SOURCE CONTROL
REMEDIAL INVESTIGATION REPORT
FOR
SHERIDAN DISPOSAL SERVICE SITE
HEMPSTEAD, TEXAS

APPENDICES
VOLUME II

002316

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY
TEXAS WATER COMMISSION

BY

SHERIDAN SITE COMMITTEE

JUNE 1987

RESOURCE ENGINEERING

3000 RICHMOND AVENUE, HOUSTON, TEXAS 77098, (713) 520-9900

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APPENDIX 4A

GEOLOGIC LOGS

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RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: B-1
Job #: 288-01
Drawn By: JDA
Approved By: CDV

DRILLING and SAMPLING INFORMATION

Date Started: 4/2/84
Date Completed: 4/2/84
Drill Foreman: Littell
Inspector: Brothers
Boring Method: HSA

Hammer Wt: 140 lbs
Hammer Drop: 30 in
Spoon Sampler OD: 2 in
Rock Core Dia: N/A in
Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION – 177.85

Soil Classification	Depth Scale	Sample No	Sample Type	% Recovery	Ground Water	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² / Pocket Penetrometer qu Tons/Ft²	Permeability x 10⁻⁷ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SANDY CLAY, stiff, brown, roots (CL) FILL		1	ST								
	5	2	ST				1.2				LL=34 PL=18 PI=16
SLUDGE		3	GS								
		4	GS								
	10	5	GS								
CLAYEY SAND, reddish brown (SC) (-)200 = 45.9%											
	15	6	ST					1.5	114	11.7	LL=18 PL=10 PI= 8
Boring Terminated @ 15'											
Groundwater Not Encountered											
	20										
	25										

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SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE
GS – GRAB SAMPLE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
▼ AFTER HRS FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: B-2
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CAP

DRILLING and SAMPLING INFORMATION

Date Started: 4/3/84 — Hammer Wt: 140 lbs
Date Completed: 4/3/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in.
Boring Method: HSA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 177.1±	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
(-)200 = 64.6%											
SANDY CLAY, firm to very stiff (FILL) (ML)		1	ST				2.2				LL=31 PL=18 PI=13
	5	2	ST				0.8				
SLUDGE		3	GS								
	10	4	GS								
CLAY, stiff, brown (CH-MH)											
	15	5	ST				1.8	7.9	111	24.3	LL=74 PL=34 PI=40
Boring Terminated @ 15'											
Groundwater Not Encountered	20										
	25										

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE
GS – GRAB SAMPLE

GROUND WATER DEPTH
∇ AT COMPLETION FT
▼ AFTER HRS FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

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RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: B-19
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt.: 140 lbs
Date Completed: 3/5/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: CFA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION – 167.8')	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability K 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, very stiff to hard, brown												
			1	ST				2.2				
(CH)			2	ST				2.0				
(-)200 = 94.2%		5	3	ST				1.5				
Calcareous nodules ? 10 feet			4	ST				1.7				LL=50 PL=20 PI=30
(-)200 = 94.9%		10	5	ST				2.7				
Clayey Silt Layer 14.5 - 15.5 feet			6	ST				2.8				LL=54 PL=21 PI=33
Silt Seams 16 - 21 feet		15	7	ST				4.0				LL=41 PL=13 PI=28
			8	ST				3.8				
		20										
SILT, stiff, brown to reddish brown, trace to little sand & clay (ML)												
		25	9	ST				2.6				

Continued on Page 2

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION 32.2 FT
▼ AFTER HRS FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: B-19
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt.: 140 lbs
Date Completed: 3/5/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: CFA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION - 167.8')	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SILT, stiff, brown to reddish brown, trace to little sand and clay (ML)												
SITLY CLAY, stiff to very stiff, brown, with silt seams (CL)		30	10	ST		▽		2.1				
Calcareous nodules @ 39 ft.		35	11	ST				1.5				LL=41 PL=15 PI=26
		40	12	ST				2.2				
SANDY SILT, dense, tannish brown (ML)			13	ST			36					
BORING TERMINATED @ 45'. Note: Boring backfilled with a cement - bentonite grout.		45										

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION 32.2 FT
▼ AFTER HRS. FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: 20
Job #: 288-02
Drawn By: JOA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt.: 140 lbs
Date Completed: 3/5/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: CFA — Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION – 167.0)	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability x 10⁻⁹ cm/sec	Natural Dry Density lbs/cu ft.	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, very stiff to hard, brown												
			1	ST				2.2				
Dark gray 5.5 - 9.0 ft. (-)200 = 97.9%			2	ST				3.5				LL=77 PL=25 PI=52
		5	3	ST				4.5+	8.1	111	19.0	
(-)200 = 97.1%			4	ST				4.5+				LL=63 PL=19 PI=44
		10	5	ST				3.7				
			6	ST				3.5				
		15	7	ST				3.2				LL=64 PL=25 PI=39
BORING TERMINATED @ 15'												
Note: Boring backfill with a cement - bentonite grout.												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION Dry FT
▼ AFTER HRS FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

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RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: B-21
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt: 140 lbs.
Date Completed: 3/5/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: CFA — Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 166.2	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q/ Tons/Ft² * Pocket Penetrometer q/ Tons/Ft²	Permeability x 10⁻⁹ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, stiff to hard, brown												
Becomes gray @ 5.5 – 7.5ft.			1	ST				2.7				
		5	2	ST				4.5+				LL=58 PL=23 PI=35
(CH) (-)200= 90.7%			3	ST				4.5+				LL=62 PL=22 PI=40
			4	ST				4.5+				
(-)200= 96.6%		10	5	ST				4.5+	8.6	102	21.8	
			6	ST				4.5+				LL=65 PL=23 PI=42
(-)200 = 98.3%		15	7	ST								
BORING TERMINATED @ 15' Note: Boring backfilled with a cement bentonite grout.												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION Dry FT
▼ AFTER HRS. FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

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RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: 22
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt.: 140 lbs
Date Completed: 3/6/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: CFA/RW — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability X 10⁻⁹ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, very stiff to hard, brown			1	ST				4.5+				LL=48 PL=17 PI=31
Dark gray 3 — 5 ft. (-)200 = 94.2%			2	ST				4.5+				
		5	3	ST				4.5+	2.4	106	22.6	
			4	ST				4.5				
(-)200 = 94.9%		10	5	ST				4.5+				LL=67 PL=23 PI=44
(CH)			6	ST				3.0				
(-)200 = 97.6%			7	ST				3.5				LL=59 PL=23 PI=36
		15										
		20	8	ST				3.2				
Ferrous oxide nodules @ 24'		25	9	ST				3.6				

Continued on Page 2

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▽ AFTER 120 HRS. 27 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING
RW = Rotary Wash

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: 22
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt.: 140 lbs
Date Completed: 3/6/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: CFA/RW — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qu Tons/Ft²	Permeability x 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, very stiff, brown (CH) Ferrous oxide and calcareous nodules @ 29'						▽						
		30	10	ST				2.6				
SANDY SILT, compact, tan, with clay seams (ML) (-)200 = 55.6%		35	11	ST								LL=22 PL=16 PI= 6
SAND, compact tan (SM) Gravel 44 - 46 feet		40										
		45										
		50										

Continued on Page 3

502327

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 120 HRS 27 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING
RW – Rotary Wash

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: 22
Job #: 288-02
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 3/5/85 — Hammer Wt: 140 lbs
Date Completed: 3/6/85 — Hammer Drop: 30 in
Drill Foreman: Littel — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: CFA/RW — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² / Pocket Penetrometer qp Tons/Ft²	Permeability X 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SAND, compact tan (SM)												
CLAY(CH), stiff, olive green (-)200 = 94.9%		55	12	ST								LL=74 PL=23 PI=51
BORING TERMINATED @ 57'		60										

Note: a) Boring drilled dry to 20'.
b) Boring was converted to well W-19.
c) Screen set 31 - 56 ft.

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
∇ AFTER 120 HRS 27 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING
RW – Rotary Wash

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-30

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No.: BH-30
Logged By: G. Groene/J. Felhaber
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/7/85 Date Completed: 11/8/85
Method: MD Total Depth: 106 feet

WELL COMPLETION INFORMATION
Screen Dia.: Length: Not completed
Slot Size: Type: grouted to the surface.
Casing Dia.: Length:

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER (BLOW COUNT)	WATER LEVEL
	SURFACE ELEVATION							
0	SILTY SANDY CLAY, dark brown.		1	ST	25		2.75	
			2	ST	79			
5	SILTY CLAY, dark brown with calcareous nodules throughout.		3	ST	46		2.4	
			4	ST	50		2.5	
10	- Olive green mottling present.		5	ST	42		3.0	
	- 5 inch silty clay layer at 13 feet.		6	ST	69		2.5	
			7	ST	83		2.5	
15	- Iron nodules present, black.		8	ST	83		3.4	
			9	ST	75			
20			10	ST	88		2.5	
			11	ST	50		3.1	
			12	ST	75		3.6	
25			13	ST	67			
	- Silt inclusions (pockets) at 25 and 29 feet.		14	ST	92		3.4	
			15	ST	67			
30	- Grades into silty sand, brown with iron and calcareous nodules present.		16	ST	NA			
	- Very sandy silt, some clay, grey (6 inches).							
	SILTY SAND with some clay, brown, calcareous and iron nodules present. Grey clay pockets throughout.		17	ST	92		2.2	
35			18	ST	58			
			19	ST	67			
			20	ST	71			
40	SAND, tan to greyish tan loose, fine grained.		21	ST	33			
	- 5 inch silty sand, tannish grey at 44 feet		22	ST	50			
45	- 3 inch silty clay seam at 46 feet.		23	ST	42			
			24	ST	42			
	SAND AND SILTY CLAY LAYERS. Sand tan, loose clay brownish grey.		25	ST	42			
50			26	SS	29		35/50 for 6"	
	LOOSE SAND AND GRAVEL. 3 inch layer of gravel, 1/2 inch diameter. Layer of coarse sand mixed with 1 inch gravel, sub-rounded, pink to grey to black. 6 inch of coarse sand with a layer of gravel changing back into sand.		27	SS	29		28/50 for 7"	
55			28	SS	54		21/50 for 8"	
56								

CONTINUED ON SHEET 2

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002320

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-30

Client
Project Name Sheridan Disposal Site
Project Location Waller County, Texas
Job No 288-04 Boring No BH-30
Logged By G. Greene, J. Felhaber
Approved By
Drilled By J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started 11/7/85 Date Completed 11/8/85
Method MD Total Depth 106'

WELL COMPLETION INFORMATION
Screen Dia Length Not completed
Slot Size Type
Casing Dia Length

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION CONTINUED FROM SHEET 1							
56	- Grades into silty clay with 1 inch gravel imbedded, yellow. (Driller observation - Larger gravel present but not recovered)		29	ST	83		>4.5	
	CLAY, greenish yellow with gray-blue mottling, calcareous nodules present throughout.		30	ST	47		>4.5	
60			31	ST	50			
			32	ST	92		>4.5	
65			33	ST	54			
			34	ST	50		>4.5	
	- Color change to grey with yellowish green mottling and brown spots, calcareous nodules absent.		35	ST	58		>4.5	
70	- Color change to grey with small amount of red and yellow mottling with some iron and calcareous nodules present.		36	ST	62			
			37	ST	67		>4.5	
75			38	ST	79		>4.5	
	- Very fine grained sand present throughout, becomes more abundant with depth.		39	ST	42		>4.5	
			40	ST	75		>4.5	
80			41	ST SS	NR 21		80for6"	
			42	SS	29		38/50 for 3"	
85			43	SS	33		38/50 for 4"	
			44	ST	38		>4.5	
			45	ST	33		>4.5	
90			46	SS	17		90 for 4"	
	SAND, tan, fine grained.			SS	NR			
95	Drilled 94 to 96, possible siltstone layer.		47	SS ST	NR 33			
	- 0.5 inch lense of silty clay at 96.5 and 97.5 feet.		48	SS	38		39/50 for 4"	
	- Grades into sandy silt, grey.		49	ST	38		>4.5	
100	CLAY, with fine grained sand, brown with grey and blue mottles, a few calcareous nodules			ST	NR			
			50	SS	46			
105	-Clay silt lense, 2 inches thick		51	SS	42			
	TERMINATED BORING AT 106'.							

