUM HARD, GRAY WITH BLUE- GREEN AND WHITISH MOTTLING, SLIGHTLY MOIST, VERY DENSE.	GP-GM	GP-GM	
	51.5								
55	55.0	S-10	14	25-60 1/4"	85 1/10"	SILTSTONE, SAME AS S-9.	GP-GM	GP-GM	
	56.0								
						END BORING AT 56.0 FEET			FINISH DRILLING AT 1:00



PROJECT NUMBER

P15600.A5

## SOIL BORING LOG

PROJECT TRI CITY STP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD MUD ROTARY, CME-55 DRILLERS & EQUIPMENT D. KENNER OF OREGON, INC.  
 ELEVATION 460.13 BORE HOLE: B-3  
 WATER LEVEL SEE TEXT DATE: START: 12/22/81 FINISH: 12/23/81 INSPECTOR CWH

DEPTH BELLOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS  BLOWS      BPF 6"-6"-6"      "N"	SOIL DESCRIPTION  (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFIICA- TION SYMBOL	COMMENTS  (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)					
					<u>PIEZOMETER INSTALLATION</u> (SEE NOTES ON BORING LOG LEGEND)  <u>PLACEMENT OF PREVIOUS TIP</u> : TIP AT 38.5 FT, BOTTOM AT 40.0 FT.  <u>GRAVEL PACK</u> : FROM 51.5 FT TO GROUND SURFACE  <u>BENTONITE SEAL</u> : FROM ABOUT 3 TO 16 FEET  <u>RISER PIPE LENGTH</u> : 40 FT.			

## SOIL BORING LOG

PROJECT TRI CITY WTP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, CME-75

DRILLERS &amp; EQUIPMENT D KENNER OF OREGON, INC

ELEVATION 44.75 FEET

BORE HOLE: B-5

WATER LEVEL SEE TEXT

DATE:

START: 1/12/82

FINISH: 1/13/82

INSPECTOR CWL

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5									
5.0									
6.5	S-1	9	1-1-1	2		SANDY SILT, NON PLASTIC, ABOUT 35% FINE SAND BROWN, MOIST, VERY SOFT TO STFT.		ML	START DRILLING AT 2:10
8.0									
10.0	ST-1	24	---	-		SANDY SILT, SAME AS S-1.		ML	
11.5	S-2	12	1-1-1	2				ML	
15.0									
16.5	S-3	9	1-2-1	3		SANDY SILT, SIMILAR TO S-1, WITH ABOUT 40% FINE SANDS		ML	
18.0									
20	ST-2	24	---	-		SANDY SILT, SAME AS S-1		ML	
21.5	S-4	14	1-1-3	4				ML	
25									
26.5	S-5	3	5-3-7	10		SAND, POORLY GRADED FINE SAND, 5-10% NON PLASTIC FIRES, BROWN, MOIST, LOOSE	GP- SM		DRILLER NOTES GRAVEL AT 27FEET
30									

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-75

DRILLERS &amp; EQUIPMENT D KENNER, INC

ELEVATION 44.75 FT.

BORE HOLE: B-5

WATER LEVEL SEE TEXT

DATE: 1/12/82

START: 1/12/82

FINISH: 1/13/82

INSPECTOR CLH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	DEPTH INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
30	300								
	31.5	S-6	7	42-36-45	81	SANDY GRAVEL, POORLY GRADED, ROUNDED GRAVEL TO AT LEAST 1 1/4 INCH, 20-25% FINE TO MEDIUM SAND, 5-10% NON PLASTIC FINES, BROWN AND BLACK, WET, VERY DENSE		GP-GM	SAMPLER BOUNCED DURING SS-6 SPT LOST CIRCULATION AT 33 FEET, MIX MORE MUD.
35	350								
	33.1	S-7	0	40 1/2	60 1/2	NO RECOVERY			SAMPLER BOUNCED DURING SS-7 SPT MIX MORE MUD AT 40FT.
40	400								
	40.3	S-8	0	60 1/2	60 1/2	NO RECOVERY			SAMPLER BOUNCED DURING S-8 SPT
45	450								
	46.0	S-9	5	28-60 1/2	88 1/2	SANDY GRAVEL, POORLY GRADED, ROUNDED GRAVEL TO AT LEAST 1 1/4 INCH, ABOUT 15% FINE TO COARSE SAND, APPROXIMATELY 5% NON PLASTIC FINES, BROWN, WET, VERY DENSE		GP-GM	LOSE CIRCULATION AT 47 FT.
50	500								
	51.5	S-10	18	20-46-60 1/2	106 1/2	SILTSTONE, HIGHLY WEATHERED TO SILT AND CLAY-SIZED PARTICLES, GRAY, UPPER 4 INCHES OXIDIZED TO ORANGE-BROWN, SLIGHTLY MOIST, RELICT TEXTURE OF A MORE COARSE-GRAINED ROCK IS APPARENT			
55	550								
	56.0	S-11	12	20-60 1/2	80 1/2	SILTSTONE, SAME AS S-10 EXCEPT FOR UNIFORM GRAY COLOR AND THE PRESENCE OF BRITTLE ROCK FRAGMENTS			
60									

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-75

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON, INC.

ELEVATION 44.75 FT

BORE HOLE: B-5

WATER LEVEL SEE TEXT

DATE:

START: 1/12/82

FINISH: 1/13/82

INSPECTOR CWH

DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
	BLOWS	BPF	6"-6"-6"	"N"					
60									DRILLER NOTICES NO CHANGE IN DRILLING RATES TO 65 FT.
65.0									
65.0	S-12	9	28-64 1/3"	88 1/2"		SILTSTONE, SIMILAR TO S-11, EXCEPT FOR LOCAL BLUE-GREEN AND ORANGE-BROWN MOTTLING			
70									DRILLER NOTES UNIFORM DRILLING TO 75 FT, EXCEPT FOR OCCASIONAL lenses of harder material, possibly gravel
75.0									
75.0	S-13	5	60/5	60/5"		SILTSTONE, SIMILAR TO S-11, EXCEPT FOR BLUE-GREEN AND ORANGE-PINK MOTTLING.			
						END BORING AT 75.5 FT			
						PIEZOMETER INSTALLATION: (see notes on Boring Log Legend) PLACEMENT OF PREVIOUS TIP: TOP AT 38.5 FT, BOTTOM AT 40.0 FT.			
						GRAVEL PACK: FROM 76.5 FT TO GROUND SURFACE.			
						BENTONITE SEAL: FROM 12-14 FT			
						RISER PIPE LENGTH: 40 FT.			

## SOIL BORING LOG

PROJECT TRI CITY STP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD MUD ROTARY, CME-75 DRILLERS & EQUIPMENT D. KENNER OF OREGON, INC.  
 ELEVATION 42.14 feet BORE HOLE: B-6  
 WATER LEVEL MEASURED DATE: START: 1/11/82 FINISH: 1/12/82 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICA- TION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
	BLOWS	BPF	6"-6"-6" "N"						
5.0						SILTY TOPSOIL AT SURFACE			START DRILLING AT 3:30
6.5	S-1	9	2-1-1	3		SANDY SILT, LOW PLASTICITY, 30-40% FINE SAND, BROWN, MOIST, VERY SOFT, TRACE OF ORGANIC MATERIAL		ML	
8.0						SILT, LOW PLASTICITY, ABOUT 10% FINE SAND, BROWN, MOIST, VERY SOFT		ML	
10.0	ST-1	20	---	-		SILT, SAME AS S-1.		ML	
11.5	S-2	14	2-2-4	6				ML	
15.0									
16.5	S-3	9	3-3-4	7		SILTY SAND, LOW PLASTICITY, 58% FINE SAND, 32% SILT, 10% CLAY, BROWN, WET, LOOSE.	.....	SM	
20.0									
22.0	ST-2	13	---	-					ENCOUNTERED GRAVEL AT 21 FT, SHELBY TUBE BENT
22.8	S-4	6	32-60/ 41; 92/ 104"			SANDY GRAVEL, ROUNDED GRAVEL TO AT LEAST 1 1/4" ABOUT 25% FINE TO COARSE SAND, 5-10%. NON PLASTIC FINES, BROWN, VERY DENSE.	GP- GM		LOSE CIRCULATION AT 23 FT, MIX MORE MUD, SOFTER DRILLING 23-25 FT.
25.0						NO RECOVERY			
26.5	S-5	0	14-20.5	25					POSS SAND LENS FROM 23-26 FT? LOSE CIRCULATION AT 26 FT, MIX MORE MUD, SLOW ROUGH DRILLING TO 30 FT.

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON, INC

ELEVATION 42.14 FEET

BORE HOLE: B-6

WATER LEVEL MEASURED DATE:

START: 1/11/82

FINISH: 1/12/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
	BLOWS	BPF	6"-6"-6" "N"						
30	30.4	S-6	0	60	/5	60/ 5"	NO RECOVERY	GP- 6M	SAMPLER BOUNCED DURING SS-6 SPT MIX MORE MUD AT 30 AND 33 FT.
35	35.0						NO RECOVERY	GP- 6M	SAMPLER BOUNCES DURING SS-7 SPT
35	35.2	S-7	0	60	/3	60/ 3"	NO RECOVERY	GP- 6M	DRILLER NOTES LARGE ROCKS IN HOLE
40	40.0						SANDY GRAVEL, POORLY GRADED ROUNDED GRAVEL TO ATLEAST 1 1/4 INCH, ABOUT 25% FINE TO COARSE SAND, 5-10% NON PLASTIC FINES BROWN, WET, VERY DENSE	GP- 6M	SAMPLER BOUNCES DURING SS-8 SPT
41.5	41.5	S-8	6	48-45-60	/3	105/ 9"		GP- 6M	
45	45.0						NO RECOVERY	GP- 6M	MIX MORE MUD AT 45 FT.
45	45.2	S-9	0	60	/2 1/2	60/ 2 1/2"		GP- 6M	DRILLER NOTES CHANGE IN DRILLING rate (up) at 50 FT.
50	50.5						SILTSTONE, HIGHLY WEATHERED TO SILT AND CLAY SIZED PARTICLES, ABOUT 10% ROUNDED FINE TO	GP- 6M	
52.0	52.0	S-10	12	14-26-47		73	END BORING AT 52.0 FEET	GP- 6M	FINISH DRILLING AT 1:15
55									

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-55

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON, INC.

ELEVATION 41.33 FEET

BORE HOLE: B-7

WATER LEVEL SEE TEXT

DATE: START: 1/11/81

FINISH: 1/11/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5.0									START DRILLING AT 8:55
6.5	S-1	5	1-2-1	3		SANDY SILT LOW PLASTICITY, ABOUT 40% FINE SAND, BROWN, MOIST, SOFT.		ML	
8.0						SILT, SIMILAR TO S-1 EXCEPT NO FINE SAND.		ML	
10.0	ST-1	24	---	-		SILTY SAND, FINE SAND WITH ABOUT 40% NON PLASTIC FINES BROWN, MOIST, LOOSE.		SM	
11.5	S-2	7	1-3-2	5		SILTY SAND, SIMILAR TO S-2 EXCEPT ABOUT 65% FINE SAND		SM	
15.0								SM	
16.5	S-3	6	2-2-2	4		SILTY SAND, SIMILAR TO S-3		SM	
20.0									HIT ROCK OR STONE AT BOTTOM OF ST-2
22.0	ST-2	18	---	-		SILTY SAND, SIMILAR TO S-3		SM	
23.5	S-4	6	12-13-17	30		SANDY GRAVEL, POORLY GRADED, ROUNDED GRAVEL TO AT LEAST 1/4 INCH, 20-30% FINE SAND, ABOUT 5% NON PLASTIC FINES, BROWN, WET, COMPACT.		GP- GM	DRILLER NOTES GRAVEL AT 22 FT.
25.0						SANDY GRAVEL, SIMILAR TO S-4, EXCEPT ABOUT 15% FINE SAND		GP- GM	SAMPLER BOUNCES DURING S-5 SPT.
26.5	S-5	6	30-49-60	109/ 111					MIX MORE MUD; SLOW, ROUGH DRILLING TO 44.9 FT.
30.0									

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-75

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON INC

ELEVATION 41.33 FEET

BORE HOLE: B-7

WATER LEVEL SEE TEXT DATE:

START: 1/11/82

FINISH: 1/11/82

INSPECTOR WWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS	
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF					
				6"-6"-6"	'N"					
30	30.0					SANDY GRAVEL, SAME AS S-4	● ● ● ●	GD-GM	DRILLER NOTES TIGHT GRAVEL AT 30 FT. DRILLED FROM 33.5-34.5 FT. POSSIBLE SAND LAYER.	
	31.5	S-6	2	24-39-46	85					
35	35.0					NO RECOVERY	● ● ● ●			
	35.4	S-7	0	60 1/4 1/2	60 1/4 1/2					
40	40.0					NO RECOVERY	● ● ● ●			
	40.2	S-8	0	60 1/2 1/2	60 1/2 1/2					
45	45.0								CAVING IN HOLE TO 33 FT, HAD TO RE DRILL TO 40 TO TAKE SS-S SAMPLER BOUNCES DURING SS-S SPT	
	46.5	S-9	18	11-30-694	90 1/8 1/11	SILTSTONE, HIGHLY WEATHERED AND OXIDIZED PARTICLES, COMPPOSED OF SILT AND CLAY SIZE MATERIAL, SLIGHTLY PLASTIC, LIGHT BLUE-GREY, ORANGE, AND DARK GRAY, MOIST, RELICT TEXTURE OF MORE COARSE-GRAINED ROCK APPARENT				DRILLER NOTES CHANGE IN DRILLING RATE (UP) AT 44.9 FT.
50	50.0					SILTSTONE, SAME AS S-9 EXCEPT FOR UNIFORM LIGHT BLUE-GREY COLOR				
	51.5	S-10	12	15-28-42	70	END BORING AT 51.5 FT			FINISH DRILLING AT 51.5	
						PIEZOMETER INSTALLATION: (See notes on PLACEMENT OF PERVIOUS TIP: TOP AT 35 FT, BOTTOM GRAVEL PACK: FROM 51.5 FT TO SURFACE BENTONITE SEAL: FROM 18 TO 20 FEET RISER PIPE LENGTH: 37.5 FT.	Drill Log Legend AT 37.5 FT			

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY, CME-55

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON, INC.

ELEVATION 42.50 FEET

BORE HOLE: B-11

WATER LEVEL SEE TEXT DATE: START: 12/28/81 FINISH: 12/28/81 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
	6"-6"-6"	"N"							
5.0									START DRILLING AT 10:00
6.5	S-1	6	1-1-2	3		SILT, LOW TO MEDIUM PLASTICITY, ABOUT 5% FINE SAND, BROWN, VERY MOIST, SOFT,		ML	
10.0								ML	
11.5	S-2	10	1-2-2	4		SILT, LOW TO MEDIUM PLAS- TICITY, 10-15% FINE SAND, BROWN, MOIST, SOFT, TRACE OF ORGANIC MATERIAL.		ML	
13.0								ML	
15.0	ST-1	24	---	-				ML	
16.5	S-3	18	1-1/2"	1		SILT, SAME AS S-2		ML	
20.0								ML	
21.5	S-4	18	1-1-1	2		SANDY SILT, SIMILAR TO S-2 EXCEPT FOR 30-30% FINE TO MEDIUM SAND, MOSTLY FINE		ML	
25.0								GP- GM	DRILLER NOTES GRAVEL AT 24.5 FT
25.9	S-5	6	28-69/4	88/ 10"		SANDY GRAVEL, POORLY GRADED, ROUNDED GRAVEL TO AT LEAST 1 1/4 INCH, 20-25% FINE TO MEDIUM SAND, 5-10% FINES WITH LOW TO MEDIUM PLASTICITY, BROWN, WET, VERY DENSE			SLOW, ROUGH DRILLING TO 25 FT.
									LOSE CIRCULATION AT 28 FT.

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD MUD ROTARY

DRILLERS &amp; EQUIPMENT D KENNEDY DRILLING INC

ELEVATION 42.50 FT

BORE HOLE: B-11

WATER LEVEL SEE TEXT DATE: 12/28/81 START: 12/28/81 FINISH: 12/28/81 INSPECTOR C.L.U.H.