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002330

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-31

Client
Project Name Sheridan Disposal Site
Project Location Waller County, Texas
Job No 288-04 Boring No BH-31
Logged By
Approved By G. Greene/J. Felheber
Drilled By J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started 11/8/85 Date Completed 11/11/85
Method MD Total Depth 104'

WELL COMPLETION INFORMATION
Screen Dia. Length Not completed
Slot Size Type Grouted to surface
Casing Dia Length

Depth in Feet	Description	Stratum Elevation in Feet	Sample No	Sample Type	% Recovery	Graphic Log	Pocket Penetrometer / Blow Count	Water Level
0	SURFACE ELEVATION							
	SILTY CLAY, dark brown with calcareous nodules throughout.		1	ST	50		>4.5	
5			2	ST	38		>4.5	
			3	ST	38		>4.5	
			4	ST	46		>4.5	
10	- Iron and calcareous nodules abundant.		5	ST	42		>4.5	
			6	ST	54		>4.5	
15			7	ST	42		>4.5	
			8	ST	46		>4.5	
			9	ST	46		>4.5	
20			10	ST	50		>4.5	
			11	ST	54		3.7	
25			12	ST	75		4.0	
			13	ST	46		4.0	
			14	ST	83		2.7	
30	- Grades into alternating layers of sand silty clay and clayey sand, reddish brown, some sand and gravel.		15	ST	50		2.8	
			16	ST	83		1.0	
35			17	ST	71			
	- 3 inch sand and gravel layer at 36 feet.		18	ST	71			
			19	SS	50			
40	- 6 inch sand and gravel layer at 39.5 feet.		20	SS	25			
	SAND, medium brown, fine grained, loose.		21	SS	4			
45			22	SS	33		45/50 for 7"	
	- 1 inch diameter gravel mixed with sand at 47 feet.		23	SS	33		15/50 for 6"	
	SAND AND GRAVEL, sand is coarse mixed with gravel, gravel is mixed, 1 inch average diameter, angular, pink.		24	SS	33		43/50 for 11"	
50			25	SS	33		12/11 for 16"	
	- 2 inch sandy clay lense at 52 feet.		26	SS	33		21/50 for 9"	
55			27	SS	46		13/50 for 11"	
	- Clay lense at 57 feet.		28	SS	46		28/50 for 8"	
58			29	SS	50		20/50 for 10"	

CONTINUED ON SHEET 2

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002374

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-31

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No: BH-31
Logged By: G. Greene/J. Felhaber
Approved By
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/8/85 Date Completed: 11/11/85
Method: MD Total Depth: 104'

WELL COMPLETION INFORMATION
Screen Dia. Length
Slot Size Type
Casing Dia. Length

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
	CONTINUED FROM SHEET 1							
58	SILTY CLAY, grey with brown mottling, some gravel embedded.		30	ST	75		>4.5	
60	CLAY, grey with brown and bluish mottling, very firm, calcareous nodules present.		31	ST	50		>4.5	
			32	ST	54		>4.5	
65	- Color grades into brownish grey with brown mottling.		33	ST	42		>4.5	
			34	ST	67		>4.5	
			35	ST	71		>4.5	
70	- Color grades into olive green with grey streaks, brown and black mottling.		36	ST	58		>4.5	
			37	ST	54		>4.5	
75			38	ST	46		>4.5	
	- Very fine grain sand is present and becomes more abundant with depth.		39	ST	46		>4.5	
			40	ST	42		>4.5	
80			41	ST	25		>4.5	
			42	ST	42		>4.5	
85			43	ST	29		>4.5	
			44	SS	NR		60/50 for 4"	
	Poor recovery from very resistant layer, drilled 89 to 90 feet, (drillers note - felt like sandstone layer).		45	SS	4			
90			46	DRILLED SS	NR			
	SAND, brown, medium grain. Grades into cemented sand layer, coarse, white.		47	SS	38		100/50 for 7"	
95	Drilled 96 to 98 feet, resistant cemented layer.		48	SS	8		100/50 for 4"	
			49	DRILLED	NR			
	CLAY, with very fine grained sand, olive green with grey mottling, very stiff. Sample pulled out of shelby tube at 102-104 foot interval.		50	SS	75		> 4.5	
100			51	SS	29		> 4.5	
			52	SS	NR			
105	BORING TERMINATED AT 104'.							

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002332

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-32

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No: BH-32
Logged By: G. Greene
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/11/85 Date Completed: 11/13/85
Method: MD Total Depth: 108'

WELL COMPLETION INFORMATION
Screen Dia.: Length: Not Completed
Slot Size: Type: Grouted to surface
Casing Dia: Length:

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER (BLOW COUNT)	WATER LEVEL
	SURFACE ELEVATION							
0	SILTY CLAY, dark brown with roots present. Black staining 0 to 4 feet, no order.		1	ST	42		4.1	
			2	ST	42		> 4.5	
5	- Silty clay lense 4 to 5 feet with a trace of sand, brown.		3	ST	42		> 4.5	
			4	ST	42		4.4	
	SILTY SAND, some clay, brown with iron and calcareous nodules present. Interval firm at top, loose at bottom.		5	ST	50			
10	SILTY SANDY CLAY, dark brown with iron nodules, calcareous nodules absent.		6	ST	58		2.0	
			7	ST	58		4.2	
	CLAY, reddish brown with abundant iron and calcareous nodules.							
15	SANDY SILTY CLAY, reddish brown, some iron and calcareous nodules.		8	ST	50		4.2	
			9	ST	38		2.0	
			10	ST	50		2.1	
20	SILTY CLAY, dark brown, iron streaked with large iron nodules, some calcareous nodules present.		11	ST	33		3.3	
			12	ST	46		2.8	
25	- Sandy silty clay lenses, 1 foot thick 27-28 and 29-30 feet.		13	ST	42			
			14	ST	50		3.5	
			15	ST	62		3.5	
30			16	ST	62		3.5	
	- Grades into a color change at 32 feet, grey mottling with some fine grained sand present.		17	ST	58		3.8	
35			18	ST	58		3.2	
			19	ST	54		4.0	
40	- Grades into sandy clay, reddish brown, fine grained sand iron and calcareous nodules present.		20	ST	50		3.4	
			21	ST	75			
	SILTY SAND, reddish brown, fine sand, loose. - 3 inch thick clay lense at 43, 43.5 and 45 feet.		22	ST	50			
45			23	ST	75			
	- No recovery.		24	ST	NR			
	- Silty sand, brown, medium grained.		25	SS	33		13/50 for 9"	
50	SAND, brown, coarse grained, rounded. Gravel is common, white and pink, from 1/8 to 1/2 inch some 1 inch diameter.		26	SS	21		22/24 for 15"	
	LOST CIRCULATION		27	SS	8			
55			28	SS	NA		30/50 for 6"	
			29	SS	38		14/24 for 16'	
58								

CONTINUED ON SHEET 2

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

0023 33

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF BH-32

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No: BH-32
Logged By: G. Groene
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/11/85 Date Completed: 11/13/85
Method: MD Total Depth: 108'

WELL COMPLETION INFORMATION
Screen Dia: Length: Not completed
Slot Size: Type: Grouted to surface
Casing Dia.: Length:

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
58	CONTINUED FROM SHEET 1							
60	CLAY, olive green with grey mottling, iron streaks and calcareous nodules present, very tight and brittle.		30	ST	50		> 4.5	
			31	ST	62		> 4.5	
65			32	ST	71		> 4.5	
			33	ST	54		> 4.5	
	(LOST CIRCULATION)		34	ST	12			
70	- Iron nodules become present. Fine grained sand througnout.		35	ST	50		> 4.5	
			36	ST	50		> 4.5	
75	- Color change, grades into grey clay with olive green mottling.		37	ST	50		> 4.5	
			38	ST	50		> 4.5	
	- Iron nodules becoming more abundant.		39	ST	42		> 4.5	
80	- Fine grained sand increases with depth.		40	ST	NR			
	SILTY SANDY CLAY, gray with olive green mottling, large calcareous nodules, firm.		41	SS	38		50/50 for 4"	
85			42	SS	8			
	- Drillers note Resistant (sandstone) layer 2 inch thick at 86.4 feet.		43	SS	12			
			44	SS	12		100/50 for 3"	
90			45	SS	NR		100/50 for 7"	
	SAND, tan, medium to fine grained, washed and sorted.		46	SS	21		100/50 for 8"	
	- Resistant layer at 92 feet. - Layers of loose sand resistant layers, unable to sample.		47	NOT SAMPLED, DRILLED				
95	SAND with some silt, fine to medium grained, yellowish brown.		48	SS	8		100/50 for 3"	
100			49	SS	21		100/50 for 9"	
	SILTY CLAY, grey with olive green and brown mottling, very stiff, large calcareous nodules.		50	SS	62		> 4.5	
105			51	SS	33		> 4.5	
			52	SS	4			
	BORING TERMINATED AT 108'.		53	SS	17		> 4.5	
110								

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002374

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-7
Job #: 288-01
Drawn By: JDA
Approved By: CAO

DRILLING and SAMPLING INFORMATION

Date Started: 3/28/84 — Hammer Wt: 140 lbs
Date Completed: 3/30/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 165.68	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, very stiff, brown (CH MH)		1	ST				2.3				LL=83 PL=37 PI=46
SANDY CLAY, stiff, dark gray (CL)		2	ST				-				
becomes reddish brown @ 5 feet	5	3	ST				-	6.6	113	13.2	
(-) 200=51.1%		4	SS			15				10.0	LL=27 PL=14 PI=13
		5	SS			13					
becomes tan @ 9.5 feet	10	6	ST								
(-)200 = 54.3%		7	SS			17				9.9	LL=25 PL=14 PI=11
		8	SS			9					
SANDY SILT/SILTY SAND, compact, brownish tan	15	9	SS			12					
(-)200 = 48.19%		10	SS			11					
		11	SS			11					
	20	12	SS			13					
		13	SS			16					
		14	SS			14					
SAND, compact, brownish tan		15	SS			18					
(-)200 = 9.0%	25	16	SS			18					
Continued on Sheet 2											

002335

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 144 HRS 34.25 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-7
Job #: 288-01
Drawn By: JDA
Approved By: CDB

DRILLING and SAMPLING INFORMATION

Date Started: 3/28/84 — Hammer Wt.: 140 lbs
Date Completed: 3/30/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

SURFACE ELEVATION – 165.68

SOIL CLASSIFICATION	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability X 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SAND, compact, brownish tan with loose and dense seams		17	SS			19					
		18	SS			37					
	30	19	SS			29					
		20	SS			24					
		21	SS		▽	28					
	35	22	SS			24					
		23	SS			7					
(-)200 = 7.8%		24	SS			14					
		25	SS			17					
	40	26	SS			19					
SILTY SAND with gravel 40' to 44'		27	SS			11					
(-)200 = 29.1%		28	SS			17					
	45	29	SS			39					
		30	SS			45					
GRAVEL, compact, tan (-)200 = 0.6%		31	SS			21					
	50	32	SS			20					
Continute on Sheet 3											

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 144 HRS. 34.25 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

002336

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-7
Job #: 288-01
Drawn By: JDA
Approved By: CDO

DRILLING and SAMPLING INFORMATION

Date Started: 3/28/84 — Hammer Wt: 140 lbs
Date Completed: 3/30/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

SOIL CLASSIFICATION

SURFACE ELEVATION - 165.68

Soil Classification	Depth Scale	Sample No.	Sample Type	% Recovery	Ground Water	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² / Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit / PL - Plastic Limit / SL - Shrinkage Limit
GRAVEL, compact to dense, tan, little sand		33	SS			24					
		34	SS			37					
(-)200 = 5.3%		35	SS			26					
	55	36	SS			30					
SANDY CLAY, (-)200 = 79.0%		37	SS			83					
Very stiff, gray-brown,		38	ST				4.5				LL 3
		39	SS			60					PL=19
sand and gravel seam at 60'	60										PI=14
(CL)		40	SS			131					
		41	ST				4.5	6.6	107	20.7	LL=44 PL=25 PI=19
	65	42	ST				4.5				
		43	ST				4.5	8.8	114	18.8	LL=48 PL=26 PI=22
	70	44	ST				4.5				
		45	ST								
CLAY, very stiff, gray-brown slickensided		46	ST								
(CH)	75	47	ST					5.8	109	20.6	LL=66 PL=27 PI=39