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
30.0 30.9	S-6	4	20-60/ <sub>15</sub> "	80/ <sub>11</sub> "	II	SANDY GRAVEL, POORLY GRADED, ROUNDED GRAVEL TO AT LEAST 1 INCH, 20-30% FINE TO COARSE SAND, 5-10% NONPLASTIC FINE, BROWN, WET, VERY DENSE.		GP- GM	SLOW, ROUGH DRILLING TO 35 FT.
35.0 35.8	S-7	4	45-60/ <sub>13</sub> "	105/ <sub>19</sub> "		SANDY GRAVEL, SAME AS S-6		GP- GM	SAMPLER BOUNCES DURING SPT FOR S-7
40.0									
41.5	S-8	12	13-50-60/ <sub>15</sub> "	110/ <sub>19</sub> "		SILTSTONE, HIGHLY WEATHERED TO SILT AND CLAY-SIZED PARTICLES WITH 5-10% FINE SAND, SOME SLIGHTLY BRITTLE, INTACT LAYERS + FRAGMENTS 1/8-1/4-INCH THICK, GRAY, SLIGHTLY MOIST.			DRILLER NOTES CHANGE IN DRILLING RATE(UP) AT 37.5 FT
45.0 45.8	S-9	5	14-60/ <sub>4</sub> "	74/ <sub>10</sub> "		SILTSTONE, SAME AS S-8			
						END BORING AT 45.8 FEET			FINISH DRILLING AT 45.8 FT
						PIEZOMETER INSTALLATION: (see notes on Boring Log PLACEMENT OF PERVIOUS TIP: TOP AT 33FT, BOTTOM GRAVEL PACK: FROM 46.5 FT TO GROUND BENTONITE SEAL: FROM 18 TO 20 FEET RISER PIPE LENGTH: 35 FEET		Legend AT 34.5FT	

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, CME-75

DRILLERS &amp; EQUIPMENT D KENNER OF OREGON

ELEVATION 38.87 FEET

BORE HOLE: B-13

WATER LEVEL SEE TEXT

DATE: START: 12/22/81 FINISH: 12/29/81

INSPECTOR CWHT

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5.0									BEGIN DRILLING AT 1:55
6.5	S-1	10	1-2-2	4		SILT, LOW TO MEDIUM PLASTICITY, ABOUT 5% FINE SAND, BROWN, MOIST, SOFT.		ML	
10.0									
11.5	S-2	14	1-1-1	2		SANDY SILT, LOW TO MEDIUM PLASTICITY, 15-20% FINE SAND, BROWN, MOIST, SOFT		ML	
13.0									
15.0	ST-1	14	---	-		SANDY SILT, SIMILAR TO S-2			
16.5	S-3	12	1-1-1	2		SILT, LOW TO MEDIUM PLASTICITY, 5-10% FINE SAND, BROWN, MOIST, SOFT.		ML	
20.0									
21.5	S-4	18	1-1-1	2		SILT, LOW TO MEDIUM PLASTICITY, ABOUT 5% FINE SAND, BROWN, MOIST, SOFT.		ML	
25.0									
26.5	S-5	10	2-11-28	39		UPPER 6 INCHES: SILT, SAME AS S-4 LOWER 4 INCHES: SILTY SAND, FINE TO MEDIUM SAND, 20-25% SLIGHTLY PLASTIC FINES, BROWN, MOIST, DENSE.		ML SM	DRILLER NOTES GRAVEL AT 26FT,
30.0									SLOW, ROUGH DRILLING TO 47.5 FT.

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, CME-75

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON

ELEVATION 38.87 FEET

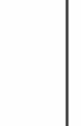
BORE HOLE: B-13

WATER LEVEL SEE TEXT

DATE: START: 12/28/81

FINISH: 12/29/81

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
				BLOWS	BPF				
30	30.0 30.5	S-6	4	41-60 1/4"	101 10"	SANDY GRAVEL, POORLY GRADED ROUNDED GRAVEL TO AT LEAST 1/4 INCH, 10-15% FINE TO MEDIUM SAND, 5-10% NON TO SLIGHTLY PLASTIC FINES, BROWN, VERY MOIST, VERY DENSE.		GP- GM	
35	35.0 35.5	S-7	4	56 1/6"	56 1/6"	SAME AS S-6		GD- GM	
40	40.0 40.4	S-8	1	60 1/4"	60 1/4"	SAME AS S-7		GP- GM	
45	45.0 45.3	S-9	0	60 1/3"	60 1/3"	NO RECOVERY			DRILLER NOTES END OF GRAVEL AT 475 FT.
50	50.0 50.7	S-10	6	43-60 1/2"	103 78"	SILTSTONE, HIGHLY WEATHERED TO SILT AND CLAY SIZED PARTICLES, WITH 10-15% FINE SAND AND GRAVEL, BLUE- GREEN WITH ORANGE-BROWN MOTTLING, SLIGHTLY MOIST,			I-2 INCH ROUNDED COBBLE WAS LODGED IN THE END OF SAMPLER FOR ST-10
55	55.0 56.5	S-11	15	25-46 60 1/3"	106 99"	SILTSTONE, HIGHLY WEATHERED TO SILT AND CLAY SIZED PARTICLES AND SOME BRITTLE, INTACT LAYERS AND FRAGMENTS, RELICT TEXTURE OF PARENT ROCK IS EVIDENT.			FINISH DRILLING AT 10' 05
60									

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, CME-75

DRILLERS &amp; EQUIPMENT D.KENNER OF OREGON, INC.

ELEVATION 38.87 FEET

BORE HOLE: B-13

WATER LEVEL SEE TEXT DATE: START: 12/28/18 FINISH: 12/29/18 INSPECTOR CWH

(FT) DEPTH BELLOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS  BLOWS      BPF 6"-6"-6"      "N"	SOIL DESCRIPTION  (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFIICA- TION SYMBOL	COMMENTS  (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)					
	INTERVAL	NUMBER	RECOVERY (INCHES)										
					PIEZOMETER INSTALLATION: (See notes on Boring PLACEMENT OF PERVIOUS TIP; TOP AT 38.5 FT, GRAVEL PACK: FROM 56.5 FT TO GROUND BENTONITE SEAL: FROM 20 TO 22 FT. RISER PIPE LENGTH: 40 FT.		Log bottom at 40 ft surface	Legend)					

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, FISHTALE &amp; TRICONE BIT DRILLERS &amp; EQUIPMENT D. KENNER CME -75

ELEVATION 44.70 FEET

BORE HOLE: B-14

WATER LEVEL SEE TEXT DATE: 5/24/82 START: 5/18/82 FINISH: 5/18/82 INSPECTOR CW/H

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
									START DRILLING AT 9.40
2.5									
4.0	S-1	4		2-1-1	2	SILT LOW PLASTICITY, ABOUT 5-10% FINE SAND, DARK BROWN, MOIST, SOFT		ML	
5.0									
6.5	S-2	7		1-1-1	2	SANDY SILT, SIMILAR TO S-1, EXCEPT IT GRADES INTO A SILTY SAND WITH 30-50% FINE SAND TOWARD BOTTOM		ML	DRILLER NOTES ALTERNATING SOFTER & FIRMER DRILLING 5-10 FT.
7.5									
9.0	S-3	5		2-3-4	7	SILTY SAND, FINE SAND, 20-25% FINES WITH LOW PLASTICITY, BROWN, WET, SOFT TO FIRM.		SM	
10.0									
11.5	S-4	7		2-1-1	2	SILTY SAND, SIMILAR TO S-3. EXCEPT WITH 30-35% FINES WITH LOW PLASTICITY.		SM	
13.5	ST-5	24		---	-	SILT, LOW PLASTICITY, ABOUT 10% FINE SAND, BROWN, WET, SOFT.		ML	ML IS AT VERY BOTTOM OF ST-5
15.0									
16.5	S-6	5		3-2-4	6	SANDY SILT, LOW PLASTICITY ABOUT 20% FINE SAND, DARK BROWN, MOIST, FIRM		ML	
20.0									
21.5	S-7	6		3-22-22	44	UPPER 2": SILT LOW PLASTICITY, 5-10% FINE SAND, DARK BROWN, MOIST LOWER 4": SILTY SAND, FINE TO MEDIUM SAND, ABOUT 15% FINES BROWN, WET, DENSE.		ML SM	DRILLER NOTES GRAVEL AT 21.5 FT.
25.0									
25.5	S-8	4	60/5½"	60/ 5½"		GRAVELLY SAND, POORLY GRADED, 25-30% SUPERIMPOSED GRAVEL TO AT LEAST 1½ INCH, FINE TO COARSE SAND, MOSTLY COARSE, 5-10% FINES, BROWN, WET, DENSE.		SP- SM	SAMPLER BOUNCED IN FIRST 6 INCHES OF S-8  SLOW, ROUGH, DRILLING TO SOFT.

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, FISHTAIL &amp; TRICONE BIT DRILLERS &amp; EQUIPMENT

D. KENNER OF OREGON

ELEVATION 44.70 FEET

BORE HOLE: B-14

WATER LEVEL SEE TEXT

DATE: 5/24/82

START: 5/18/82 FINISH: 5/18/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS  BLOWS      BPF 6"-6"-6"      "N"	SOIL DESCRIPTION  (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFICATION SYMBOL	COMMENTS  (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)					
30	30.0 30.9	S-9	5	32 - 60 / 15	92 / 11"	SANDY GRAVEL, WELL GRADED ANGULAR AND SUBCIRCLED GRAVEL TO ATLEAST 20-25% FINE TO COARSE SAND, LESS THAN 5% FINES, BROWN AND BLACK, WET DENEE.	GP	SLOW ROUGH DRILLING TO 35 FT.
35	35.0 35.8	S-10	2	35 - 60 / 4½	95 / 10½"	SANDY GRAVEL SIMILAR TO S-9, BUT TOO LITTLE RECOVERY TO PROVIDE A THOROUGH DESCRIPTION.	GP	DRILLED POUNDED SAMPLE DOWN 3FT. TO GET IT IN POSITION. SOME OF SAMPLES S-10 MIGHT BE CAUSES
40	40.0 41.2	S-11	8	25-31-60 / 7½	91 / 8½"	SANDY GRAVEL, SAME AS S-9	GP	LOSE CIRCULATION AT 35.5 FT; MIX MUD SLOW; SLOW, ROUGH DRILLING TO 40FT.
45	45.0 45.2	S-12	0	60 / 3"	60 / 3"	NO RECOVERY		LOST CIRCULATION AT 42 FT, MIX MUD SLOW; ROUGH DRILLING TO 47 FT.
50	50.0 51.5	S-13	18	22-41-36	77	SILTSTONE, HIGHLY WEATHERED, FRAG- TURES INTO ANGULAR, BLOCKY PIECES ABOUT 1/4" ON A SIDE;		SAMPLER BOUNCES IN FIRST BINCH INTERVAL OF S-12
						CONTAINS ABOUT 10% FINE SAND, AND LOCAL PIECES OF THOROUGHLY WEATHERED GRAVEL TO ~1/2 INCH; GRAY W/BLUE-GREEN MOTTLING AT TOP, MOIST.		DRILLER NOTES END OF GRAVELY MATERIAL AT 47 FT.
						END BORING AT 515 FEET		FINISH DRILLING AT 2:20
						PIEZOELECTRIC INSTALLATION: (see notes on boring PLACEMENT OF PREVIOUS TIP: TOP AT 385 FT, BOTTOM AT 40FT, GRAVEL PACK: FROM 51.5 FEET TO GROUND BENTONITE SEAL: FROM 15.5 to 17.5FT, AND REER PIPE DIMENSIONS: 40 FEET	log legged at surface from about 7 to 9 feet	

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, FISH TAIL BIT DRILLERS &amp; EQUIPMENT D KENNER OF OREGON

ELEVATION 416.69 FT. BORE HOLE: B-15

WATER LEVEL MEASURED DATE: START: 5/18/82 FINISH: 5/18/82 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
				6"-6"-6"	"N"				
2.5									START DRILLING AT 3:35
4.0	S-1	5	2-2-2	4		SILT LOW PLASTICITY, 10-15% FINE SAND, BROWN, WET, SOFT.		ML	
5.0								ML	
6.5	S-2	8	1-2-2	4		SANDY SILT, LOW PLASTICITY, ABOUT 15% FINE SAND BROWN, WET, LOOSE, SOME ROOTS PRESENT		ML	
8.0								ML	
10.0	ST-3	24	---	-		SANDY SILT, SIMILAR TO S-2		ML	
11.5	S-4	5	2-2-3	5		SANDY SILT LOW PLASTICITY, ABOUT 15% FINE SAND, DARK BROWN, MOIST, SOFT TO FIRM.		ML	
15.0								NL	
16.5	S-5	7	2-2-3	5		SILT LOW TO MEDIUM PLASTICITY, LESS THAN 5% FINE SAND, BROWN, WET, SOFT TO FIRM			
20.0									
21.5	S-6	10	2-3-4	7		SANDY SILT LOW PLASTICITY, 35-45% FINE SAND, DARK BROWN, MOIST, FIRM		ML	
25.0									
26.5	S-7	12	8-19-58	77		UPPER 9": SAND UNIFORMLY GRADED, FINE SAND, 5-12% FINE WITHIN GRAVEL, BROWN, WET LOWER 3": SANDY GRAVEL, WELL GRADED GRAVEL TO 1/4 INCH, 20-30% FINE TO COARSE SAND, LESS THAN 5% FINE. END BORING AT 26.5FT	SD.SN G.P		FINISH DRILLING AT 4:20

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, FISHTAIL BIT DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON

ELEVATION 40.20 FEET

BORE HOLE: 3-16

WATER LEVEL MEASURED DATE: NOT START: 5/19/82 FINISH: 5/19/82 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION  (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS  (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)						
	BLOWS	BPF	6"-6"-6"	"N"					
2.5									
4.0	S-1	7	2-2-1	3		SILT LOW TO MEDIUM PLASTICITY, DARK BROWN, MOIST, SOFT		ML	START DRILLING AT 11:10
5.0									
6.5	S-2	9	1-1-2	3		SILT SIMILAR TO S-1, EXCEPT WITH 5-10% FINE SAND		ML	
7.5									
9.0	S-3	12	1-1-1	2		SILT LOW TO MEDIUM PLASTICITY, ABOUT 10% FINE SAND, DARK BROWN, MOIST, SOFT,		ML	
10.0									
12.0	ST-4	24	---	-		SANDY SILT LOW PLASTICITY 15% FINE TO MEDIUM SAND, MOSTLY FINE 65% SILT, 17% CLAY, MOIST, SOFT.		ML	
13.5	S-5	18	1-1-1	2		SILT SIMILAR TO S-1, EXCEPT ABOUT 5% FINE SAND		ML	
15.0									
16.5	S-6	18	1-1-2	3		SILT LOW PLASTICITY, DARK BROWN, MOIST, SOFT		ML	
20.0									
21.5	S-7	12	2-2-1	3		SANDY SILT LOW PLASTICITY, 15- 20% FINE SAND, BROWN, MOIST, SOFT.		ML	
25.0									
26.5	S-8	5	7-7-8	15		SAND, UNIFORMLY GRADED, FINE TO MEDIUM SAND, MOSTLY FINE, 5-12% FINES, BROWN, MOIST, COMPACT	SP-SM		DRILLED NOTES GRAVEL AT 27.5 FT
27.5									
28.5	S-9	2	41-60/6"	10 1/2"		SANDY GRAVEL, POORLY GRADED GRAVEL TO AT LEAST 1 1/4 INCH, 10-15%	GP-GM		
						FINE TO COARSE SAND, 5-12% FINES, WET, BROWN, DENSE, END BORING @ 29.0 FT			FINISH DRILLING AT 1:50

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY NILD, FISHTAIL: TRICONE BIT

TRICONE DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON

ELEVATION 4052 FEET

BORE HOLE: B-17

WATER LEVEL MEASURED DATE:

START: 5/20/82

FINISH: 5/20/82

INSPECTOR CWH

(ft) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5.0									
6.5	S-1	5	1-2-2	4		SILT LOW PLASTICITY, ABOUT 5% FINE SAND, BROWN, WET, SOFT TO FIRM.		ML	START DRILLING AT 8:45
10.0									
11.5	S-2	12	1-1-1	2		SANDY SILT, LOW PLASTICITY, 25-30% FINE SAND, BROWN, WET, SOFT.		ML	
13.0									
15.0	ST-3	24	---	-		SILT LOW TO MEDIUM PLASTICITY, 6% FINE SAND, 73% SILT, 21% CLAY, BROWN, SOFT.		ML	
16.5	S-4	18	1-1-1	2		SANDY SILT, SIMILAR TO S-2, EXCEPT WITH 20-25% FINE SAND.		ML	
18.0									
20.0	ST-5	24	---	-		SANDY SILT SIMILAR TO S-2, EXCEPT WITH 10-15% FINE SAND.		ML	
21.5	S-6	15	1-1-1	2		SANDY SILT SIMILAR TO S-2, EXCEPT WITH 10-15% FINE SAND		ML	DRILLER NOTES SLIGHTLY FIRMER DRILLING 20-25 FT
23.0									
25.0	ST-7	20	---	-		SANDY SILT, SIMILAR TO S-2, EXCEPT WITH 10-20% FINE SAND		ML	
26.5	S-8	18	3-2-2	4		SANDY SILT SIMILAR TO S-2, EXCEPT WITH 15-20% FINE SAND, AND ORANGE-BROWN MOTTLING IN LOWER 6 INCHES		ML	
30									DRILLER NOTES GRAVEL AT 29FT