Continued on Sheet 4

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
∇ AFTER 144 HRS 34.25 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

002337

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-7
Job #: 288-01
Drawn By: JDA
Approved By: CDV

DRILLING and SAMPLING INFORMATION

Date Started: 3/28/84 — Hammer Wt. 140 lbs
Date Completed: 3/30/84 — Hammer Drop 30 in
Drill Foreman: Littell — Spoon Sampler OD 2 in
Inspector: Brothers — Rock Core Dia N/A in
Boring Method: HSA — Shelby Tube OD 3 in

SOIL CLASSIFICATION SURFACE ELEVATION – 165.68	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² / Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, very stiff, gray-brown slickensided (CH)		48	ST								
	80	49	ST				4.5	2.9	111	20.4	LL=53 PL=24 PI=29
		50	ST				4.5				
SAND, compact to very dense, tan		51	SS			26					
	85	52	SS			115					
silty clay seam 88.3' to 88.9'		53	SS			71					
	90	54	SS			86					
	95	55	SS			98					
CLAY, very stiff, gray to light brown, slickensided (CH)		56	SS			34					LL=68 PL=27 PI=41
	100	57	ST				4.5				
Boring Terminated @ 100'											
Well screened 80' to 95'											

002338

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 144 HRS 34.25 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-10
Job #: 288-01
Drawn By: JDA
Approved By: CDO

DRILLING and SAMPLING INFORMATION

Date Started: 4/2/84 — Hammer Wt.: 140 lbs
Date Completed: 4/2/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION – 166.1)	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * / Pocket Penetrometer q_p Tons/Ft² *	Permeability X 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, very stiff, brown	5	1	ST				4.5				
SILTY SAND, compact, reddish brown and tan, with layers of clay and sandy clay	10	2	ST				-				
(-) 200 = 34.7%	15	3	SS			11					
2" clay layer at 19' (-)200 = 90.3%	20	4	SS			11					
Sandy Clay Layer (-)200 = 57.9%	25	5	ST								
Continued on Sheet 2											

002339

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 72 HRS 29.85 FT
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-10
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDV

DRILLING and SAMPLING INFORMATION

Date Started: 4/2/84 — Hammer Wt.: 140 lbs
Date Completed: 4/2/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

SOIL CLASSIFICATION SURFACE ELEVATION - 166.1	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft²	Pocket Penetrometer qp Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
SILTY SAND, compact reddish brown and tan												
	30	6	SS		▽	16						
(-)200 = 15.1%	35	7	SS			12						
	40											
(-)200 = 38.2%		8	SS			22						
Boring Terminated @ 44.5'	45											
Well screened at 28'- 43'	50											

002340

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 72 HRS 29.85 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-12
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDO

DRILLING and SAMPLING INFORMATION

Date Started: 4/3/84 — Hammer Wt: 140 lbs
Date Completed: 4/3/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION ~ 167.0	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² / Pocket Penetrometer qp Tons/Ft²	Permeability X 10⁻⁵ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, stiff to hard, gray to brown, iron oxide and calcareous nodules (CH)											
	5	1	ST				1.8				LL=73 PL=31 PI=42
(-)200 = 95.7%	10	2	ST				4.6				LL=73 PL=32 PI=41
	15										
	20	3	ST				3.8				LL=65 PL=29 PI=36
	25										

Continued on Sheet 2

002341

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
▼ AFTER 72 HRS 26.0 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-12
Job #: 288-01
Drawn By: JDA
Approved By: CDB

DRILLING and SAMPLING INFORMATION

Date Started: 4/3/84 — Hammer Wt.: 140 lbs
Date Completed: 4/3/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: HSA — Shelby Tube OD: 3 in

SOIL CLASSIFICATION SURFACE ELEVATION - 167.0	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability X 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, stiff, gray to brown, calcareous nodules becomes sandier at 29' (-)200 = 89.4% (CL)	30	4	ST		▽		1.8				LL=47 PL=22 PI=25
GRAVEL, compact, tan (-)200 = 1.5%	35 40	5	SS			5					
Boring Terminated @ 40' Well screened 24' - 40'	45 50										

002342

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 72 HRS 26.0 FT.
WATER ON RODS FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-13
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDW

DRILLING and SAMPLING INFORMATION

Date Started: 6/7/84 — Hammer Wt: 140 lbs.
Date Completed: 6/8/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

SOIL CLASSIFICATION SURFACE ELEVATION – 171.7	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
Layers of CLAY, SILT, SAND AND SILTY SAND ranging in thickness from 6" to 3'			1	ST				1.5				
			2	ST								
		5	3	ST								
			4	ST								
			5	SS			12					
		10										
		15	6	ST				3.5				
(-) 200 = 71.2% (CL-ML)		20	7	ST				1.7				LL=28 PL=13 PI=15
(-)200 = 69.3		25	8	SS			11					

Continued on Sheet 2

002343

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
▼ AFTER 72 HRS 36.9 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-13
Job #: 288-01
Drawn By: JDA
Approved By: CJB

DRILLING and SAMPLING INFORMATION

Date Started: 6/7/84 — Hammer Wt. 140 lbs
Date Completed: 6/8/84 — Hammer Drop 30 in
Drill Foreman: Littell — Spoon Sampler OD 2 in
Inspector: Brothers — Rock Core Dia N/A in
Boring Method: Rotary Wash — Shelby Tube OD 3 in

SURFACE ELEVATION – 171.7

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
Layers of CLAY, SILT, SAND and SILTY SAND		30										
SANDY CLAY, stiff, tannish brown, trace SILT												
(CL) (-)200 = 62.9		35	9	SS			11					LL=29 PL=11 PI=18
(-)200 = 81.6			10	ST		▽		1.8	5.3	108	20.7	LL=34 PL=15 PI=19
		40										
SILTY SAND, loose, tannish brown wet												
(-)200 = 51%		45	11	SS			9					
		50										
Continued on Sheet 3												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 72 HRS 36.9 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

002344

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-13
Job #: 288-01
Drawn By: JDA
Approved By: CNO

DRILLING and SAMPLING INFORMATION

Date Started: 6/7/84 — Hammer Wt.: 140 lbs.
Date Completed: 6/8/84 — Hammer Drop: 30 in.
Drill Foreman: Littell — Spoon Sampler OD: 2 in.
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: Rotary Wash — Shelby Tube OD: 3 in.

SURFACE ELEVATION – 171.7

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² / Pocket Penetrometer q_p Tons/Ft²	Permeability x 10⁻¹⁰ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
GRAVEL, compact, tan, trace to little SAND		55										
(-) 200 = 92.0		60	12	ST				4.5	8.1	101	23.4	LL=56 PL=14 PI=42
CLAY, very stiff, light gray to olive, scattered calcareous nodules, slickensided (CH)		65										
		70	13	ST				4.5				
		75										

Continued on sheet 4

002345

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 72 HRS. 36.9 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-13
Job #: 288-01
Drawn By: JDA
Approved By: CMO

DRILLING and SAMPLING INFORMATION

Date Started: 6/7/84 — Hammer Wt: 140 lbs
Date Completed: 6/8/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION - 171.7	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive* Strength qu Tons/Ft² / Pocket Penetrometer qp Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
CLAY, very stiff, light gray to olive, scattered calcareous nodules, slickensided (CH)		80										
SAND, compact to dense, tan		85, 90										
Layers of SAND, SILT, and CLAY		95, 100										

002346

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 72 HRS 36.9 FT.
WATER ON RODS FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-13
Job #: 288-01
Drawn By: JDA
Approved By: CDJ

DRILLING and SAMPLING INFORMATION

Date Started: 6/7/84 — Hammer Wt.: 140 lbs
Date Completed: 6/8/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: Rotary Wash — Shelby Tube OD: 3 in.

SOIL CLASSIFICATION — SURFACE ELEVATION – 171.7

Description	Stratum Depth	Depth Scale	Sample No.	Sample Type	% Recovery	Ground Water	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * / Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻¹⁰ cm/sec.	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
Alternating layers of SAND, SILT and CLAY		105										
CLAY, very stiff, light gray to brown, slickensided (-)200=92.4		110	14	SS			15					LL=56 PL=21 PI=35
(CH) (-)200=91.9			15	ST				4.5	4.5	95	27.6	LL=81 PL=22 PI=59
Boring terminated at 114'		115										
Well Screened 83'-93'												

002347

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 72 HRS. 36.9 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Services
Project Location: Waller County, Texas

Boring #: W-14
Job #: 288-01
Drawn By: JOA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 6/10/84 — Hammer Wt: 140 lbs
Date Completed: 6/10/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

SOIL CLASSIFICATION SURFACE ELEVATION ~ 173.1	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft²	Pocket Penetrometer qp Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL Liquid Limit PL Plastic Limit SL Shrinkage Limit
CLAY, stiff to very stiff, brown (CH)		5	1	ST				1.5					
(-)200=100%		10	2	ST				3.5					LL=69 PL=19 PI=50
SILT Seam 11' to 11.5'													
SANDY CLAY, very stiff, tannish brown to grayish brown (CL)		15	3	ST				3.0					LL=31 PL=17 PI=14
SANDY SILT, loose, tannish brown (-)200 = 88.6%													
CLAY, stiff, brown, sand seams		20	4	SS			8						
Continued on Sheet 2		25											

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▽ AFTER 24 HRS 26.2 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

002348

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Services
Project Location: Waller County, Texas

Boring #: W-14
Job #: 288-01
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 6/10/84 — Hammer Wt.: 140 lbs
Date Completed: 6/10/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION – 173.1)	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL Liquid Limit PL Plastic Limit SL Shrinkage Limit
CLAY, stiff, brown												
SILTY SAND, compact, tan		30										
		35										
		40										
		45										
(-)200 = 10.4%			5	SS			26					
Continued on Sheet 3		50										

002349

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 24 HRS 26.2 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Services
Project Location: Waller County, Texas

Boring # W-14
Job # 288-01
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 6/10/84 Hammer Wt. 140 lbs.
Date Completed: 6/10/84 Hammer Drop 30 in.
Drill Foreman: Littell Spoon Sampler OD 2 in.
Inspector: Brothers Rock Core Dia. N/A in.
Boring Method: Rotary Wash Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION – 173.1	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * / Pocket Penetrometer q_p Tons/Ft²	Permeability X 10⁻¹ cm/sec	Natural Dry Density lbs./cu. ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
SILTY SAND, compact, tan												
GRAVEL, compact, tan		55										
CLAY, very stiff, light gray to olive brown, slickensided, mottled (CH) (-)200=100%		60										
		65	6	ST				4.5	8.4	101	24.5	LL=66 PL=18 PI=48
		70	7	ST				4.5				
		75										
Continued on Sheet 4												

002350

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
∇ AFTER 24 HRS 26.2 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Services
Project Location: Waller County, Texas

Boring #: W-14
Job #: 288-01
Drawn By: JDA
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 6/10/84 — Hammer Wt.: 140 lbs
Date Completed: 6/10/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: Rotary Wash — Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 173.1	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft² *	Permeability X 10⁻ cm/sec	Natural Dry Density lbs/cu ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
CLAY, very stiff, light gray to olive brown, slickensided, mottled (CH)		80										
		85										
thin layers of claystone from 91' to 95'		90										
SAND, dense, tan, medium grained		95										
(-)200 = 10.7			8	SS			75					
Continued on Sheet 5		100										

002351

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 24 HRS. 26.2 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-14
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Services
Drawn By: JDA
Project Location: Waller County, Texas
Approved By:

DRILLING and SAMPLING INFORMATION

Date Started: 6/10/84 Hammer Wt.: 140 lbs
Date Completed: 6/10/84 Hammer Drop: 30 in.
Drill Foreman: Littell Spoon Sampler OD: 2 in
Inspector: Brothers Rock Core Dia.: N/A in.
Boring Method: Rotary Wash Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 173.1	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength qu Tons/Ft² ★ Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻ cm/sec	Natural Dry Density lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
SAND, dense, tan, medium grained		105										
CLAY, very stiff, light gray to olive brown, mottled (CH) (-)200=91.4%		110	9	ST				4.5				LL=65 PL=17 PI=48
Boring terminated at 110' Well Screened 92' - 102'												

002352

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
▼ AFTER 24 HRS 26.2 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-15
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDO