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, DRILLERS &amp; EQUIPMENT D KENNER OF OREGON

ELEVATION 40.52 FEET

BORE HOLE: B-17

WATER LEVEL MEASURED DATE: NOT

START: 5/20/82

FINISH: 5/20/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	SOIL CLASSIFICATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)				
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF								
				6"-6"-6"	"N"								
30	30.3	S-9	3	60/3"	60/ 3"	SANDY GRAVEL, POORLY GRILLED, SUBANGULAR GRAVEL TO AT LEAST 1/4 INCH, 12-15% FINE TO COARSE SAND, 5-10% FINES, BROWN AND BLACK, WET, DENSE	GP-GM	GP-GM	SLOW, ROUGH DRILLING TO 465 FT.				
35	35.0												
35.5	35.5	S-10	5	60/5 1/2"	60/ 5 1/2"	SANDY GRAVEL, SIMILAR TO S-9 EXCEPT FOR 35-40% FINE TO COARSE SAND.	GP-GM	GP-GM	DRILLER NOTES SLIGHTLY SOFTER DRILLING AT 35 FT, PROBABLY A SAND LENS, HE THINKS				
40	40.0												
40.5	40.5	S-11	5	56 1/16"	56/ 1/16"	SANDY GRAVEL, SIMILAR TO S-9 EXCEPT FOR 20-25% FINE TO COARSE SAND	GP-GM	GP-GM	LOSE CIRCULATION AT 38 FT, MAX MUD				
45	45.0												
45.1	45.1	S-12	0	60 1/2"	60/ 1/2"	NO RECOVERY	GP-GM	GP-GM	LOSE CIRCULATION AT 42 FT, MIX MUD DRILLER THINKS GROUNDWATER IS DILUTING MUD MIXTURE.				
47.5													
48.5	48.5	S-13	11	29-60 15/16"	89/ 15/16"	SILTSTONE, WEATHERED, FRACTURES INTO BLOCKY, ANGULAR PIECES ALMOST 1/4 INCH ON A SIDE, BLUE- GREEN, MOIST.	GP-GM	GP-GM	DRILLER NOTES BOTTOM OF GRAVEL AT 465 FT.				
50													
52.5													
53.5	53.5	S-14	11	16-59 1/6"	75/ 1/2"	SILTSTONE, SAME AS S-13, EXCEPT CONTAINS THOROUGHLY WEATHERED PEBBLES (COARSE SAND) WEATHERED TO BLUE, GREEN, YELLOW AND REDDISH BROWN; SILTSTONE IS BLUE-GREEN IN UPPER 4 INCHES, GRAY IN LOWER 7 INCHES	GP-GM	GP-GM	DM-15 IS A 2 INCH DIA TUBE, DOUBLE DIA. HOLE HAMMER WAS USED, HAD TO END AFTER A 5 INCH DRIVE BECAUSE OF CAVING.				
57.5													
58.0	58.0	DM-15	0	82 5"	82/ 5"	NO RECOVERY	--	--					
						END BORING AT 58.0 FT.	--	--					

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD

DRILLERS &amp; EQUIPMENT D. KENNER OF OREGON

ELEVATION 44.19 FEET

BORE HOLE: B-18

WATER LEVEL MEASURED DATE:

START: 5/19/82 FINISH: 5/19/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
2.5									
4.0	S-1	6	2-2-2	4		SILT LOW PLASTICITY, 5-10% FINE SAND, DARK BROWN, MOIST, FIRM.		ML	START DRILLING AT 9:45
5.0									
6.5	S-2	5	1-1-1	2		SANDY SILT, LOW PLASTICITY, 10- 15% FINE SAND, BROWN, MOIST, SOFT.		ML	
7.5									
9.0	S-3	5	1-2-2	4		SILT LOW PLASTICITY, ABOUT 5% FINE SAND, DARK BROWN, MOIST, FIRM.		ML	
10.0									
12.0	ST-4	14	---	—		SILTY SAND, 53% FINE TO MEDIUM SAND, MOSTLY FINE, 35% SILT, 12% CLAY, BROWN, MOIST, LOOSE		SM	
13.5	S-5	2	3-2-2	4		SILT, SAME AS S-3		ML	
15.0									
16.5	S-6	8	2-2-3	5		SILT SIMILAR TO S-3, EXCEPT NO FINE SAND.		ML	
20.0									
21.5	S-7	7	3-5-3	8		SILT LOW PLASTICITY, ABOUT 5% FINE SAND, BROWN, MOIST, FIRM		ML	DRILLER NOTES FIRMER DRILLING 20-25 FT.
25.0									
26.5	S-8	6	3-3-5	8		UPPER 3 INCHES; SILT, SAME AS S-3 LOWER 3 INCHES; SILTY SAND, FINE SAND, 5-12% FINES, DARK BROWN, MOIST, LOOSE.		ML SP-SAT	
27.5									
28.0	S-9	5	60/45°	60/ 45"		SILTY GRAVEL, POORLY GRADED GRAVE TO AT LEAST 1 1/4 INCH, 10-15% SAN- 20-25% FINES WITH LOW PLASTICITY COMPACT		GM	DRILLER NOTES GRAVEL AT 27.5 FT.
						END BORING AT 29.0 FT			FINISH DRILLING AT 10:45

## SOIL BORING LOG

PROJECT TRICITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY MUD, FISHTAIL BIT

DRILLERS &amp; EQUIPMENT

D KENNER OF OREGON

ELEVATION 39.77 FT

BORE HOLE: B-20

WATER LEVEL MEASURED NOT DATE:

START: 5/19/82

FINISH: 5/19/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
2.5									
4.0	S-1	7		2-2-2	4	SILT ABOUT 5% FINE SAND, LOW PLASTICITY, BROWN, WET, SOFT, SOME ROOTS		ML	START DRILLING AT 8:35
5.0									
6.5	S-2	7		1-2-2	4	SILT, SIMILAR TO S-1, EXCEPT 5-10% FINE SAND		ML	
7.5									
9.0	S-3	10		1-1-2	3	SILT, SAME AS S-1		ML	
10.0									
11.5	S-4	13		1-1-2	3	SILT, SIMILAR TO S-1 EXCEPT 5-10% FINE SAND		ML	
15.0									
16.5	S-5	13		1-2-2	4	SILT, SIMILAR TO S-1 EXCEPT NO FINE SAND		ML	
20.0									
21.5	S-6	15		2-2-2	4	SANDY SILT, LOW PLASTICITY, 15-20% FINE SAND, BROWN, WET, LOOSE.		ML	DRILLER NOTES GRAVEL AT 24.5 FT
25.0									
25.8	S-7	0		40-60 1/4"	100/10"	END BORING AT 26.5 FEET		GP	FINISH DRILLING AT 9:20

## SOIL BORING LOG

PROJECT TRI CITY STP

LOCATION OREGON CITY, OREGON

DRILLING METHOD ROTARY, WATER

DRILLERS &amp; EQUIPMENT

D. KENDER OF OREGON-CMEI

ELEVATION 4153 FEET

BORE HOLE: B-21

WATER LEVEL SEE TEXT

DATE: START: 5/24/82

FINISH: 5/24/82

INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
5									
10	10.0								
12.0	ST-1	24	---	---	—	SANDY SILT, SAME AS S-2 (SEE BELOW)		ML	START DRILLING AT 9:00 DRILL TO 8 FT WITH WATER, CIRCULATED CUTTINGS OUT; LOSING SOME WATER INTO HOLE
13.5	S-2	15	1-1-1	2		SANDY SILT, LOW TO MEDIUM PLASTICITY, 20-25% FINE SAND, DARK BROWN, WET, SOFT.		ML	SET 5 IN I.D. CASING TO 8 FT, THEN DRILLED TO 10 FT FALLING HEAD PERMEABILITY TEST #1 PERFORMED WITH 8 TO 10 FT AS TEST INTERVAL
15									
20.6						UPPER PART: SAME AS S-2 LOWER PART: SAME AS S-4			
22.0	ST-3	24	---	---	—	SILTY SAND, FINE SAND, 15-20% FINE WITH LOW PLASTICITY, MORE FINES TOWARD TOP OF SAMPLE, DARK BROWN, WET, COMPACT.		ML	DRILLER NOTES ABOUT SINKHOLE SETTLED ON BOTTOM OF HOLE DURING TEST NO 2
23.5	S-4	12	5-7-7	14				SM	DRILLED TO 23 FT WITH WATER, NO LOST CIRCULATION AT 23 FT WHEN BIT ENCOUNTERED GRAVEL.
25									
30								GP	DRILLER NOTES VERY SOFT MATZ 26.5 TO 28 FT. DRILLER NOTES GRAVEL AT 28 FT SET CASING TO 28 FT PERMEABILITY TEST 3+4 FROM 28 TO 30 FT.

## SOIL BORING LOG

PROJECT TRI CITY STP LOCATION OREGON CITY, OREGON  
 DRILLING METHOD ROTARY, WATER DRAG BIT DRILLERS & EQUIPMENT D. KENNER OF OREGON CHETS  
 ELEVATION 41.58 FEET

WATER LEVEL SEE TEXT DATE: 5/24/82 START: 5/24/82 FINISH: 5/24/82 INSPECTOR CWH

(FT) DEPTH BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION (COLOR, RELATIVE DENSITY OR CONSISTENCY, MOISTURE, GRAIN SHAPE AND TYPE, STRUCTURE, CEMENTATION, ORGANICS, MATERIAL)	GRAPHIC LOG	UNIFIED SOIL CLASSIFI- CATION SYMBOL	COMMENTS (DRILLING PROGRESS, LOST CIRCULATION, TYPE OF DEPOSIT, PROBLEMS, ETC.)
	INTERVAL	NUMBER	RECOVERY (INCHES)	BLOWS	BPF				
				6"-6"-6"	"N"				
30	30.0 30.2	55	0	693"	60/3"	NO RECOVERY	30.0 30.2	GP	
35						END BORING 30.5 FT			FINISH DRILLING AT 1:20
						PILE ZOMETER INSTALLATION!			
						PLACEMENT OF PREVIOUS TIP: TOP AT 28.5 FT, BOTTOM AT 20. FT			
						GRAVEL PACK: FROM 31.5 FT TO GROUND SURFACE			
						BENTONITE SEAL: FROM 24.7 TO 26.7 FT			
						RISER PIPE LENGTH: 30 FT			

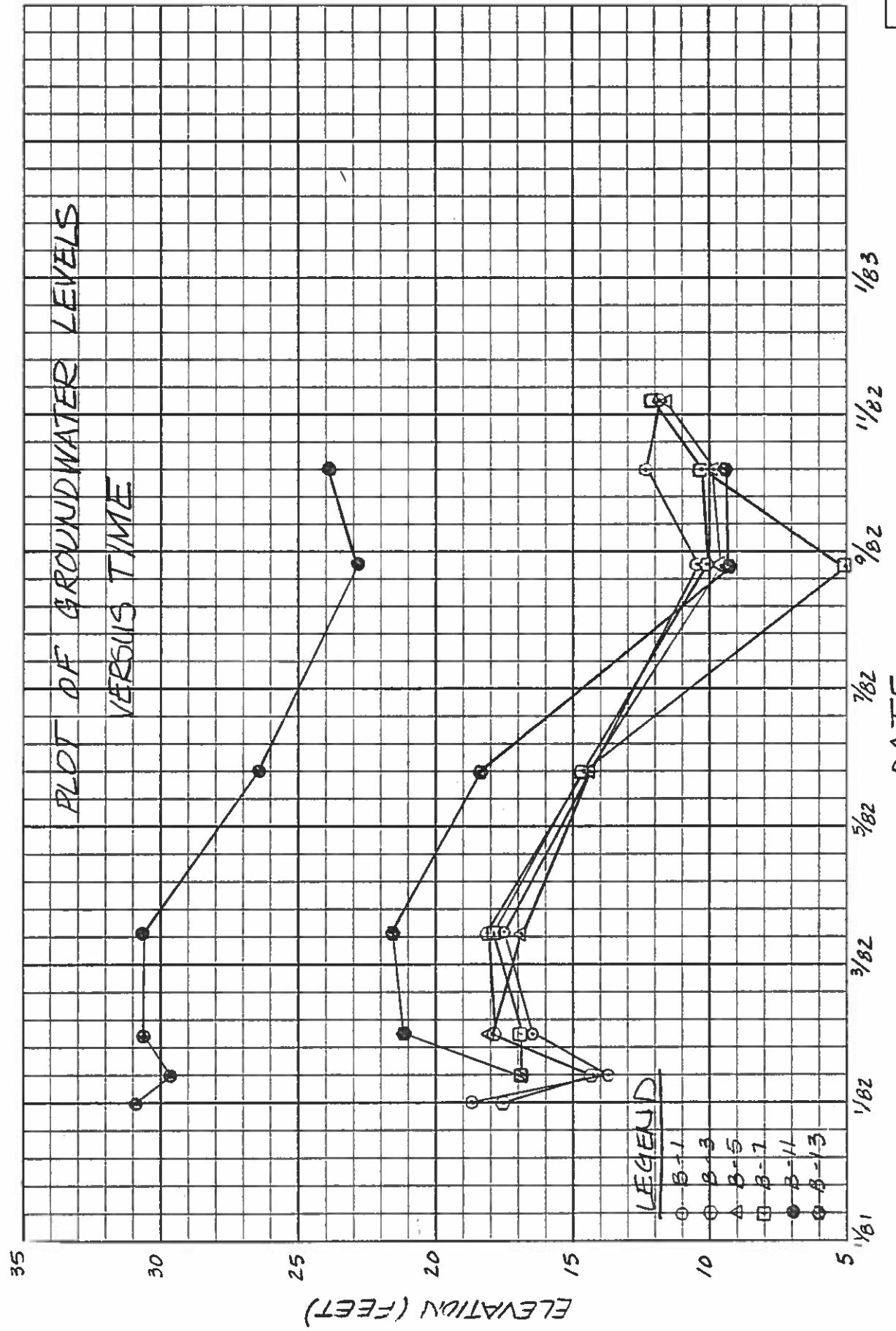
**SUMMARY OF GROUNDWATER LEVELS**  
 (ELEVATIONS IN FEET)

BORING NUMBER	DATE											
	12/23/81	12/26/81	12-29-81	1-11-82	1-12-82	1-13-82	2-2-82	3-12-82	5-24-82	8-26-82	10-7-82	11-8-82
B-1	19.5 <sup>a</sup>	18.6	18.7	13.6	13.7	13.7	16.5	17.5	14.4	10.4	12.4	11.9
B-3	34.3 <sup>a</sup>	17.8	17.4	13.6	14.4	14.3	17.8	18.1	14.6	10.1	10.3	12.0
B-5	-	-	-	-	-	-	26.0 <sup>a</sup>	17.9	16.9	14.4	9.6	9.9
B-7	-	-	-	-	-	20.5 <sup>a</sup>	16.9	16.5	17.9	14.6	5.0	10.3
B-11	-	32.0 <sup>a</sup>	30.8	29.5	30.0	29.7	30.7	30.7	26.4	22.8	23.8	c
B-13	-	-	15.2	17.6	18.3	21.2	21.4	18.4	9.3	9.4	11.1	
B-14	-	-	-	-	-	-	-	-	14.9	b	b	
B-21	-	-	-	-	-	-	-	-	22.7 <sup>a</sup>	b	b	

NOTE: <sup>a</sup> READINGS WERE TAKEN WITHIN 24 HOURS AFTER  
 PIEZOMETER WAS INSTALLED.

<sup>b</sup> NO WATER LEVEL MEASURED IN PIEZOMETER.

<sup>c</sup> PIEZOMETER DESTROYED.

PLOT OF GROUNDWATER LEVELS  
VERSUS TIME

 Appendix B  
 LABORATORY TEST RESULTS



PROJECT NUMBER

P/Steel AS.10

ASTM D2487

## SOILS CLASSIFICATION AND TEST SUMMARY

TRI CITIES

CH2M HILL INC.

SAMPLE LOCATION: AS NOTED

PROJECT DESCRIPTION:

MATERIALS LABORATORY:

SAMPLE NO: \_\_\_\_\_

TYPE OF SAMPLE:

SAMPLE LOCATION	SAMPLE NUMBER	DEPTH INTERVAL (FEET)	DESCRIPTION OF MATERIAL	ASTM CLASSIFI-CATION	MOISTURE P.L. (%)	L.L. (%)	GRADATION, % PASSING	SAMPLE NO:
B-1	SS-1	7.0-8.5	MED.BROWN MED-F SAND	SP			* 3" 1½" # 4 #200	LABORATORY TESTS
B-6	ST-1	9.0-10.0	MED.BROWN SILT w/ESAND	ML			* 100 * 50	
B-6	SS-3	15.0-16.5	MED.Brown SILTY F SAND	SM			* 100 43	Hydrometer
B-7	ST-1	8.0-10.0	MED.Brown SILT	ML			* 100 100	Direct shear
B-7	SS-3	15.0-16.5	MED.Brown SILTY F SAND	SM			* 100 * 35	
B-14	SS-6	15.0-16.5	MED.Brown F SANDY SILT	ML			* 100 80	
B-15	SS-2	5.0-6.5	MED.Brown F SANDY SILT	ML			* 100 * 85	
B-15	SS-5	15.0-16.5	MED.Brown SILT	ML	NP		* 100 * 95	Limits
B-15	SS-4	10.0-11.5	MED.Brown F SANDY SILT	ML			* 100 * 85	
B-16	SS-3	7.5-9.0	MED.Brown SILT w/ESAND	ML			* 100 90	
B-16	ST-4	10.0-11.0	MED.Brown F SANDY SILT	ML	NP	50 NP	100 82	Hydrometer, Limits, Consolidation
B-16	SS-6	15.0-16.5	MED.Brown SILT	ML			* 100 * 97	

REMARKS: \* = ESTIMATED VALUE

TESTED BY: J. RAMON DAN DATE: 14 June 1982 COMPUTED BY:

DATE TESTED:

CHECKED BY:

LAB FORM D2487P

2/78



PROJECT NUMBER

P15600.A5.10

ASTM D2487

## SOILS CLASSIFICATION AND TEST SUMMARY

TRI CITIES

CH2M HILL INC.

AS NOTED

PROJECT DESCRIPTION: \_\_\_\_\_

\_\_\_\_\_

MATERIALS LABORATORY: \_\_\_\_\_

CH2M HILL INC.

SAMPLE LOCATION: \_\_\_\_\_

\_\_\_\_\_

AS NOTED

TYPE OF SAMPLE: \_\_\_\_\_

SAMPLE NO.: \_\_\_\_\_

SAMPLE LOCATION	SAMPLE NUMBER	DEPTH INTERVAL (FEET)	DESCRIPTION OF MATERIAL	ASTM CLASSIFICATION	MOISTURE P.L. (%)	GRADATION, % PASSING L.L. (%)	TESTS
B-17	SS-1	5.0-6.5	MED. BROWN SILT	ML	35	81	#200
B-17	ST-3	13.0-15.0	MED. BROWN SILT	ML			* 100 100 LIMITS
B-18	ST-4	10.0-12.0	MED. BROWN SILTY SAND	SM	NP 30	NP	100 47 Direct Shear, Hydrometer, Limits
B-18	SS-6	15.0-16.5	MED. BROWN SILT	ML			* 100 100
B-18	SS-7	20.0-21.5	MED. BROWN SILT	ML			* 100 95
B-20	SS-5	15.0-16.5	MED. BROWN SILT	ML			* 100 100
B-20	SS-6	20.0-21.5	MED. BROWN F.SANDY SILT	ML			* 100 85
BAG SAMPLE CWHB21							* 100 75 Compaction D1557
NEAR B-1 MED. BROWN F. SANDY SILT.				ML	29		
B-17	ST-3	13.0-15.0	MED. BROWN SILT	ML	54		100 98 Hydrometer consolidation
B-17	ST-7	23.0-25.0	MED. BROWN SANDY SILT	ML	52		100 68 Hydrometer consolidation

REMARKS: \* = ESTIMATED VALUE

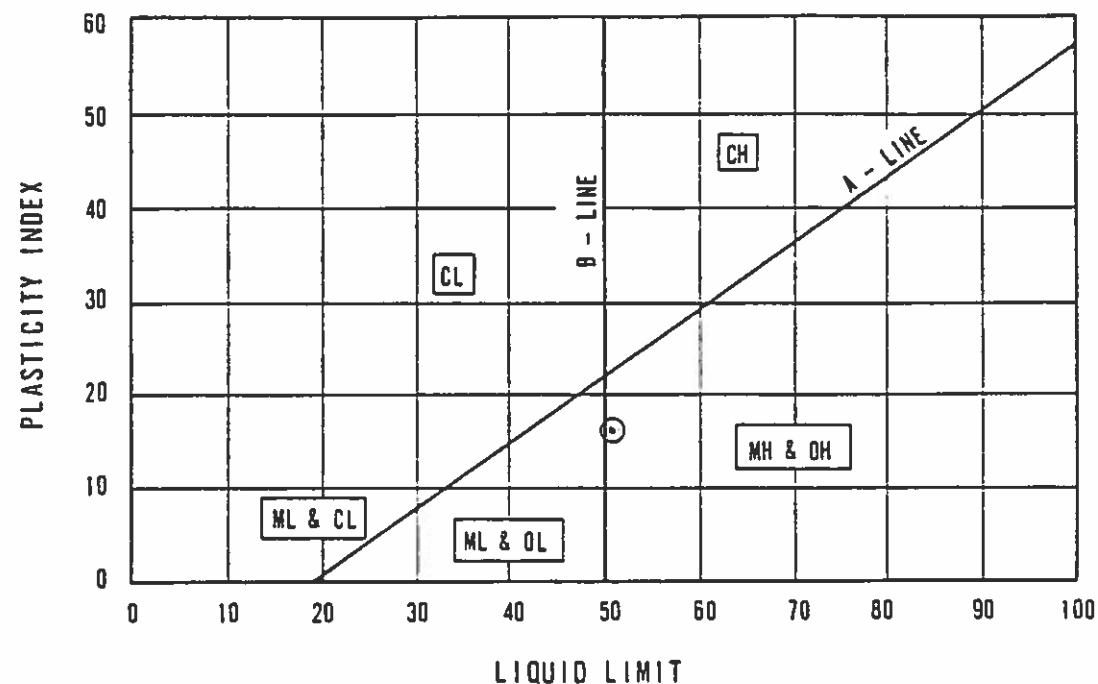
TESTED BY:  
J. RameyDATE: 14 June 1982  
COMPUTED BY:DATE: 14 June 1982  
CHECKED BY:

DATE:

LAB FORM D2487 2/78

DATE: 14 June 1982

# PLASTICITY CHART



<u>SYMBOL</u>	<u>SAMPLE</u>	<u>LIQUID LIMIT</u>	<u>PLASTICITY INDEX</u>	<u>NATURAL MOISTURE</u>
○	B-17, SS-1, 5.0-6.5'	51	16	81
	B-15, SS-5, 15.0-16.5'	NP*	-	41
	B-16, ST-4, 10.0-12.0'	NP*	-	50
	B-18, ST-4, 10.0-12.0'	NP*	-	30

NOTE: \* NONPLASTIC

P15600.AS.10

PLASTICITY CHART  
TRI-CITY SEWAGE  
TREATMENT PLANT



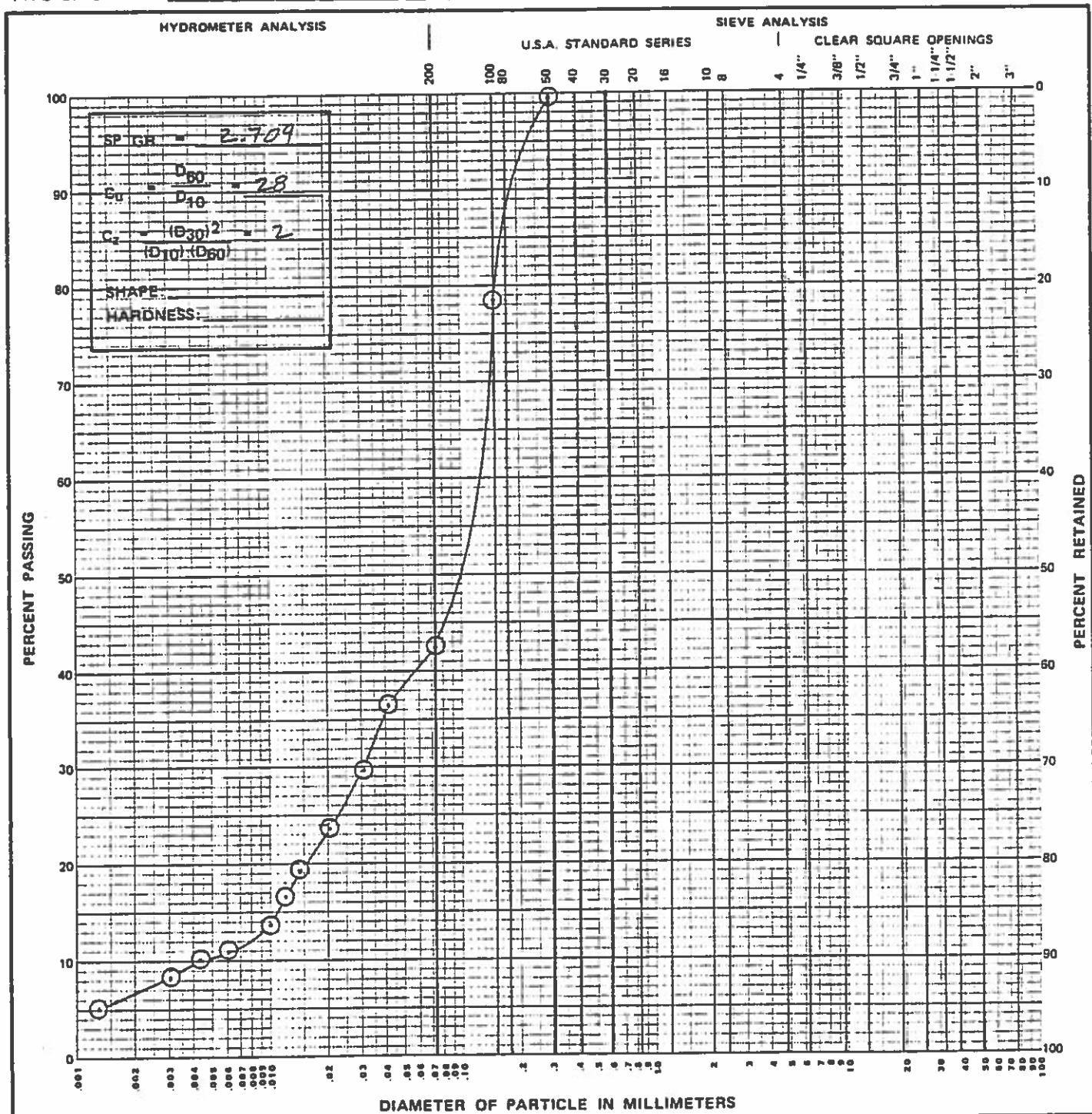
CH2M  
HILLSHEET        OF       

PROJECT NUMBER

P15600.A5.10

## PARTICLE-SIZE ANALYSIS

ASTM D422

PROJECT DESCRIPTION: TRI CITIESMATERIALS LABORATORY: CH2M HILL INC.SAMPLE LOCATION: B-6 15'-16.5' SAMPLE NO. SS-3TYPE OF SAMPLE: MED. BROWN SILTY F SAND SM

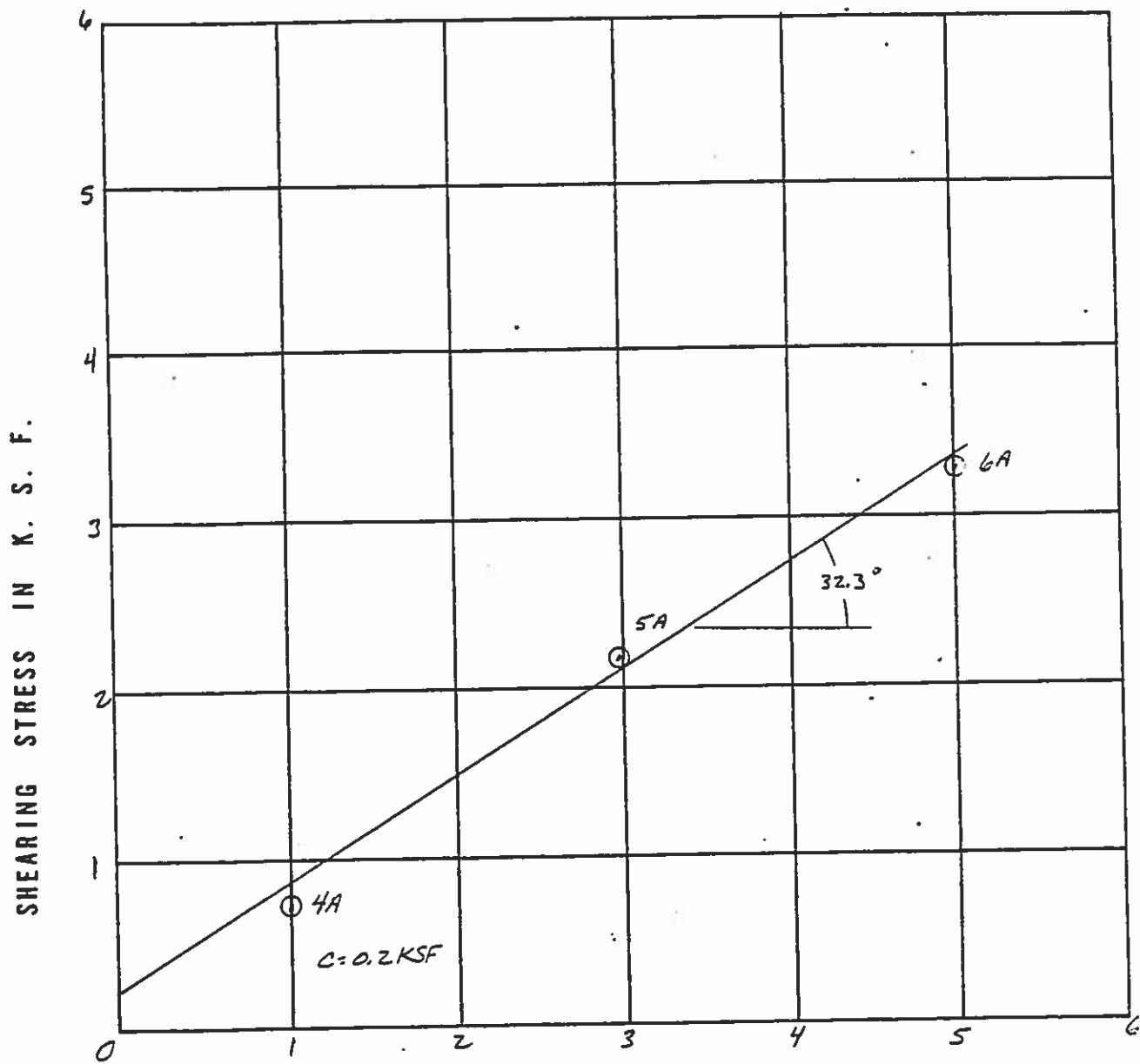
COL. LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION \_\_\_\_\_

TESTED BY: <u>J. PLAMONDON</u>	DATE: <u>7-JUNE-1982</u>	COMPUTED BY: <u>J. PLAMONDON</u>	DATE: <u>7-JUNE-1982</u>	CHECKED BY: <u></u>	DATE: <u></u>
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Job No. P15600.AS.10 Date: 11-June-1982 By: J.P. Gammie

PROJECT NO. TRI CITIES PROJECT NO. P15600.AS.10  
 SAMPLE NO. R-7 ST- 1 DEPTH 8'-10'  
 MATERIAL TYPE MED. BROWN SILT



### NORMAL STRESS IN K. S. F.

SPECIMEN	UNITS	4A	5A	6A
WET DENSITY	pcf	105.44	109.86	108.47
DRY DENSITY	pcf	72.72	75.20	74.04
MOISTURE	%	49.1	46.1	46.5
NORMAL STRESS	KSF	1.01	2.97	5.03
SHEAR STRESS	KSF	0.72	2.18	3.27
SHEAR RATE	0.005IN/MIN.			
SPECIMEN TYPE	INDISTURBED			
REMARKS	SPECIMENS WERE UNDISTURBED DURING SHEAR			