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 — Hammer Wt: 140 lbs
Date Completed: 6/9/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SURFACE ELEVATION - 171.7

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SANDY CLAY, very stiff, tannish brown, with layers of SILT and SAND (CL)			1	ST				2.0				
		5	2	ST				3.3				LL=33 PL=17 PI=16
		10	3	ST				4.4				
SILTY SAND, compact, brown with clay		15	4	SS			12					
		20	5	ST				2.2				LL=36 PL=14 PI=22
		25										

Continued on Sheet 2

002353

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
∇ AFTER 48 HRS. 38.8 FT.
WATER ON RODS FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-15
Job #: 288-01
Drawn By: JDA
Approved By: CNO

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 — Hammer Wt: 140 lbs
Date Completed: 6/9/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

SURFACE ELEVATION – 171.7

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL Liquid Limit PL Plastic Limit SL Shrinkage Limit
SILTY SAND, loose, brown, with clay layers												
		30	6	SS			7					
SANDY CLAY, very stiff, brown, trace to little SILT (-)200 = 61% (CL)		35	7	ST				2.6	3.2	106	21.3	LL=30 PL=17 PI=13
SILTY SAND, loose, tannish brown, wet with layers of SILT and CLAY		40	8			▽		-				
		45										
SILTY SAND, compact, brown (-)200 = 32.7%		50	9	SS			28					
Continued on Sheet 3												

002354

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 48 HRS. 38.8 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-15
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDB

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 Hammer Wt.: 140 lbs.
Date Completed: 6/9/84 Hammer Drop: 30 in.
Drill Foreman: Littell Spoon Sampler OD: 2 in.
Inspector: Brothers Rock Core Dia.: N/A in
Boring Method: Rotary Wash Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 171.7	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft²	Permeability x 10⁻ cm/sec	Natural Dry Density lbs/cu ft.	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
GRAVEL, compact, tan, little sand		55										
CLAY, very stiff, light gray to olive brown, mottled (CH) (-)200=100%		60	10	ST				4.2				LL=75 PL=22 PI=53
Boring Terminated at 61' Well Screened 61'to 51'		65										

002355

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
∇ AFTER 48 HRS. 38.8 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-16
Job #: 288-01
Drawn By: JDA
Approved By: CDO

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 — Hammer Wt.: 140 lbs
Date Completed: 6/9/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 171.9	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft² *	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SILTY SAND, compact, tannish brown with SILTY CLAY layers at 10' and 15'			1	ST				-				
		5	2	ST				-				
(-)200=84.9%		10	3	ST				2.9				LL=34 PL=11 PI=23
(CL)												
(-)200=96.3%		15	4	ST				2.4				LL=29 PL=9 PI=20
(-)200=24.4%		20	5	SS			16					
		25										

Continued on Sheet 2

002356

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
▼ AFTER 48 HRS 40.1 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-16
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDP

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 — Hammer Wt: 140 lbs
Date Completed: 6/9/84 — Hammer Drop: 30 in.
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 171.9	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability x 10 cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SILTY SAND, compact, tannish brown												
(-)200=38.6%		30	6	SS			11					
		35										
Layers of SILTY SAND, SILT and CLAY												
(-)200=19.2%		40	7	SS		▽	9					
		45										
(-)200=35.8%		50	8	SS			18					

Continued on Sheet 3

002357

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER 48 HRS 40.1 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-16
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CJO

DRILLING and SAMPLING INFORMATION

Date Started: 6/9/84 — Hammer Wt.: 140 lbs
Date Completed: 6/9/84 — Hammer Drop: 30 in.
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in.
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION (SURFACE ELEVATION – 171.9)	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft.² * Pocket Penetrometer qp Tons/Ft.²	Permeability x 10⁻⁸ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
Layers of SILTY SAND, SILT and CLAY		55										
GRAVEL, compact, tan												
SILTY CLAY, very stiff, light gray to olive brown (CL) (-)200=98.5%		60	9	ST				4.5	1.0	107	20.8	LL=40 PL=13 PI=27
Boring terminated at 61'		65										

002358

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
∇ AFTER 48 HRS. 40.1 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Boring #: W-17
Architect Engineer:
Job #: 288-01
Project Name: Sheridan Disposal Service
Drawn By: JDA
Project Location: Waller County, Texas
Approved By: CDP

DRILLING and SAMPLING INFORMATION

Date Started: 6/11/84 — Hammer Wt.: 140 lbs
Date Completed: 6/11/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia.: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

SURFACE ELEVATION – 170.3

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength q_u Tons/Ft² * Pocket Penetrometer q_p Tons/Ft²	Permeability x 10⁻⁶ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SILTY SAND, loose, brown												
SANDY CLAY, very stiff, brownish gray (CL) (-)200=67.5%		5	1	ST				3.6				LL=35 PL=16 PI=19
		10	2	ST				-				
Sandier at 12'		15	3	ST				-	2.3	104	13.0	LL=25 PL=14 PI=11
SILTY SAND, compact brown, with SILT and CLAY layers (-)200=69.3%		20	4	SS				9				
		25										
Continued on Sheet 2												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT.
▼ AFTER 504 HRS. 34.5 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

002359

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-17
Job #: 288-01
Drawn By: JDA
Approved By: CDP

DRILLING and SAMPLING INFORMATION

Date Started: 6/11/84 — Hammer Wt.: 140 lbs.
Date Completed: 6/11/84 — Hammer Drop: 30 in.
Drill Foreman: Littell — Spoon Sampler OD: 2 in.
Inspector: Brothers — Rock Core Dia.: N/A in.
Boring Method: Rotary Wash — Shelby Tube OD: 3 in.

SURFACE ELEVATION – 170.3

SOIL CLASSIFICATION	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength (qu) Tons/Ft.² * Pocket Penetrometer (qp) Tons/Ft.²	Permeability X 10⁻⁶ cm/sec	Natural Dry Density lbs/cu ft	Water Content %	LL - Liquid Limit PL - Plastic Limit SL - Shrinkage Limit
SILTY SAND, compact, brown with SILT and CLAY layers		30										
(-)200 = 68.5%		35	5	ST		▽		1.8				LL=31 PL=14 PI=17
		40										
		45										
GRAVEL, compact, tan		50										
Continued on Sheet 3												

002360

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT
▼ AFTER 504 HRS. 34.5 FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Baker & Botts
Architect Engineer:
Project Name: Sheridan Disposal Service
Project Location: Waller County, Texas

Boring #: W-17
Job #: 288-01
Drawn By: JDA
Approved By: CDP

DRILLING and SAMPLING INFORMATION

Date Started: 6/11/84 — Hammer Wt.: 140 lbs
Date Completed: 6/11/84 — Hammer Drop: 30 in
Drill Foreman: Littell — Spoon Sampler OD: 2 in
Inspector: Brothers — Rock Core Dia: N/A in
Boring Method: Rotary Wash — Shelby Tube OD: 3 in

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION – 170.3	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft	Unconfined Compressive Strength qu Tons/Ft² * Pocket Penetrometer qp Tons/Ft² *	Permeability x 10⁻⁷ cm/sec	Natural Dry Density lbs/cu. ft	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
GRAVEL, compact, tan		55										
CLAY, stiff, tan and light gray (-)200 = 99.7%			6	ST				-	7.6		27.6	LL=81 PL=13 PI=68
Boring terminated at 59'		60										
Well Screened 45' - 55'												

002361

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
∇ AT COMPLETION FT
∇ AFTER 504 HRS 34.5 FT
WATER ON RODS FT

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-20

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No.: 288-04 Boring No.: MW-20
Logged By: G. Greene
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/14/85 Date Completed: 11/18/85
Method: MD Total Depth: 100'

WELL COMPLETION INFORMATION
Screen Dia.: 4 inches Length: 12.5'
Slot Size: 0.01 inches Type: PVC schd 40
Casing Dia: 4 inch Length: 85'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
0	SILTY CLAY, chocolate brown, iron streaked, roots and shells present.		01	ST	21		1.3	
			02	ST	29		1.8	
5			03	ST	58			
	CLAY, reddish brown, iron streaked with calcareous nodules, firm, stiff.		04	ST	58		>4.5	
	SANDY SILTY CLAY, reddish brown, calcareous nodules.		05	ST	25		>4.5	
10			06	ST	50			
	- Grades into silty sand, tan, very fine grained. Silty clay lense at 14.5 feet, 8 inches thick. Grades into a silty clay.		07	ST	58			
15			08	ST	67			
			09	ST	83		3.0	
	SILTY CLAY, brown with grey mottling, iron streaked.		10	ST	33		4.0	
20			11	ST	54			
			12	ST	42			
	SILTY SAND, reddish tan, fine grained, loose.		13	ST	62			
25	- Sandy silt lense at 26 feet.							
	- Frequent fingers of silt and clay.		14	ST	50			
	- Silty clay lense at 29 feet, 2 inches thick.		15	ST	62			
30	- Grey sand partings 30 to 32 feet.		16	SS	58			
			17	SS	NR			
35			18	SS	50			
	- Sandy, clayey silt, dark grey at 36 to 37 feet		19	SS	N/A			
	- Grades into sand, brown, medium to coarse grained.		20	SS	21			
40			21	SS	25		38/50 for 6"	
	- Very fine grained sand, white-grey at 43 to 44 feet.		22	SS	33		11/50 for 9"	
45	- Clay inclusions at 46 feet.		23	SS	29		18/50 for 10"	
			24	SS	21			
50			25	SS	33			
	Gravel mixed with sand, from 50 to 54 feet. Gravel pink to white, rounded, 1/4 inch to 1 inch diameter.		26	SS	N/A		22/13 for 17"	
			27	SS	33		9/8 for 10"	
55	CLAY, olive green with grey mottling.		28	ST	38		3.3	
			29	ST / SS	NR / 8			
58								
	CONTINUED ON SHEET 2							

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002362

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-20

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No. MW-20
Logged By: G. Groene
Approved By
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/14/85 Date Completed: 11/18/85
Method: MD Total Depth: 100'

WELL COMPLETION INFORMATION
Screen Dia.: 4 inch Length: 12.5'
Slot Size: 0.01 inch Type: PVC schd 40
Casing Dia.: 4 inch Length: 85'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
	CONTINUED FROM SHEET 1							
58	CLAY, olive green with grey mottling, very stiff and brittle.		30	ST	75		2.0	
60	- Color change, grades to grey with olive green red mottling.		31	ST	58		> 4.5	
	- Fine grained sand present.		32	ST	67		> 4.5	
65			33	ST	54		> 4.5	
			34	ST	25		> 4.5	
	- Lense from 67.5 to 70 feet, olive green with grey mottling		35	ST	42		> 4.5	
70	- Calcareous nodules present.		36	SS	25		11/12 for 22"	
	- Sand increasing with depth.		37	ST	75		> 4.5	
75			38	ST	100		> 4.5	
			39	ST	50		> 4.5	
			40	ST	75		> 4.5	
80	- Grades into a color change, grey with olive green mottling.		41	ST	50		> 4.5	
			42	ST	50		> 4.5	
85	SANDY CLAY, grey with olive green mottling.		43	ST	58		> 4.5	
			44	ST	58		> 4.5	
	SAND, greyish brown grading into a tan, medium to fine grained		45	SS	21		70/50 for 7"	
90	- Clayey sand lense 93-94 feet.		46	SS	25		20/50 for 6"	
			47	SS	25		32/50 for 8"	
95	- Grades into a clayey sand, brown with grey mottling, sand partings.		48	SS	21		25/50 for 5"	
			49	SS	33		32/50 for 8"	
	CLAY, carmel brown with grey mottling, some fine grained sand, iron streaked.		50	ST	62		> 4.5	
100	BORING TERMINATED AT 100'.							

WELL COMPLETION DETAILS

TD - 98'
Screen - 97.5' - 85.0'
Sand - 97.5' - 81'
Bentonite Seal - 81' - 75'
Grouted to surface.