CH2M  
HILLSHEET        OF       

PROJECT NUMBER

P15600.A5.10

## PARTICLE-SIZE ANALYSIS

ASTM D422

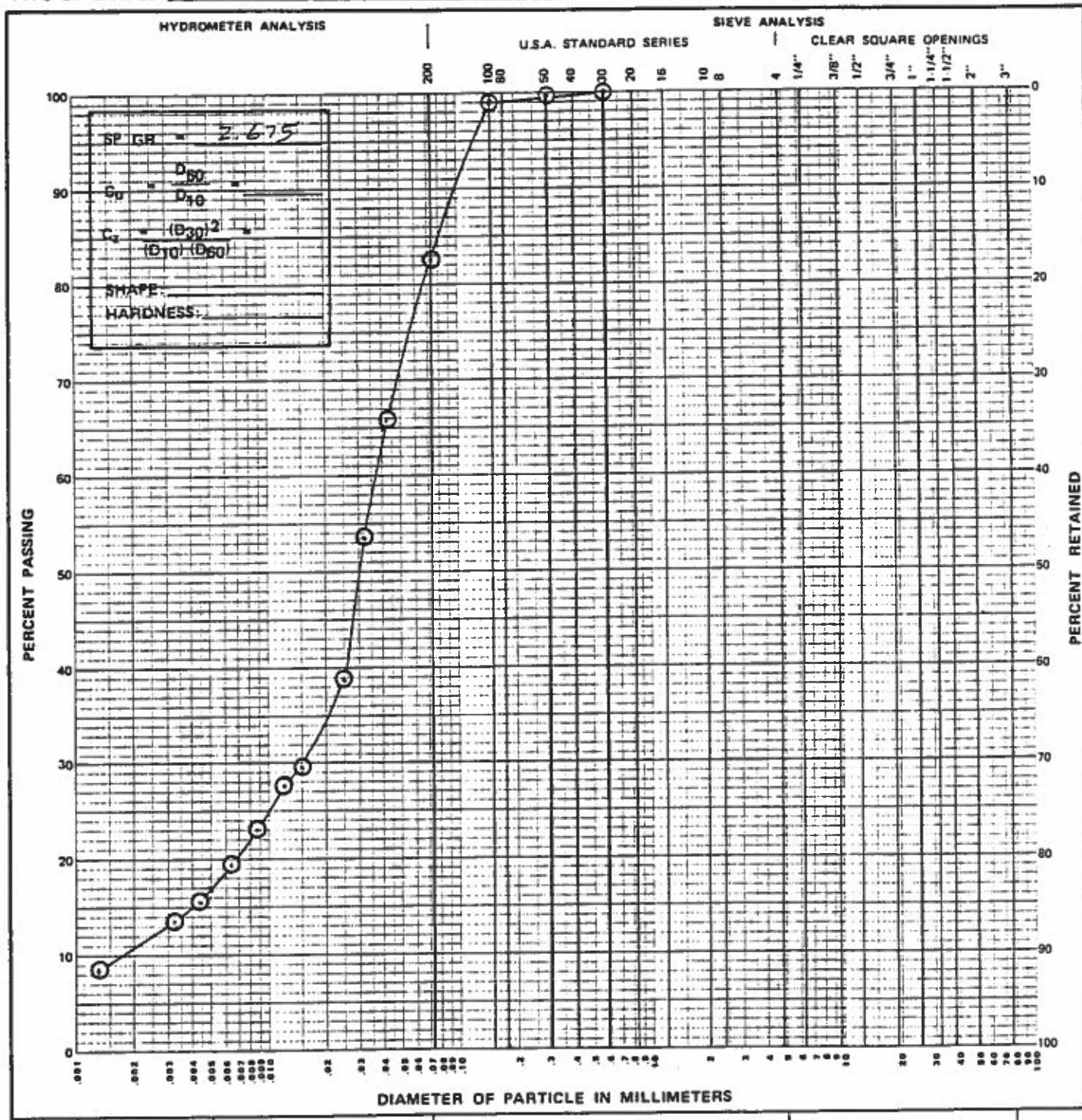
PROJECT DESCRIPTION: TRI CITIES

MATERIALS LABORATORY: CH2M HILL INC

SAMPLE LOCATION: B-16 10'-12'

SAMPLE NO. ST-4

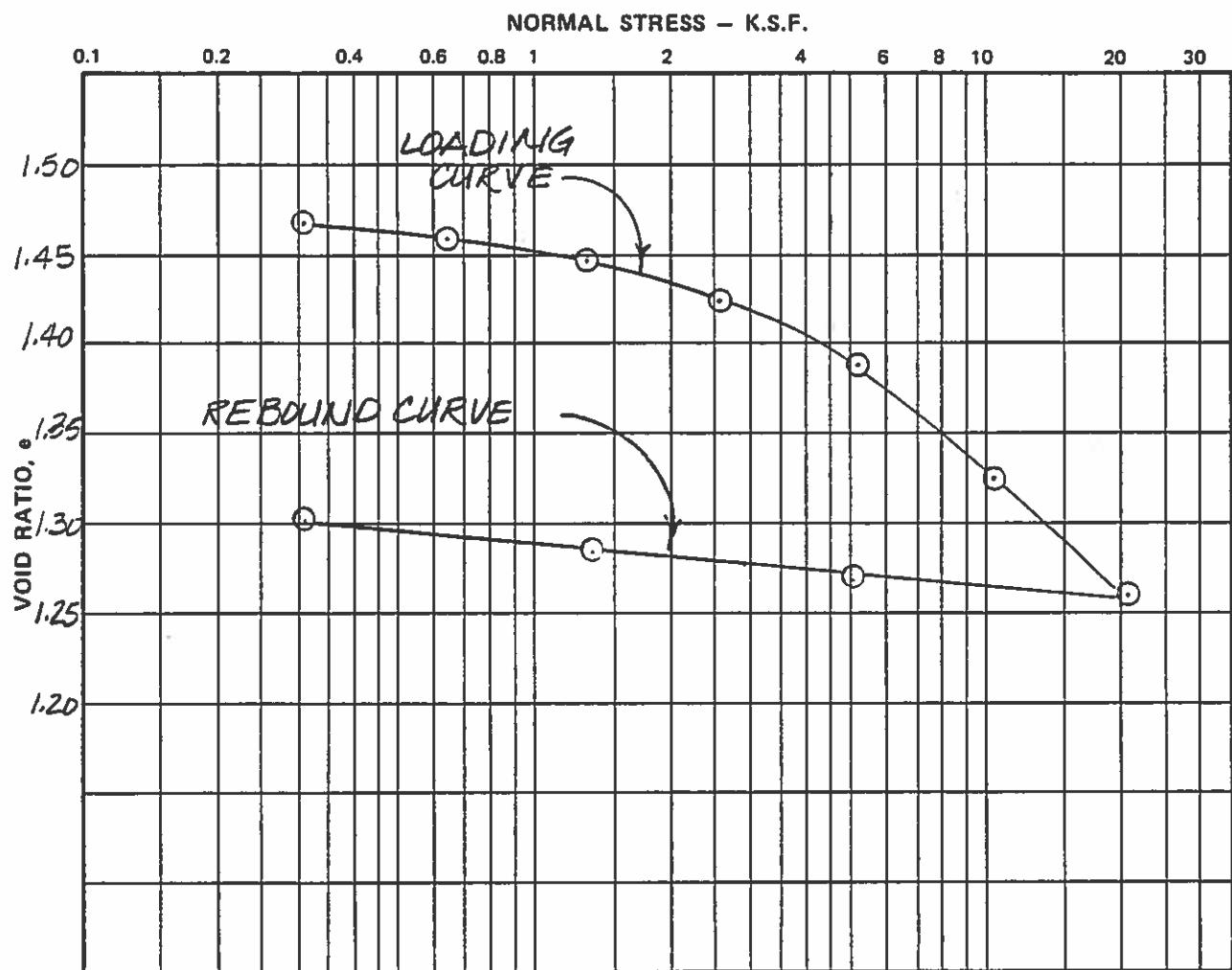
TYPE OF SAMPLE: MED BROWN F SANDY SILT ML



COL. LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION

TESTED BY: J RAMONDON	DATE: 7 JUNE 1982	COMPUTED BY: J RAMONDON	DATE: 7 JUNE 1982	CHECKED BY:	DATE:
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### PLOT OF PRIMARY CONSOLIDATION

SAMPLE DATA:

BROWN SANDY SILT (ML)  
 DEPTH 10.0-12.0 FT.  
 INITIAL DIAMETER = 2.50 IN.  
 INITIAL HEIGHT = 1.00 IN.  
 INITIAL VOID RATIO = 1.47  
 NATURAL MOISTURE CONTENT = 52 %  
 DRY DENSITY = 67 PCF

B-16 ST-4  
 CONSOLIDATION TEST  
 TRI-CITY SEWAGE TREATMENT  
 PLANT

P15600.A5



CH2M  
HILLSHEET OF 1

PROJECT NUMBER

P15600.AS.10

## PARTICLE-SIZE ANALYSIS

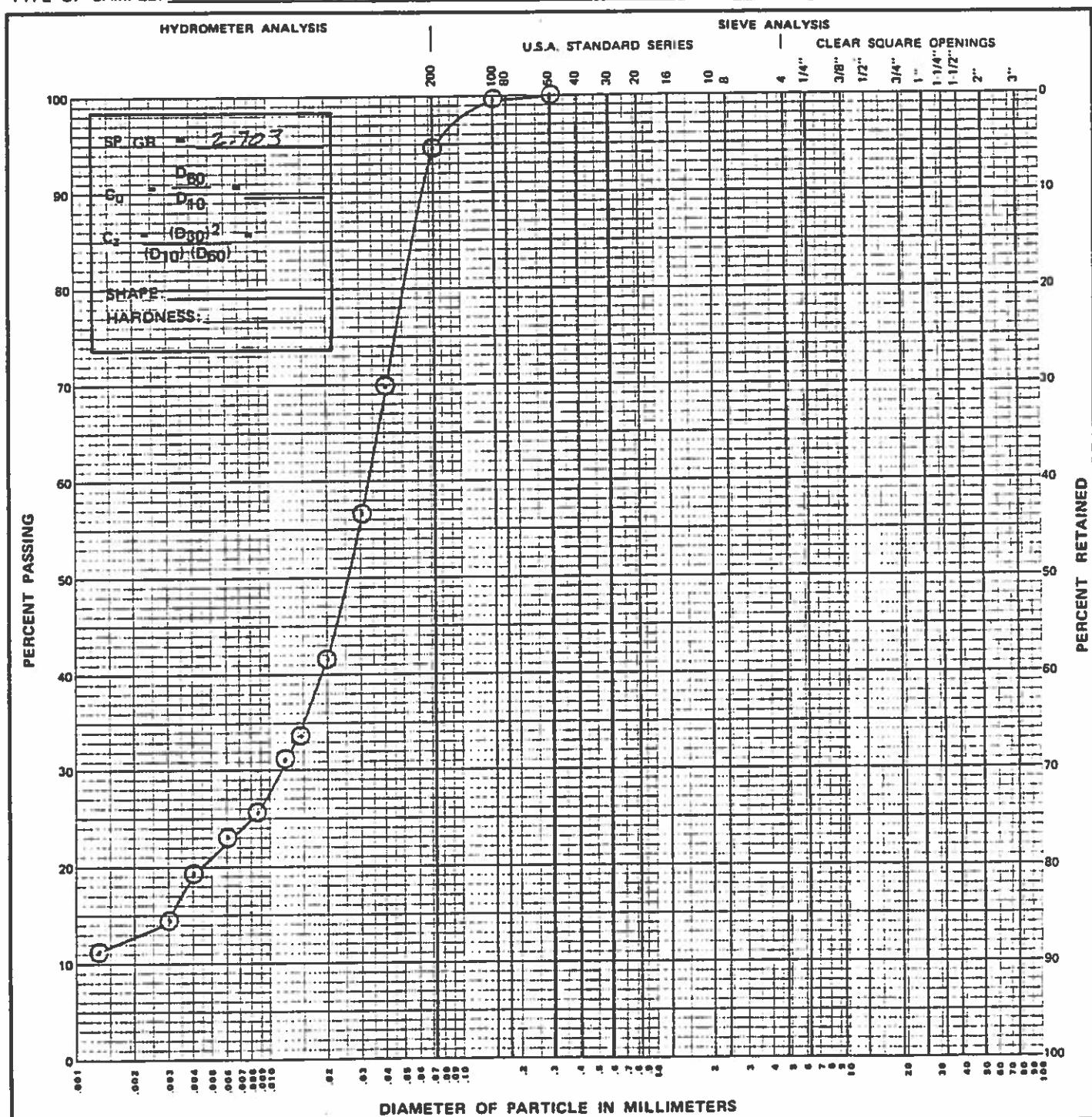
ASTM D422

PROJECT DESCRIPTION: TRI CITIES

MATERIALS LABORATORY: CH2M HILL INC.

SAMPLE LOCATION: B-17 13'-15' SAMPLE NO. ST-3

TYPE OF SAMPLE: MED. BROWN SILT ML



COL. LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION

TESTED BY: J PLAMONDON	DATE: 7 JUNE 1982	COMPUTED BY: J PLAMONDON	DATE: 7 JUNE 1982	CHECKED BY:	DATE:
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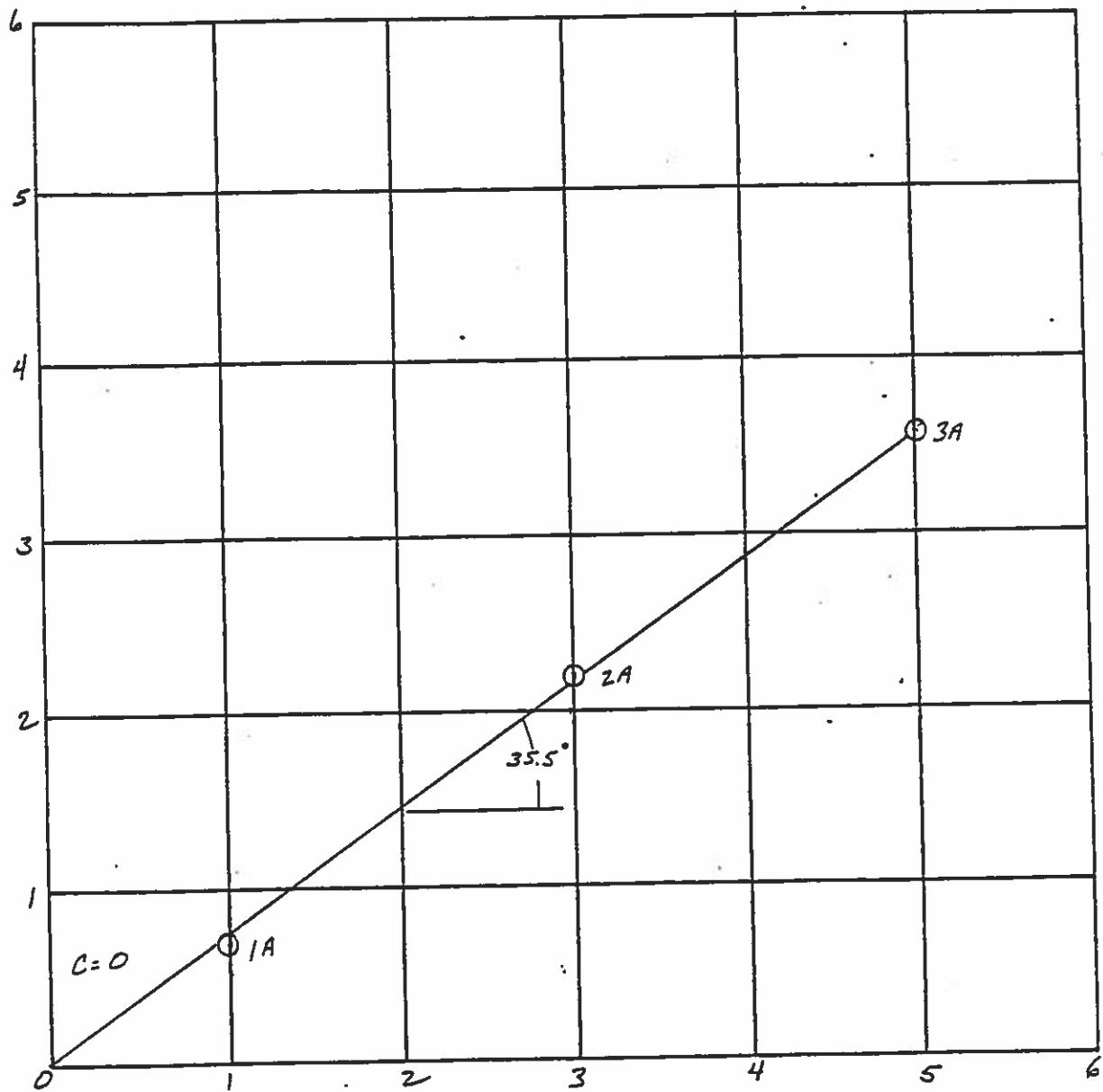
PROJECT TRI CITIES  
 SAMPLE NO. B-1B ST-4  
 MATERIAL TYPE MED BROWN SILTY F SAND

PROJECT NO. P15600.A5.00  
 DEPTH 10'-12'  
SM

SHEARING STRESS IN K. S. F.

By: J. Parsons

Date: 11/26/1982 Job No. P15600.A5.00



NORMAL STRESS IN K. S. F.

SPECIMEN	UNITS	1A	2A	3A
WET DENSITY	pcf	100.48	104.70	102.73
DRY DENSITY	pcf	76.70	79.73	79.88
MOISTURE	%	31.0	30.7	28.6
NORMAL STRESS	KSF	1.01	2.97	5.03
SHEAR STRESS	KSF	0.69	2.17	3.62
SHEAR RATE	0.005 IN/MIN.			
SPECIMEN TYPE	UNDISTURBED			
REMARKS	SPECIMENS WERE INUNDATED DURING SHEAR.			

CH2M  
HILLSHEET        OF       

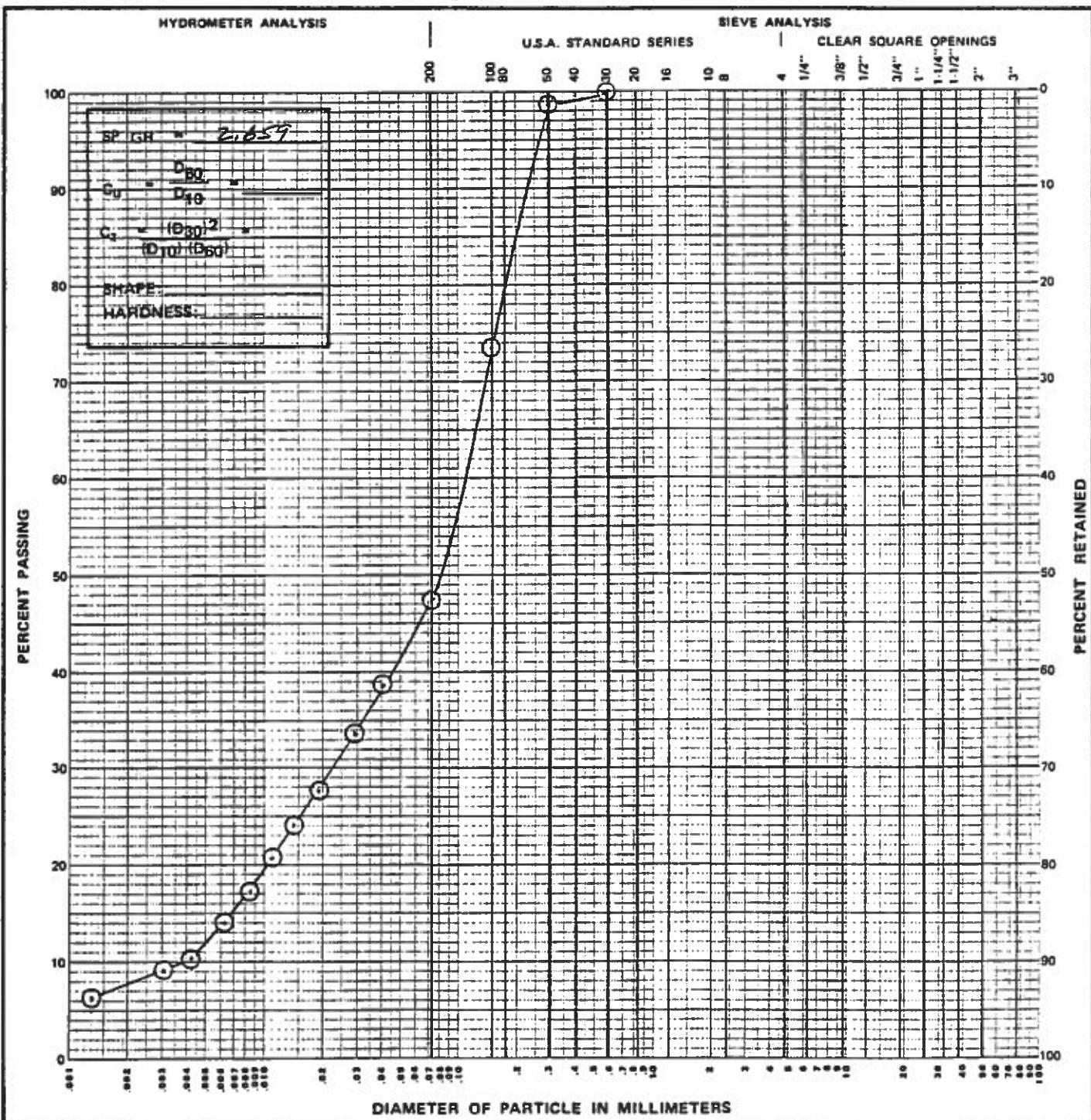
PROJECT NUMBER

P15600.A5.10

## PARTICLE-SIZE ANALYSIS

ASTM D422

PROJECT DESCRIPTION: TRI CITIES  
 MATERIALS LABORATORY: CH2M HILL INC.  
 SAMPLE LOCATION: B-18 10'-12'  
 SAMPLE NO. ST-4  
 TYPE OF SAMPLE: MED. BROWN SILTY F SAND



COL. LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION \_\_\_\_\_

TESTED BY: J RAMONDON DATE: 7 JUNE 1982 COMPUTED BY: J RAMONDON DATE: 7 JUNE 1982 CHECKED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

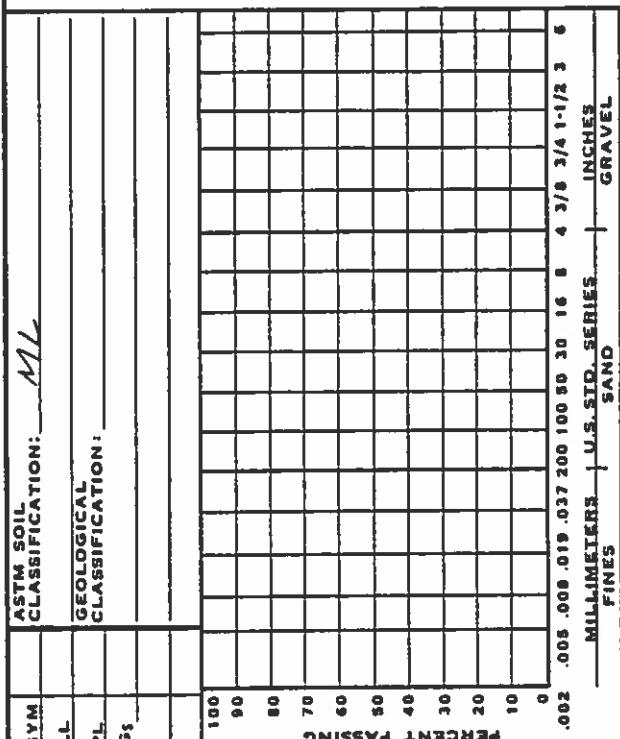
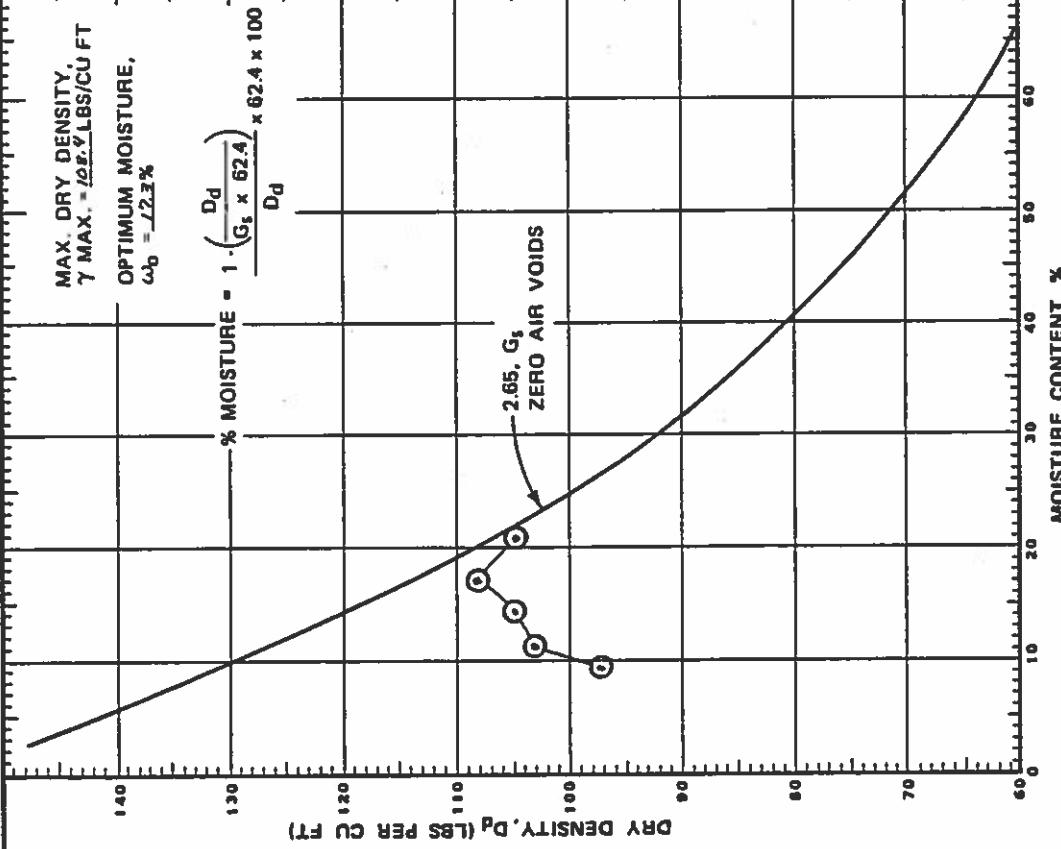
CH2M  
HILL

PROJECT NUMBER  
P5600, A5

## MOISTURE - DENSITY TEST RESULTS

PROJECT DESCRIPTION: Tri Cities  
MATERIALS LABORATORY: Cel/221 Milic Inc.

SAMPLE LOCATION:



## FIELD TEST RESULTS

TEST NO.	(UNITS)	(UNITS)	(UNITS)
FIELD DRY DENSITY	LB/FT <sup>3</sup>		
FIELD MOISTURE CONTENT	%		
PERCENT COMPACTION	%		
TEST NO.	(UNITS)	(UNITS)	(UNITS)
FIELD DRY DENSITY	LB/FT <sup>3</sup>		
FIELD MOISTURE CONTENT	%		
PERCENT COMPACTION	%		
REMARKS:			

TESTED BY: JR Reynolds DATE: 6-16-82 COMPUTED BY: JB Rewards CHECKED BY: JB Rewards DATE: 16 June 1982 LAB FORM D698P 2/78

## PARTICLE-SIZE ANALYSIS

ASTM D422

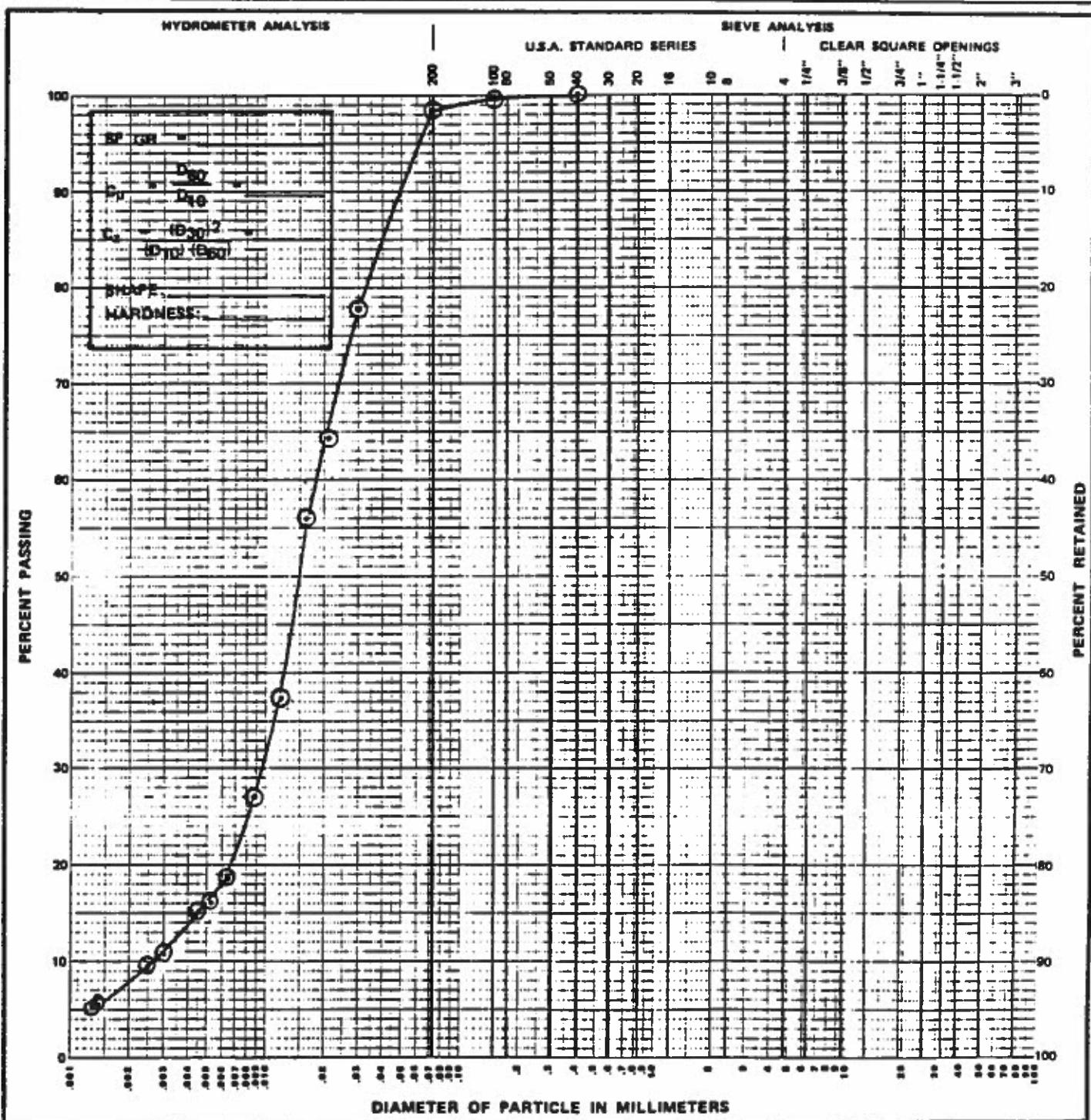
PROJECT DESCRIPTION: TRICITY - WWTP

MATERIALS LABORATORY: PDX

SAMPLE LOCATION: B-17 S-3 D-13-15'