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-22

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No: MW-22
Logged By: C. Groene
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/20/85 Date Completed: 11/21/85
Method: MD Total Depth: 101'

WELL COMPLETION INFORMATION
Screen Dia.: 2 inch Length: 15'
Slot Size: 0.01 inch Type: PVC schd 40
Casing Dia.: 2 inch Length: 85'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	HOLE DRILLED TO 80 FEET WITHOUT SAMPLING							
80	CLAY with fine grained sand, olive green with grey mottling, calcareous nodules present, very stiff.		01	ST	75		>4.5	
			02	ST	50		>4.5	
85	SANDY CLAY, tannish-grey, fine grained. Thin clay seams frequent.		03	ST	38		>4.5	
	- Drillers note - 2 inch sandstone layer at 87.5 feet.		04	SS	17		75/50 for 4"	
90			05	SS	<1		100/50 for 3"	
	- Sandy clay seam, 6 inches thick at 91 feet.		06	SS	38		19/50 for 9"	
			07	SS	50		36/50 for 2"	
95	SAND, brown, fine grained became coarse with depth, some pebbles present. Several thin layers of grey clay.		08	SS	17		38/50 for 4"	
			09	SS	21		30/50 for 3"	
100			10	SS	NA		36/50 for 5"	
	CLAY, with fine grained sand, greenish with olive green mottling, frequent sand partings.		11	ST	100		>4.5	
	BORING TERMINATED AT 101'.							

WELL COMPLETION DETAILS

TD - 101 feet
Screen - 100 - 85
Sand - 100 - 80
Seal - 80 - 75
Grouted to surface

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

7 9 5 6 4

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-26

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No.: MW-26
Logged By: G. Groene
Approved By:
Drilled By: J. Turner

DRILLING AND SAMPLING INFORMATION
Date Started: 11/21/85 Date Completed: 12/2/85
Method: MD Total Depth: 100'

WELL COMPLETION INFORMATION
Screen Dia.: 2 inch Length: 15'
Slot Size: 0.01 inch Type: PVC schd 40
Casing Dia: 2 inch Length: 83.5'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	HOLE DRILLED TO 82 FEET WITHOUT SAMPLING							
82	CLAY with fine sand throughout, grey with olive green mottling, calcareous nodules.		01	ST	50		> 4.5	
85	SANDY SILTY CLAY, with sand partings. - 4 inch layer of sandstone, drilled from 86 to 87 feet.		02	ST	79		4.5	
				DRILLED				
	SANDY CLAY, tan, fine to medium grained sand, some gravel present.		03	SS	67		50/50 for 4"	
90	- Several thin sand lenses. - Several thin clay lenses.		04	SS	17		36/50 for 5"	
			05	SS	58		34/50 for 5"	
	SAND, grey, medium grained sand. Gravel present in stuff		06	SS	8		78/50 for 3"	
95			07	SS	12		95/50 for 6"	
	SILTY CLAY, some silt lenses, brown with grey mottling, very stiff. Resistant layer at 98 feet, drilled to 98.5 feet.			NO SAMPLE				
			08	ST	75		> 4.5	
100	BORING TERMINATED AT 100'.							

WELL COMPLETION DETAILS

TD - 98.5'
Screen - 98.5 - 83.5'
Sand - 98.5 - 78
Seal - 78 - 75
Grouted to surface

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-27

Client
Project Name Sheridan Disposal Site
Project Location Waller County, Texas
Job No 288-04 Boring No. MW-27
Logged By G. Groene
Approved By
Drilled By D. F.

DRILLING AND SAMPLING INFORMATION
Date Started 11/22/85 Date Completed 11/26/85
Method MD Total Depth 102'

WELL COMPLETION INFORMATION
Screen Dia 2 inch Length 12'
Slot Size 0.01 inch Type PVC schd 40
Casing Dia. 2 inch Length 85'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
	HOLE DRILLED TO 82 FEET WITHOUT SAMPLING							
82	CLAY, with abundant fine grained sand, olive green with grey mottling, firm, pink tint at 83 feet. - Becomes sandy, small pebbles present.		01	ST	54		> 4.5	
85	SANDY CLAY, olive green with grey mottling grading to brown with grey mottling. Some pebbles and small gravel present in clay.		02	ST	92		> 4.5	
	- Sand lense 90 to 90.5, medium grained. - Sand lense 2 inch thick at 91 feet. - Sand lense 2 inches at 92.2 feet, 3 inches at 92.5 feet, partings at 93.0, 93.3, 93.5 feet.		03	ST	92		> 4.5	
90			04	SS	62		3.5	
			05	ST	79		> 4.5	
	- Sand lense at 94.5 to 95.0 feet, medium grained.		06	ST	92		> 4.5	
95	- Becomes clayier with depth.		07	ST	67		4.5	
	CLAY with fine sand, grey with olive green mottling, calcareous nodules present.		08	ST	100		> 4.5	
100			09	ST	50		> 4.5	
	BORING TERMINATED AT 102'.		10	ST	54		> 4.5	

WELL COMPLETION DETAILS

TD - 102'
Screen - 97 - 85'
Sand - 97 to 85'.
Seal 84 to 82'.
Grouted to surface.

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

002366

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-28

Client
Project Name Sheridan Disposal Site
Project Location Waller County, Texas
Job No 288-04 Boring No. MW-28
Logged By G. Groene
Approved By
Drilled By D. F.

DRILLING AND SAMPLING INFORMATION
Date Started 11/26/85 Date Completed 11/27/85
Method MD Total Depth 98'

WELL COMPLETION INFORMATION
Screen Dia. 2 inch Length 12.5'
Slot Size 0.01 inch Type PVC schd 40
Casing Dia. 2 inch Length 85.5'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
	HOLE DRILLED TO 82 FEET WITHOUT SAMPLING							
82	CLAY with fine sand throughout, olive green with grey mottling, calcareous nodules, very stiff.		01	ST	50		>4.5	
85			02	ST	71		>4.5	
	SANDY CLAY grading into clayey sand, grey with brown mottling, calcareous nodules abundant.		03	ST	92		4.3	
	SAND, fine grained grading into medium grained, tan-brown. - Sandy clay lense 3 inches thick at 89 feet.		04	SS	NA		20/50 for 4"	
90			05	SS	17		18/50 for 6"	
			06	SS	17		25/50 for 4"	
95			07	SS	8		50/50 for 4"	
	END OF SAMPLING Drillers note, clay at 97.5'							
	BORING TERMINATED AT 98'							

WELL COMPLETION DETAILS

TD - 98
Screen - 98 - 85.5'
Sand - 98 to 83'
Seal - 83 to 81'
Grouted to surface.

002367

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING

RESOURCE ENGINEERING
SUBSURFACE EXPLORATION

LITHOLOGIC LOG AND CONSTRUCTION OF MW-29

Client
Project Name: Sheridan Disposal Site
Project Location: Waller County, Texas
Job No: 288-04 Boring No: MW-29
Logged By: G. Greene
Approved By
Drilled By: D.F.

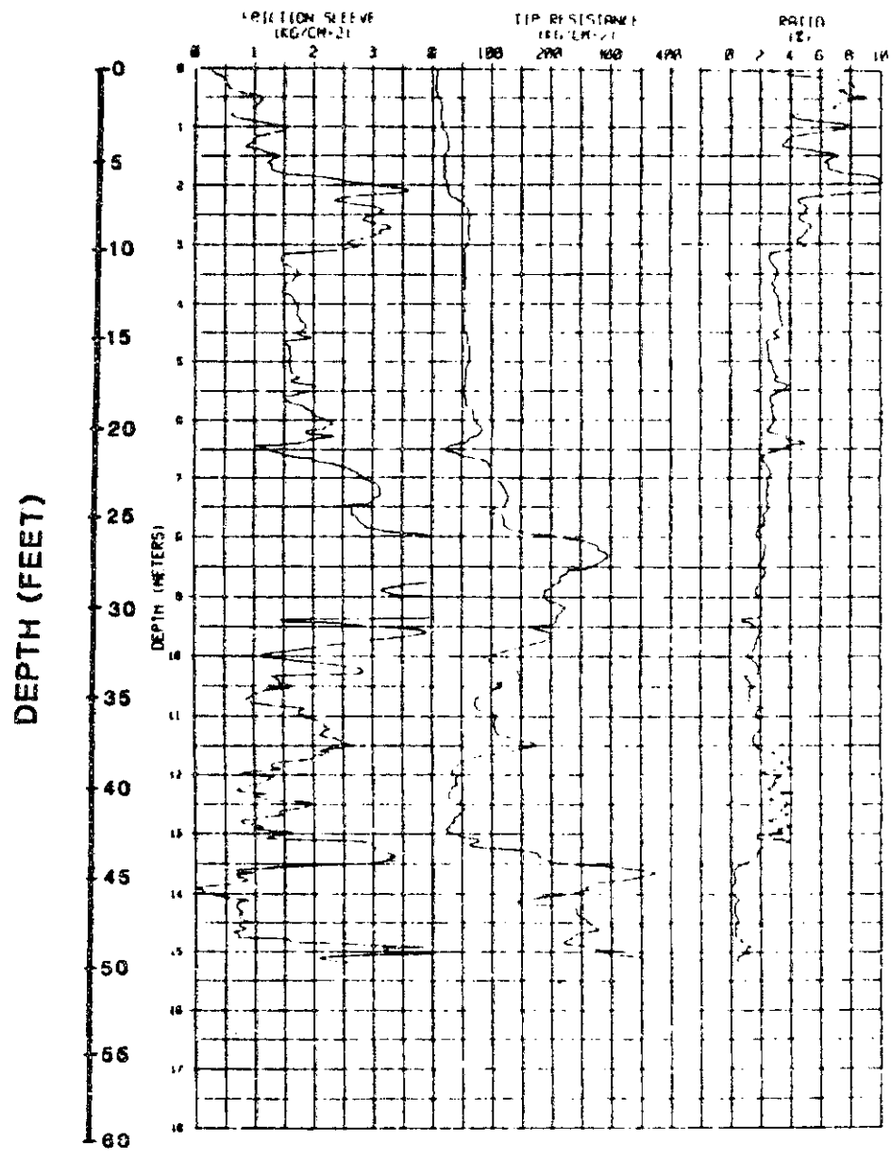
DRILLING AND SAMPLING INFORMATION
Date Started: 12/3/85 Date Completed: 12/3/85
Method: MD Total Depth: 56'

WELL COMPLETION INFORMATION
Screen Dia.: 4 inch Length: 50'
Slot Size: 0.01 inch Type: PVC schd 40
Casing Dia.: 4 inch Length: 7.5'

DEPTH IN FEET	DESCRIPTION	STRATUM ELEVATION IN FEET	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GRAPHIC LOG	POCKET PENETROMETER /BLOW COUNT	WATER LEVEL
	SURFACE ELEVATION							
0	SILTY CLAY, dark brown, calcareous and iron nodules present.		01	ST	38		2.3	
			02	ST	50		2.5	
5			03	ST	67		>4.5	
	CLAY, some silt, dark brown, no calcareous nodules.		04	ST	54		3.2	
	CLAY, black, iron and organic stained, no odor.		05	ST	62		>4.5	
10	CLAYEY SAND, reddish brown, calcareous nodules abundant.		06	ST	75		4.4	
			07	ST	54		2.4	
15	SANDY SILT, reddish brown, clay sense 2 inches at 17 feet.		08	ST	42			
	SILTY CLAY, reddish brown.		09	ST	83		3.0	
			10	ST	62			
20	SILTY SAND, reddish brown, very fine grained, loose.		11	ST	50			
			12	ST	11			
25			13	ST	33			
			14	ST	33			
			15	SS	62			
30			16	SS	50			
			17	SS	29			
35			18	SS	62			
	- Thin clay lense at 35.5 feet.							
	- Sandy clay lense, 6 inches thick at 38 feet.		19	SS	NR			
	- Resistant layer at 39.0 feet, drilled at 40.0.		20	SS	100			
40				Drilled				
	- Sand grading to tan and medium grained.		21	SS	50			
			22	SS	8			
45			23	SS	17			
	- Pullers note (hard to push split spoon).		24	SS	17			
			25	SS	50		30/50 for 9"	
50	- Thin gravel layer, 2 inches, 1/4 inch diameter.		26	SS	17		22/50 for 14	
	- Gravel from 53.0 to 53.6, 1/2 inch diameter, round edges, flat.		27	SS	50			
55	CLAY, olive green with grey mottling.		28	ST	50		>4.5	
	BORING TERMINATED AT 56'.							

SAMPLER TYPE
SS - DRIVEN SPLIT SPOON CA - CONTINUOUS FLIGHT AUGER
ST - PRESSED SHELBY TUBE RC - ROCK CORE

BORING METHOD
HSA - HOLLOW STEM AUGERS DC - DRIVING CASING
CFA - CONTINUOUS FLIGHT AUGERS MD - MUD DRILLING



ELEVATION 165.16

DESCRIPTION

- CLAY
- SANDY CLAY
- SANDY SILT
  Grading to SAND
- SANDY CLAY SEAM
- SAND
- SANDY SILT SEAM
  CLAY
- SAND AND GRAVEL
- Depth - 49.8'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

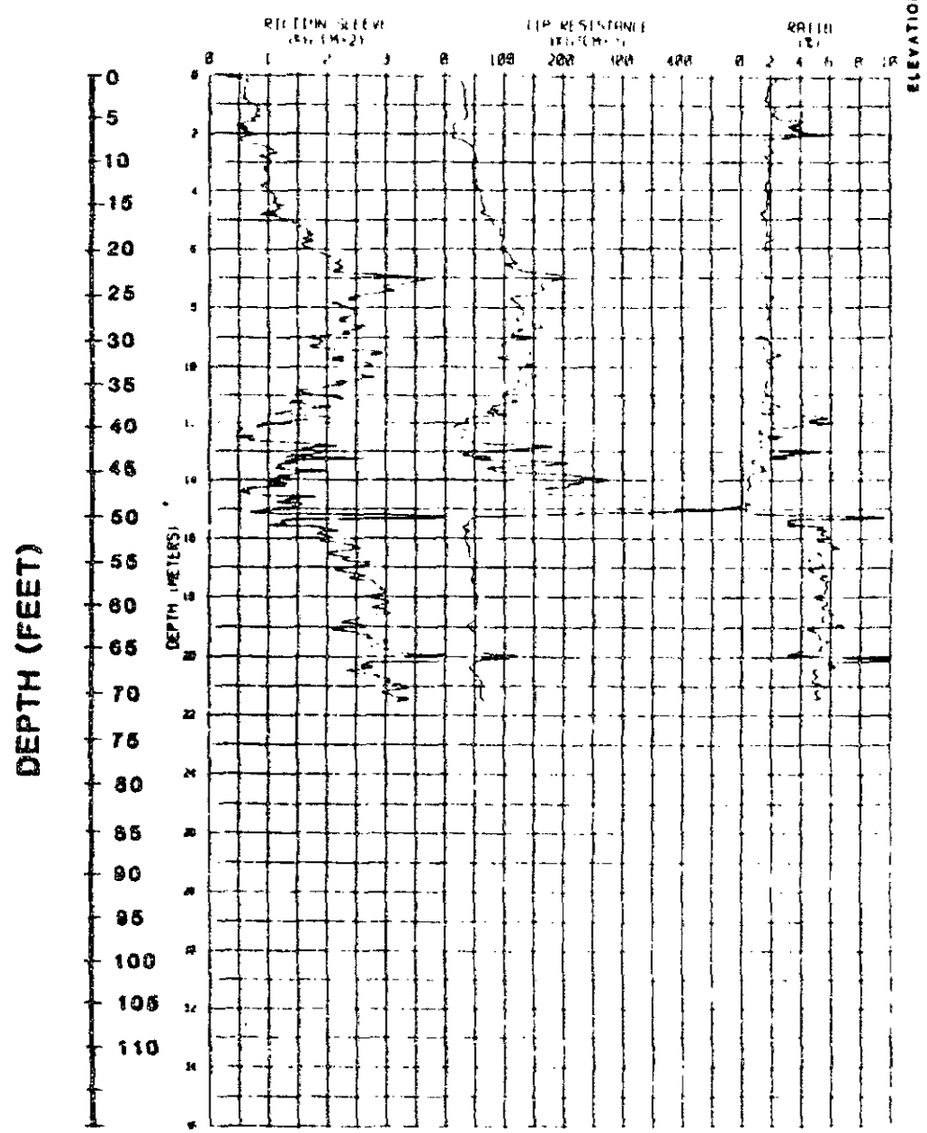
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-1
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JBA	4/18/84	288 01
CHECKED BY	SCALE	DRAWING NO.
	As Indicated	

002369



165.04

DESCRIPTION

SILTY SAND LAYER
SANDY CLAY LAYER

SAND

SANDY CLAY LAYER
SANDY CLAY SEAM

CLAY

SANDY SILT SEAM

Depth = 70.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

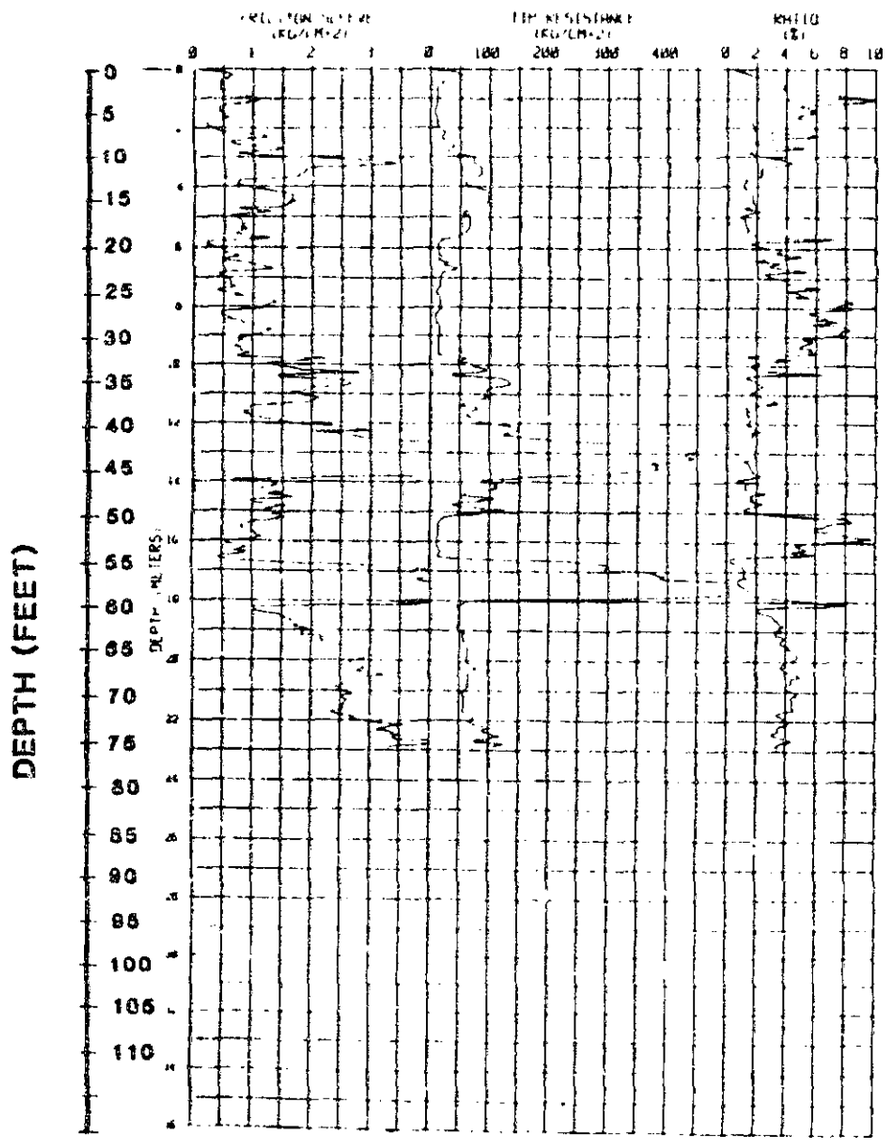
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

Cone Penetrometer Data
Location C-2
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO.
JDA	4/18/84	288-01
CHECKED	SCALE	
	As Indicated	

002370



DESCRIPTION

172 26

- SAND
- CLAY
- LAYERS of SAND and SANDY CLAY
- SAND
- LAYERS OF SANDY CLAY, SAND AND SANDY SILT
- CLAY
- LAYERS OF SAND AND SANDY CLAY
- SAND, SILT AND GRAVEL
- CLAY
- GRAVEL
- SANDY SILT SEAM CLAY

Depth = 75.4'

NOTES

1. Test performed according to ASTM 3441-75T.
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

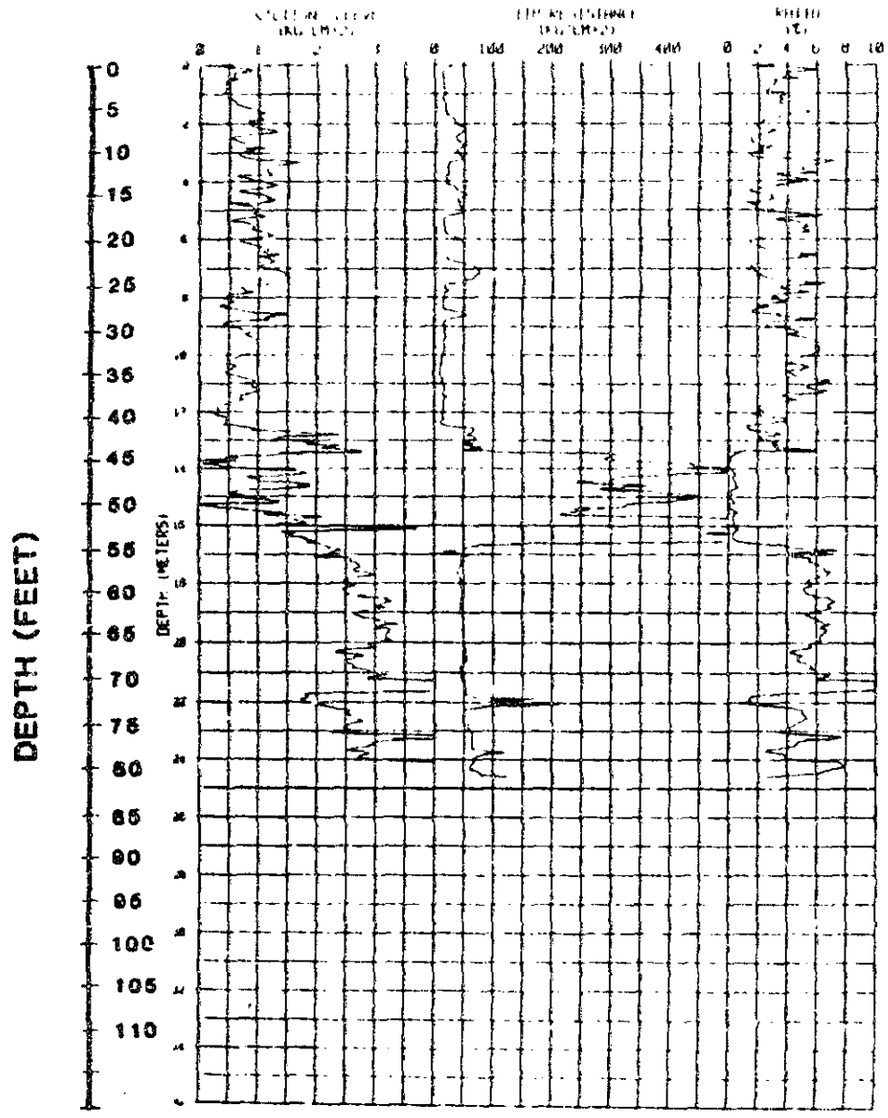
REV	DESCRIPTION	DATE

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

Cone Penetrometer Data
Location C 3
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO
JDA	4/18/84	288-01
	As Indicated	

J02371



ELEVATION

170.79

DESCRIPTION

LAYERS OF SANDY CLAY, SANDY SILT AND SAND

CLAY

Layers of SANDY SILT, SANDY CLAY and SAND

SAND AND GRAVEL

CLAY

SAND SEAM

SAND SEAM

Depth = 80.7'