SAMPLE NO. 2

TYPE OF SAMPLE: QUICK CONSOL. TEST

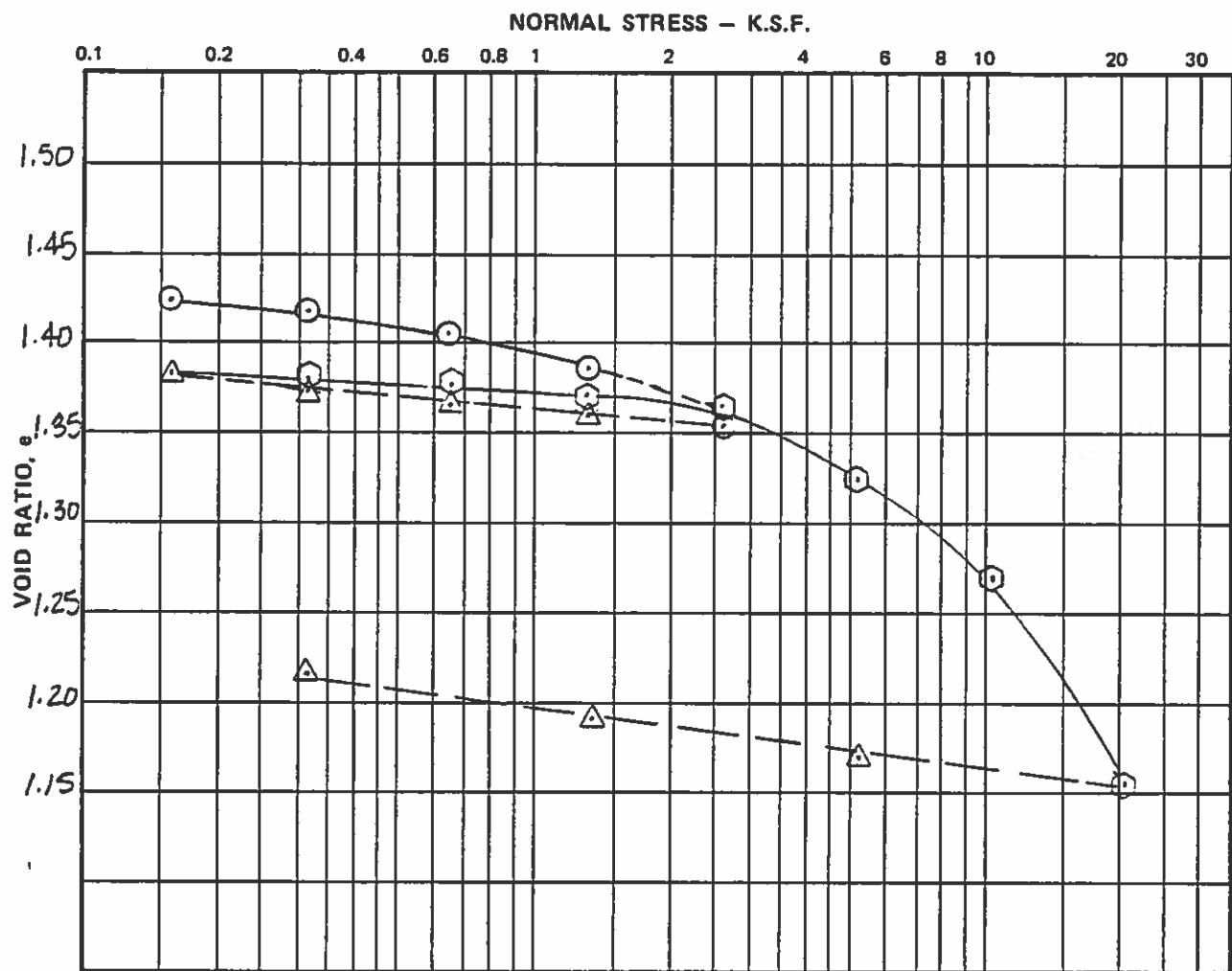


## SAMPLE CLASSIFICATION

TESTED BY:  
A-ShahDATE:  
09/14/82COMPUTED BY:  
A-ShahDATE:  
09/16/82

CHECKED BY:

DATE:



### PLOT OF PRIMARY CONSOLIDATION

SAMPLE DATA :

MEDIUM BROWN SILT (ML)  
 DEPTH 13-15 FT.  
 INITIAL DIAMETER = 2.50 IN.  
 INITIAL HEIGHT = 1.00 IN.  
 INITIAL VOID RATIO = 1.426  
 INITIAL MOISTURE CONTENT = 54%  
 DRY DENSITY = 69.4 PCF

B-17 ST-3  
 CONSOLIDATION TEST  
 TRI-CITY SEWAGE TREATMENT  
 PLANT

P15600.A5.10



## PARTICLE-SIZE ANALYSIS

ASTM D422

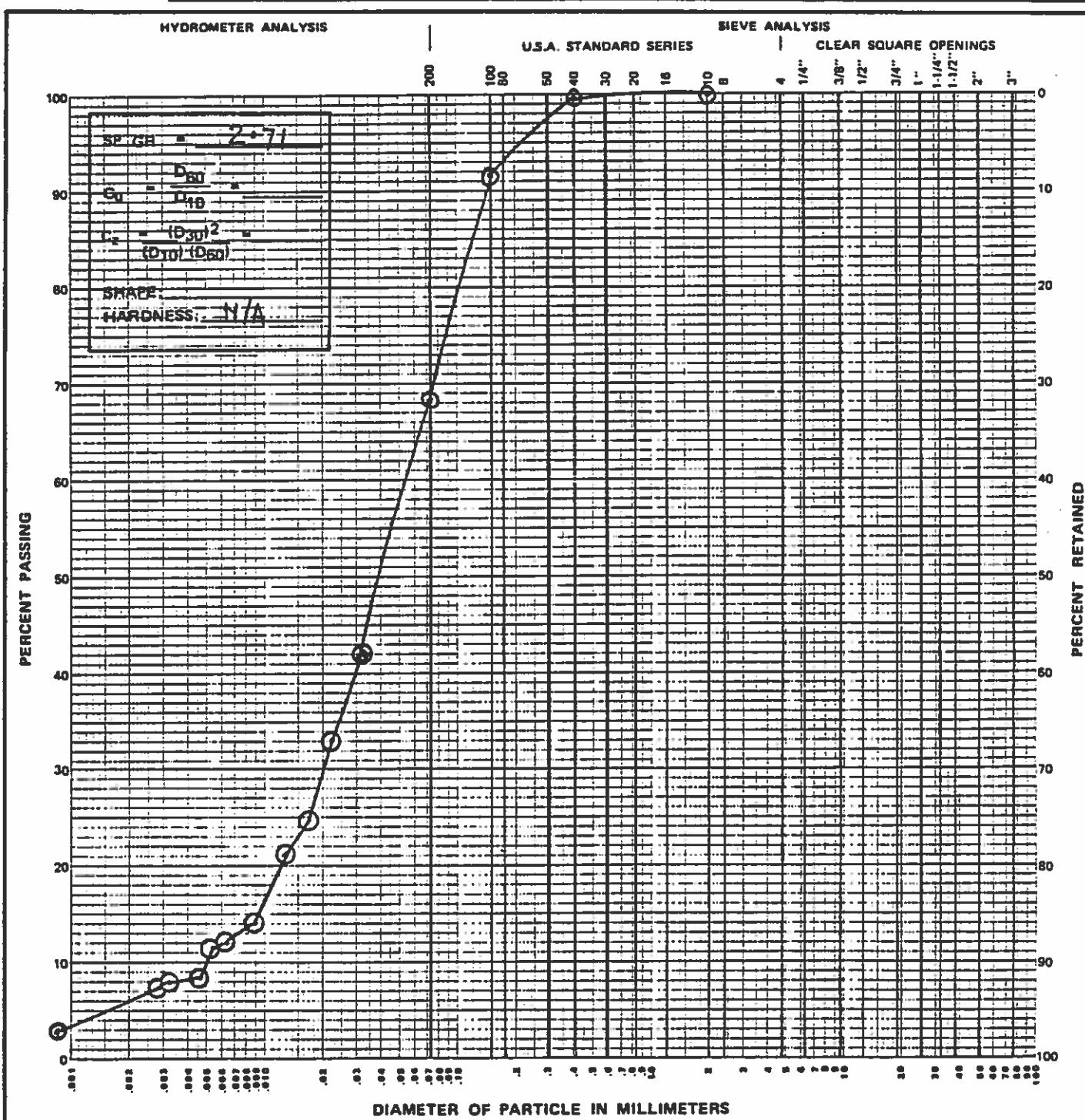
PROJECT DESCRIPTION: TRICITY - WWTP

MATERIALS LABORATORY:

SAMPLE LOCATION: B-17, ST-7 D - 23-25'

SAMPLE NO. ST-7

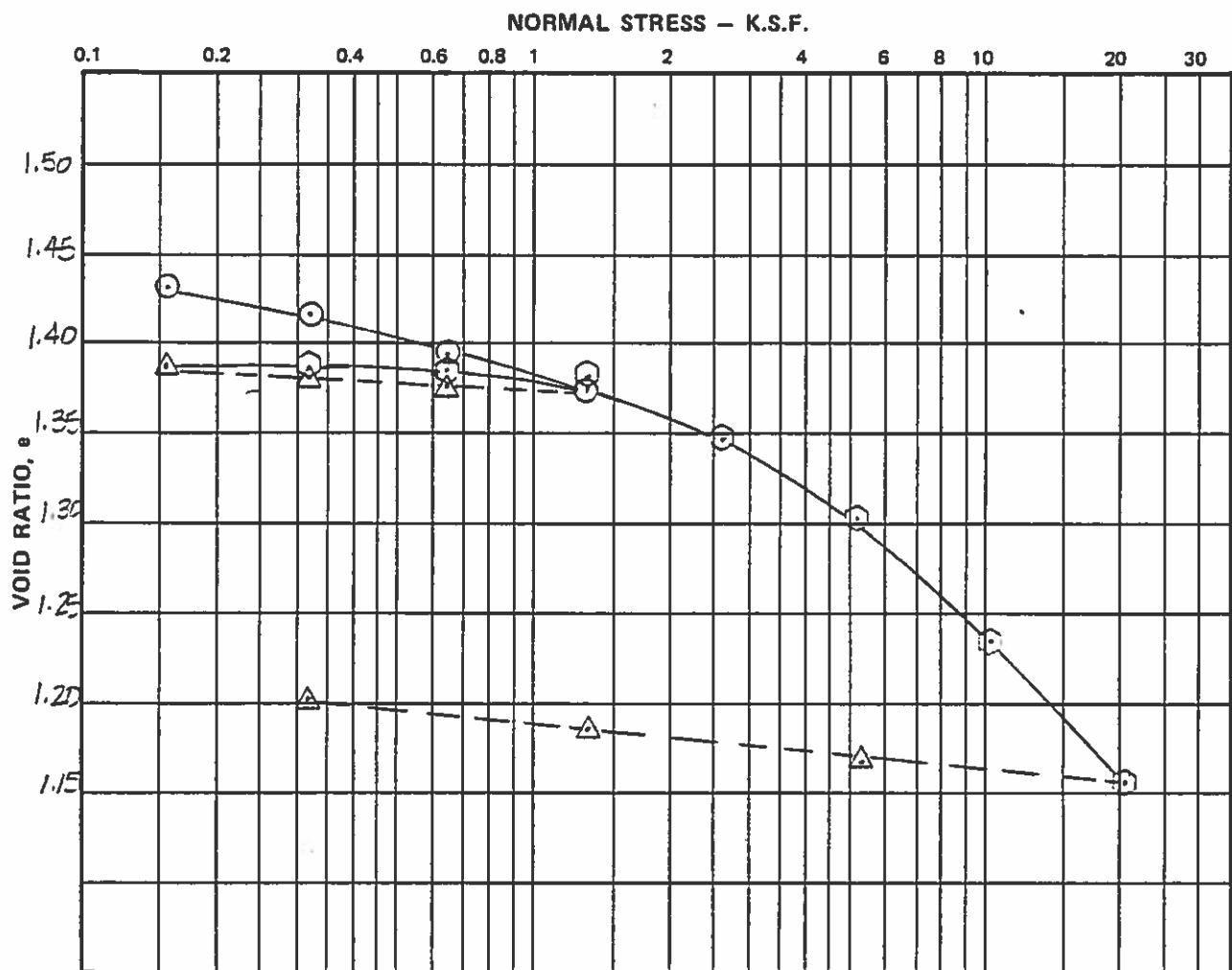
TYPE OF SAMPLE:



COL. LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION

TESTED BY: A. Shah	DATE: 09/09/82	COMPUTED BY: A. Shah	DATE: 09/13/82	CHECKED BY: A. Shah	DATE: 09/13/82
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PLOT OF PRIMARY CONSOLIDATION  
SAMPLE DATA:

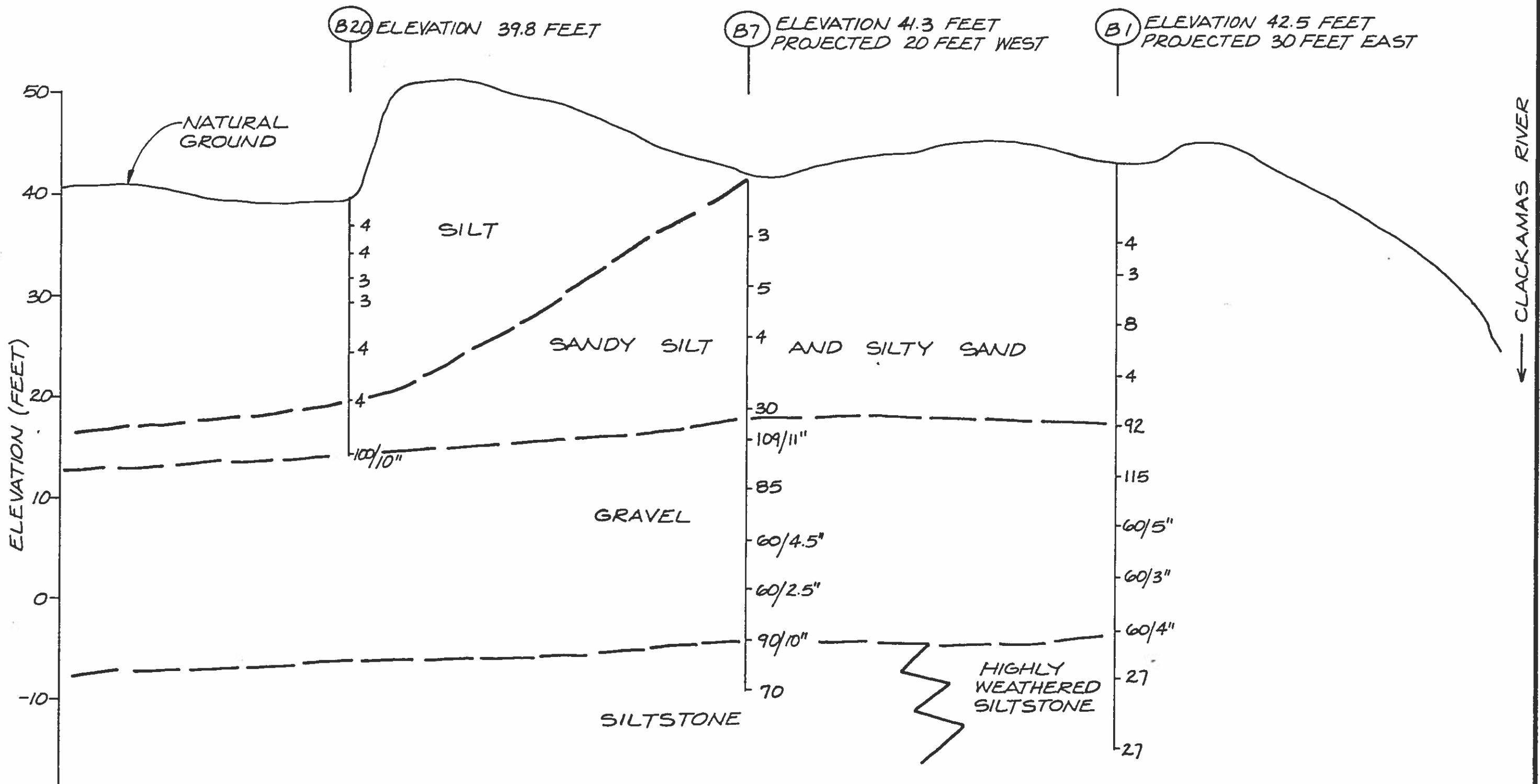
MEDIUM BROWN SANDY SILT (ML)  
DEPTH 23-25 FT.  
INITIAL DIAMETER = 2.50IN.  
INITIAL HEIGHT = 1.00 IN.  
INITIAL VOID RATIO = 1.44  
NATURAL MOISTURE CONTENT = 52 %  
DRY DENSITY = 69 PCF