NOTES

1. Test performed according to ASTM 3441-75T.
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

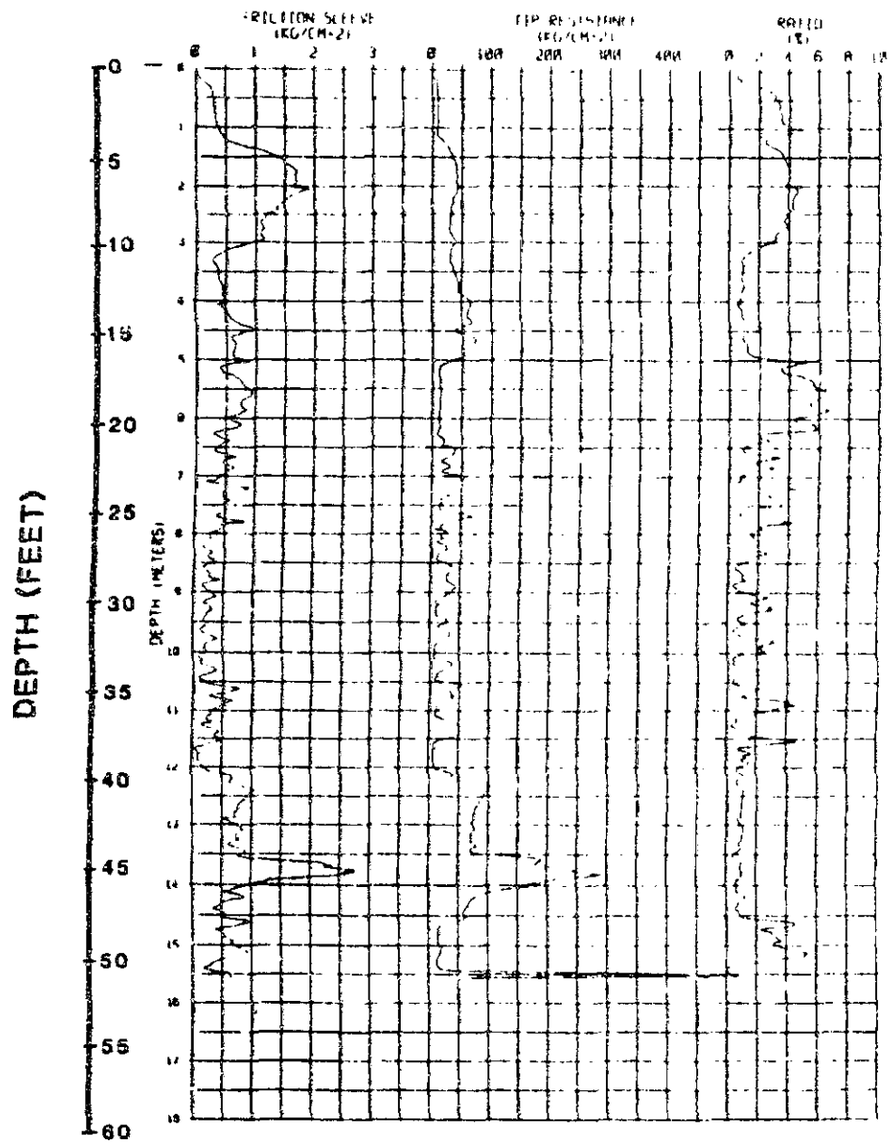
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-4
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO
JDA	4/18/84	288-01
	AS Indicated	

002372



DESCRIPTION

163 93

SAND, grading to SANDY SILT

SANDY SILT LAYER

CLAY

SAND

CLAY

SAND with layers of SANDY SILT and SANDY CLAY, and GRAVEL

Depth = 50.8'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 Kg/cm^2 ≅ 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

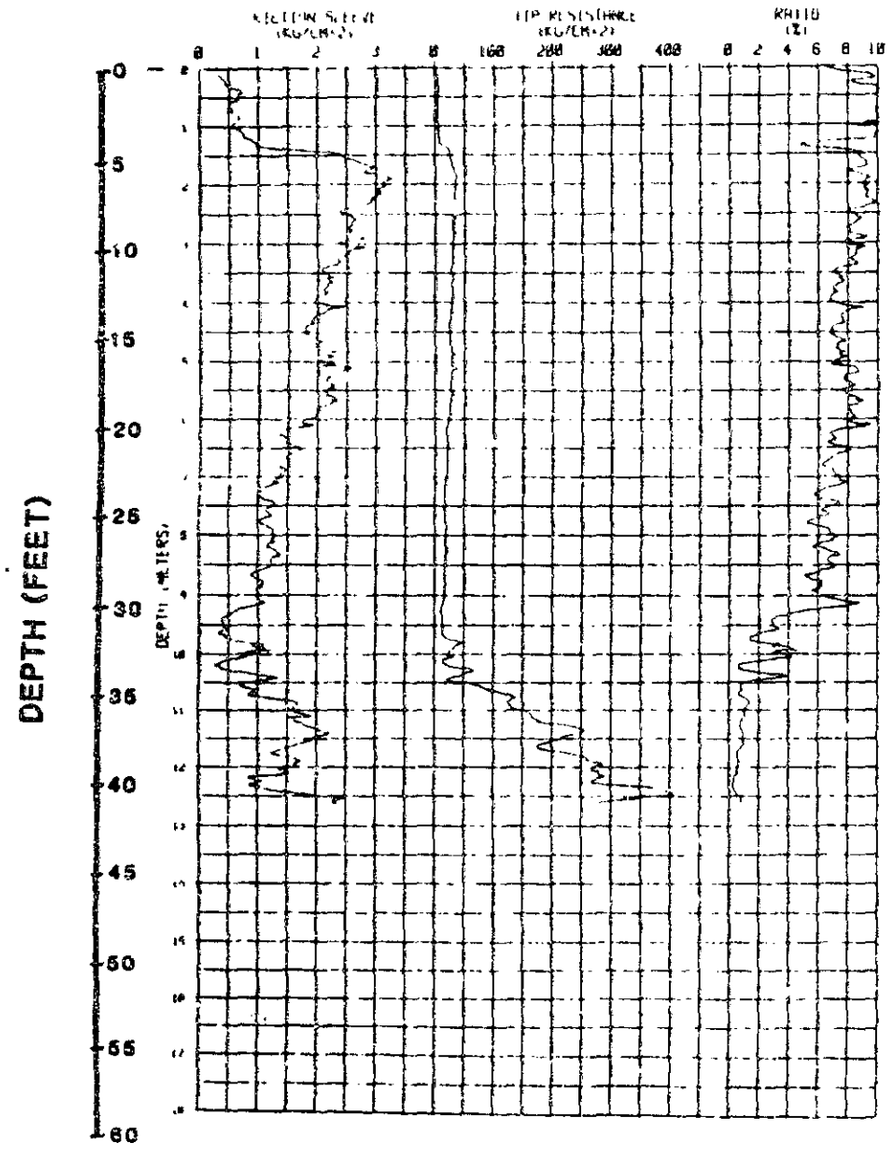
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-5
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO
JDA	4/18/84	288-01
CDD	As Indicated	

002373



ELEVATION

166.55

DESCRIPTION

SILTY CLAY seam

CLAY

SAND with SANDY SILT SEAMS

GRAVEL

Depth = 41.3'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

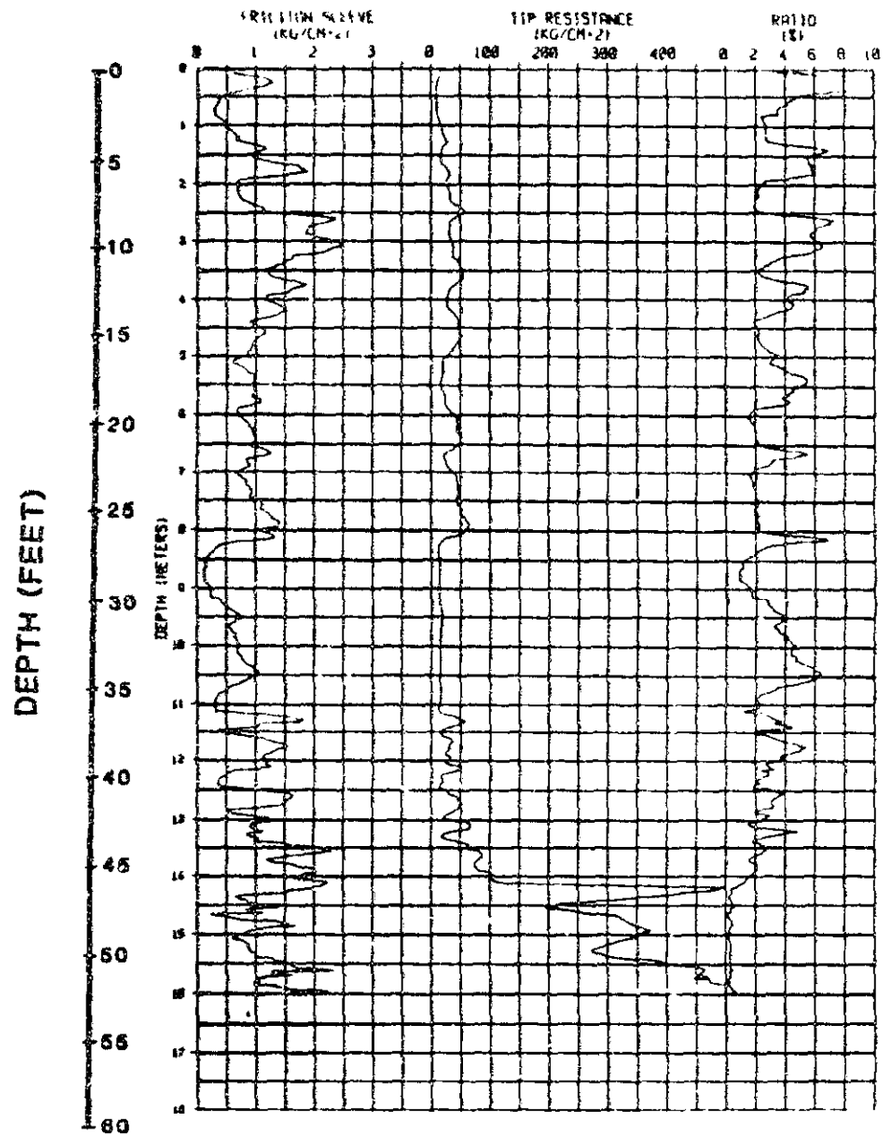
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-6
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO
JDA	4/18/84	288-01
DESIGN	SCALE	DRAWING NO
CMB	As Indicated	

002374



DESCRIPTION

CLAY WITH SILT, SAND AND SILTY SAND LAYERS

SAND WITH CLAY and SILT SEAMS

CLAY

LAYERS OF SILT, SAND and CLAY

SAND AND GRAVEL

Depth = 52.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

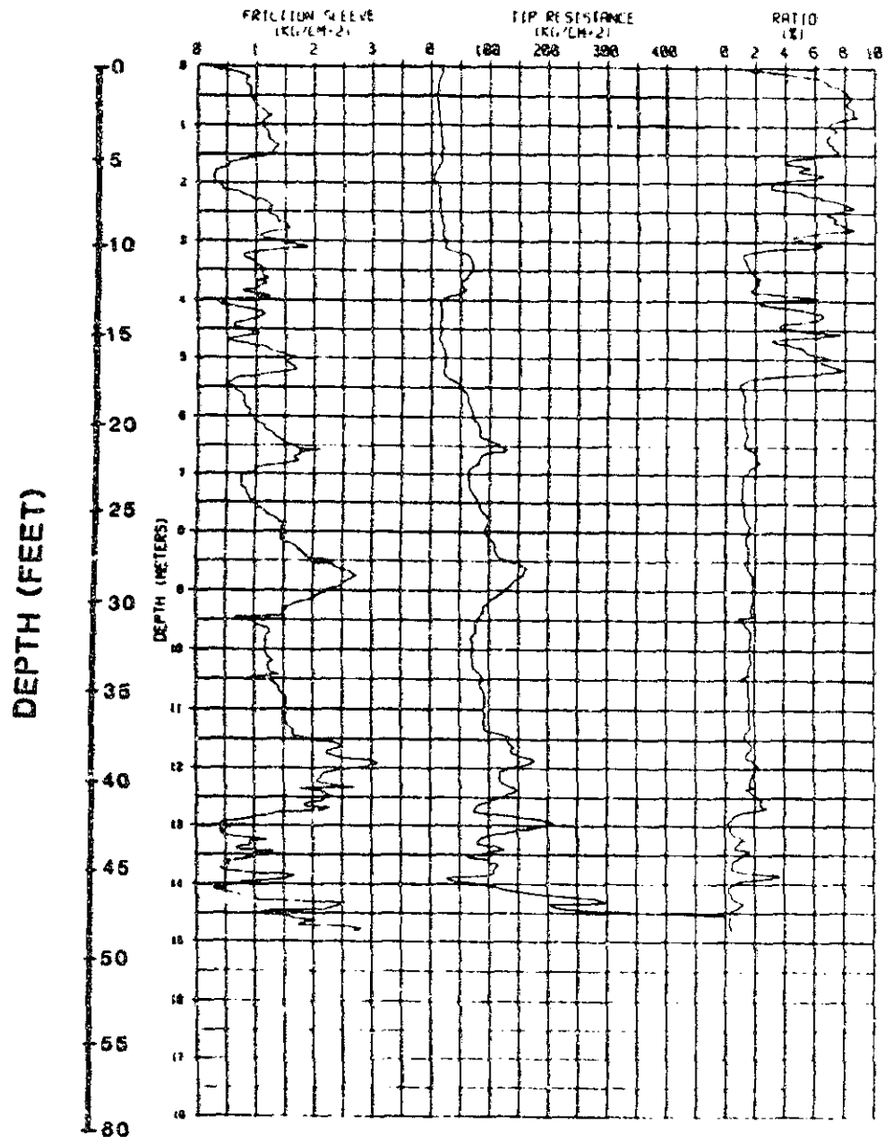
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-7
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO
JDA	7/23/84	288-01
CHECKED	SCALE	DRAWING NO
	As Indicated	