B-17 ST-7  
CONSOLIDATION TEST  
TRI-CITY SEWAGE TREATMENT  
PLANT

P15600.A5.10



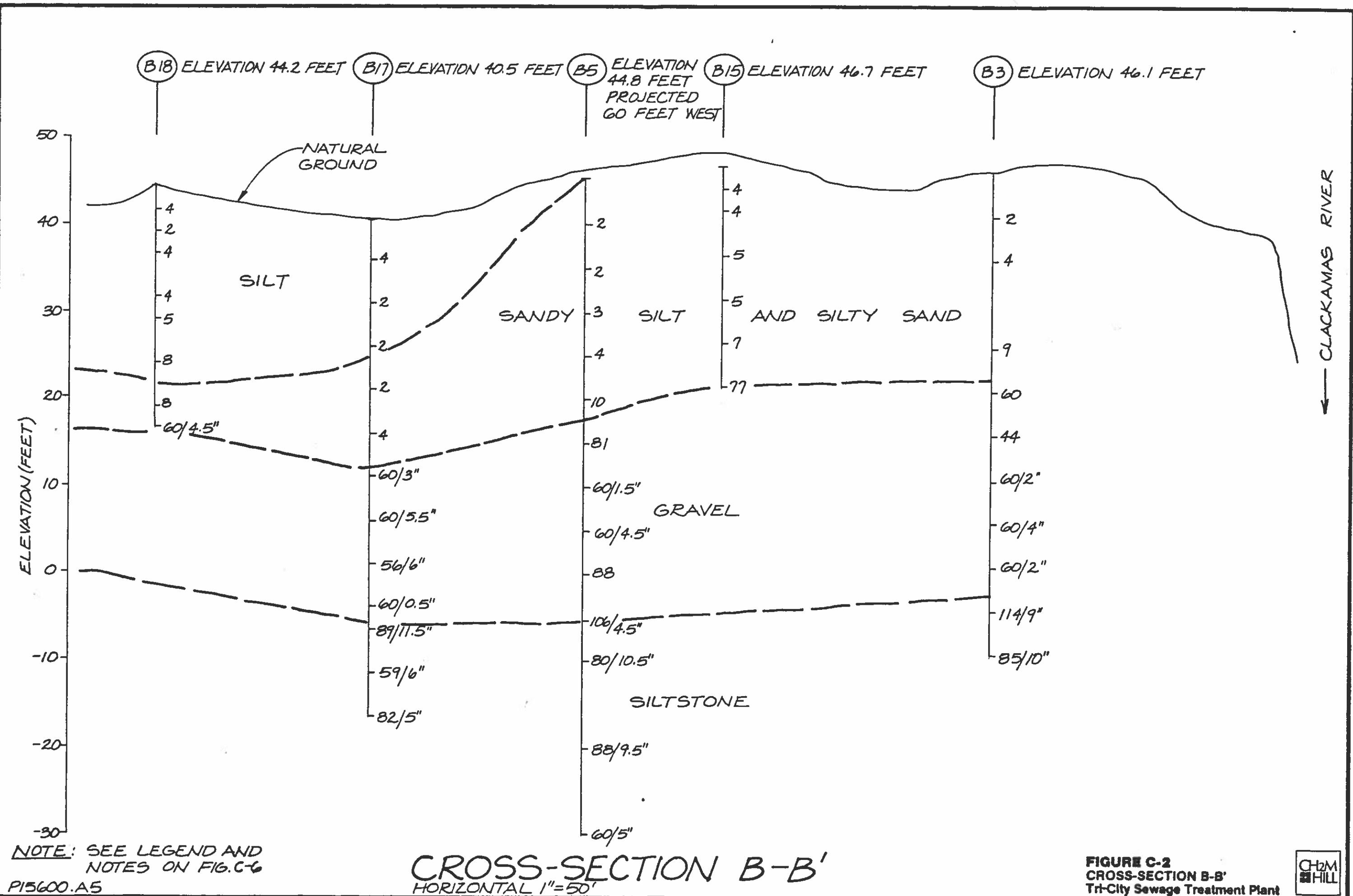
**■■ Appendix C  
■■ CROSS-SECTIONS**

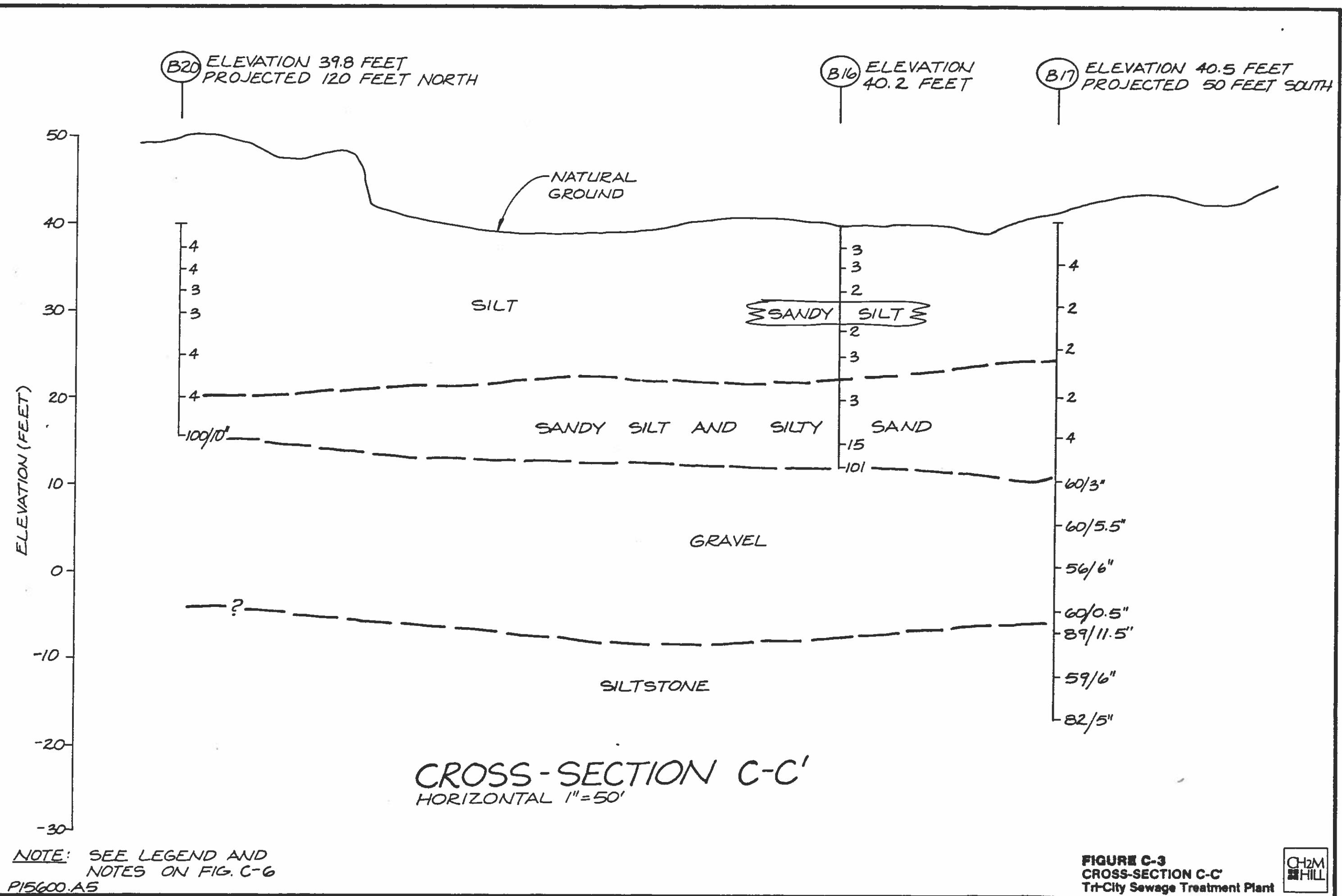


CROSS - SECTION A-A'  
HORIZONTAL 1" = 50'

NOTE:  
SEE LEGEND AND  
NOTES ON FIG. C-6  
P15600.A5

FIGURE C-1  
CROSS-SECTION A-A'  
Tri-City Sewage Treatment Plant

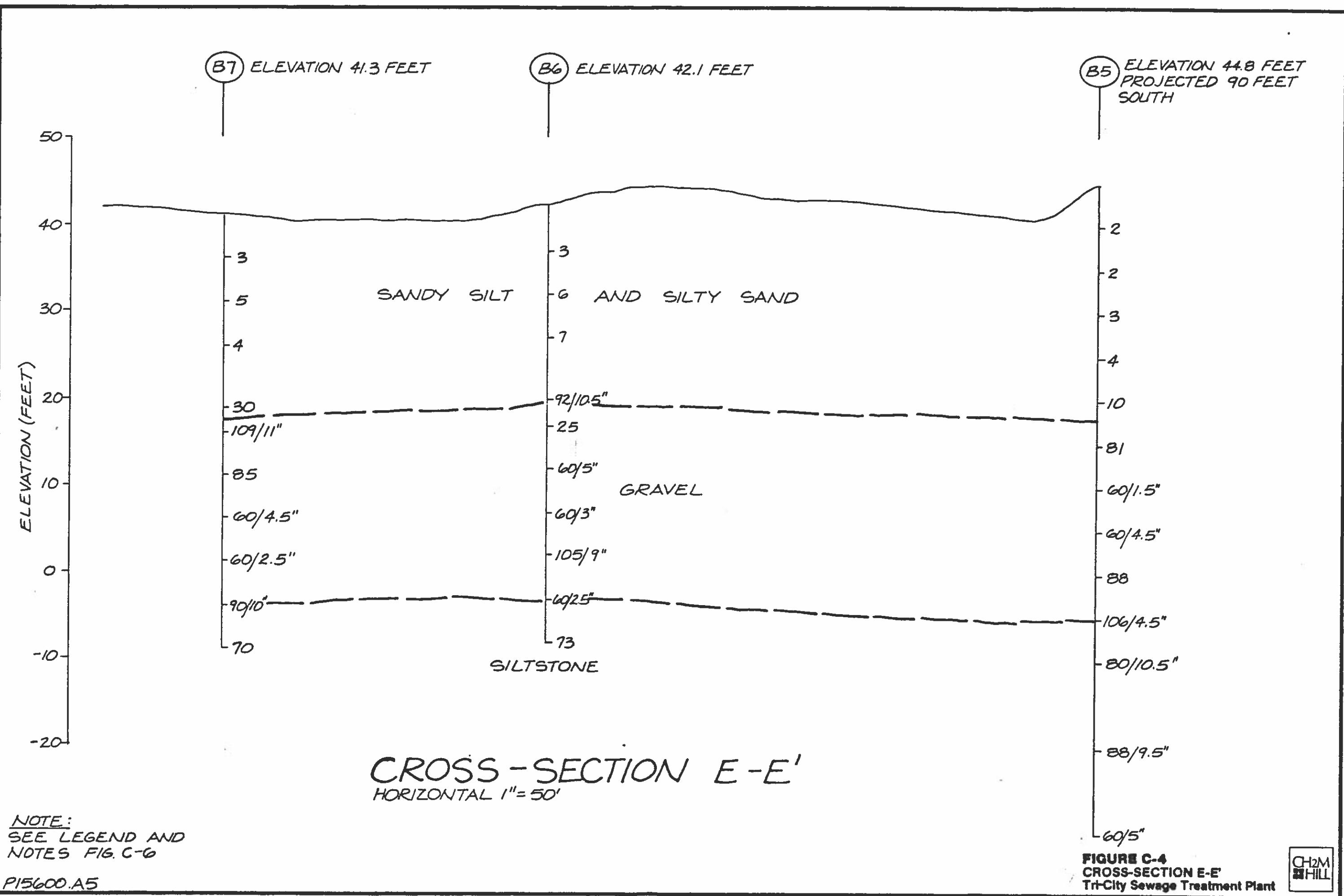


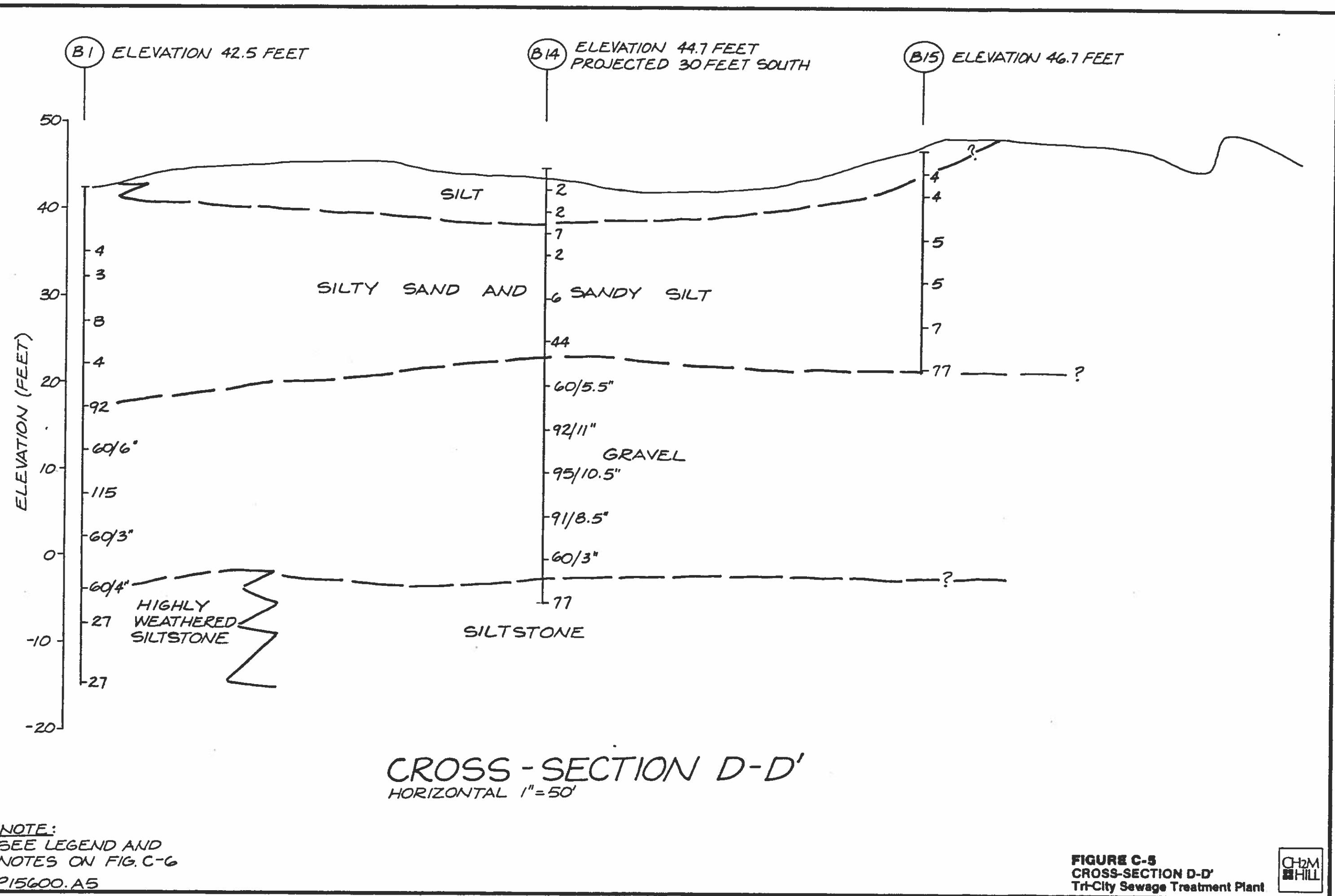


NOTE: SEE LEGEND AND  
NOTES ON FIG. C-6  
P15600.A5

**FIGURE C-3**  
**CROSS-SECTION C-C'**  
Tri-City Sewage Treatment







**NOTES:**

1. THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTIONS WERE GENERALIZED FROM AND INTERPOLATED BETWEEN SOIL BORINGS. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS.
2. BORING LOCATIONS ARE SHOWN ON FIGURE 2.
3. BORINGS WERE LOGGED IN THE FIELD BY A CH2M HILL ENGINEERING GEOLOGIST.
4. BORINGS WERE DRILLED BY DON KENNER OF OREGON, INC. OF SHERWOOD, OREGON. BORINGS B-1 AND B-3 WERE DRILLED IN DECEMBER, 1981, USING A TRUCK-MOUNTED CME-55. THE REMAINDER OF THE BORINGS WERE DRILLED WITH A TRUCK MOUNTED CME-75 IN DECEMBER, 1981, AND IN JANUARY AND MAY, 1982.
5. TRANSITIONS BETWEEN SOIL TYPES MAY BE GRADUAL AND ARE APPROXIMATELY AT THE ELEVATIONS SHOWN.
6. SEE THE BORING LOGS FOR DETAILED DESCRIPTIONS OF THE SUBSURFACE CONDITIONS.

**LEGEND**



BORING NUMBER



SPLIT-SPOON SAMPLE (ASTM D1586), "N"-VALUE

**STANDARD PENETRATION TEST:**

**BLOWS** - THE NUMBER OF BLOWS FOR THREE 6-INCH INCREMENTS REQUIRED FROM A 140-LB HAMMER FALLING 30 INCHES TO DRIVE A STANDARD 2-INCH O.D. SPLIT-BARREL SAMPLER (ASTM D1586).

**"N"** - THE SUM OF BLOWS FOR THE SECOND AND THIRD 6-INCH INCREMENTS. IF THE SAMPLER IS DRIVEN LESS THAN 18-INCHES, THEN "N" IS THE NUMBER OF BLOWS FOR THE FRACTION OF THE LAST 2 6-INCH INCREMENTS.

**FIGURE C-6**  
**LEGEND AND NOTES**  
Tri-City Sewage Treatment Plant