002375



DESCRIPTION

166.19

CLAY WITH SILT AND SAND SEAMS

SAND

CLAY SEAM

GRAVEL

Depth = 48.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

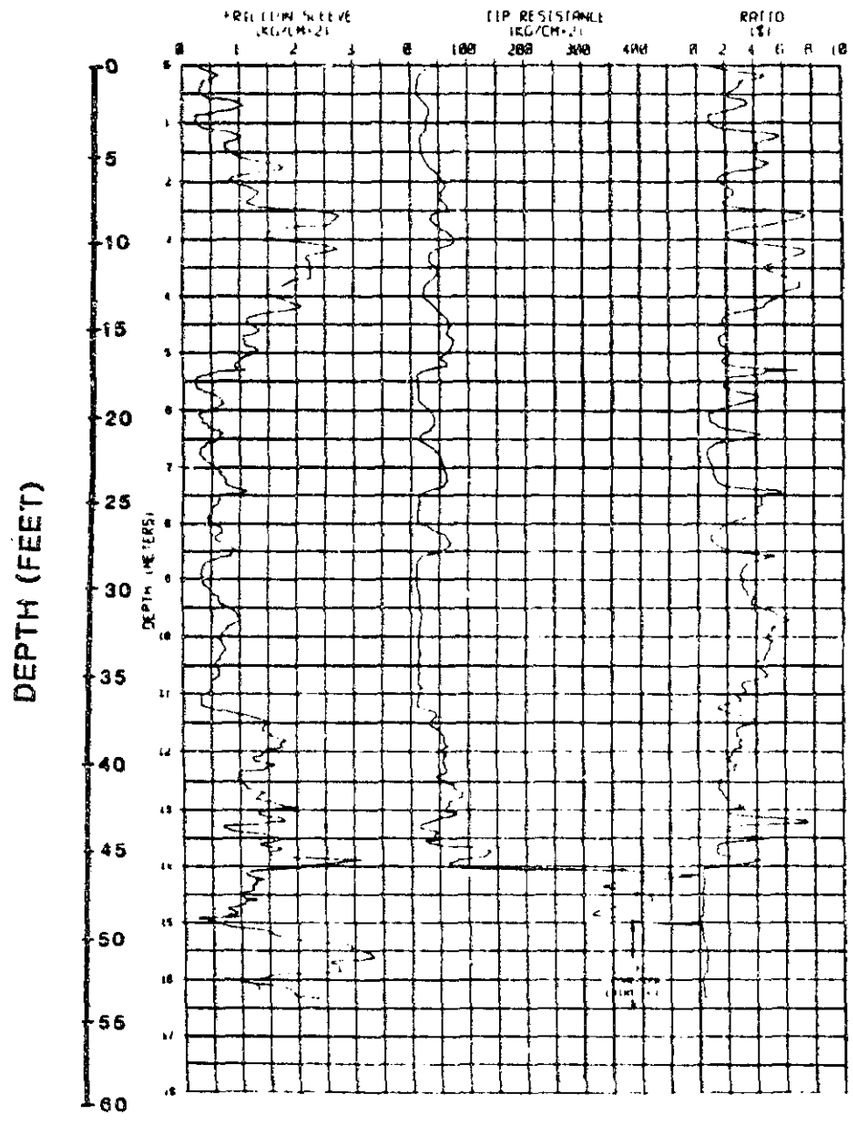
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-8
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO
JDA	7/23/84	288-01
	As Indicated	

002376



ELEVATION

DESCRIPTION

171.11

CLAY WITH LAYERS OF SILT AND SAND

SAND WITH CLAY LAYERS

CLAY

LAYERS OF SAND, SILT AND CLAY

GRAVEL

Depth = 53.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

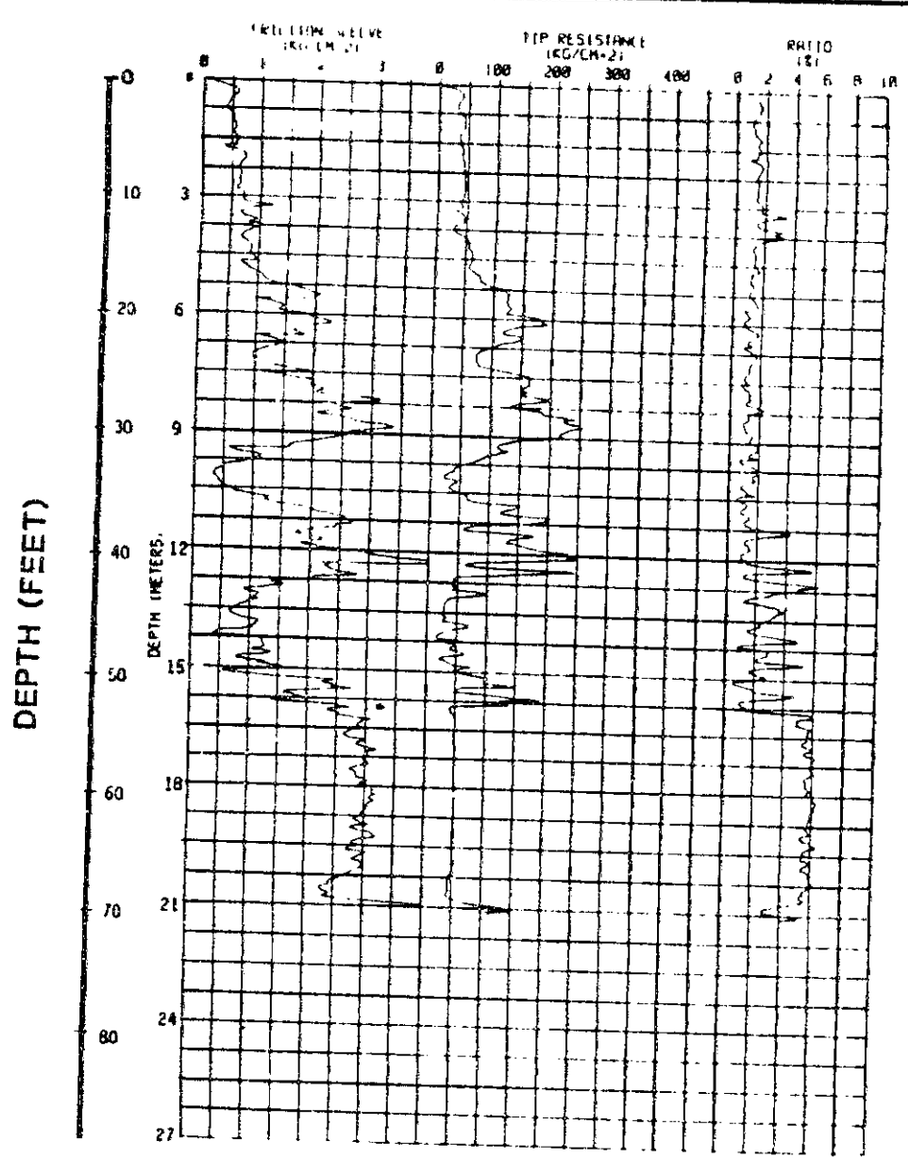
REV.	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

Cone Penetrometer Data
Location C-9
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO.
JDA	7/23/84	288.01
	As Indicated	

002577



ELEVATION

165.63

DESCRIPTION

SAND WITH CLAYEY SAND LAYERS

LAYERS OF CLAY, SAND AND SILT

CLAY

Depth = 69.3'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

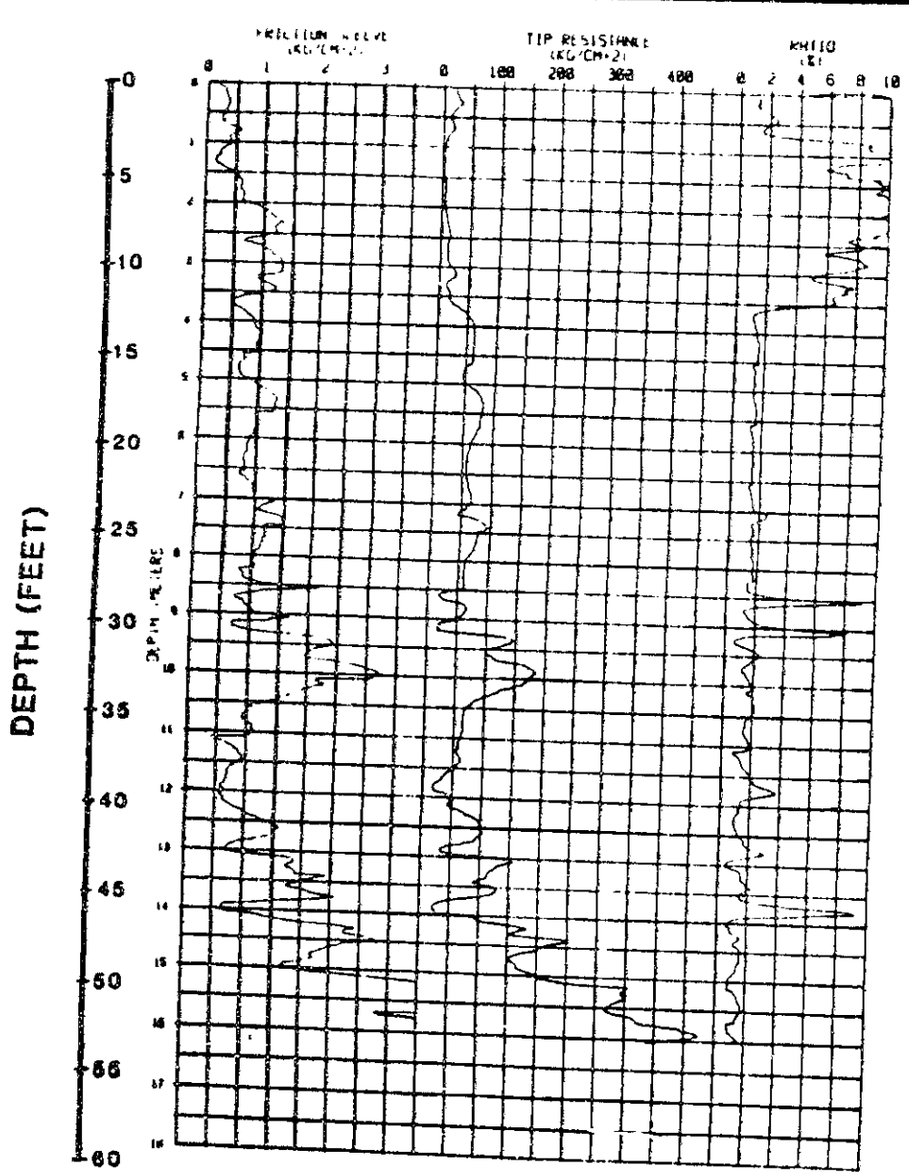
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

Cone Penetrometer Data
Location C-10
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO
JDA	7/23/84	288-01
	AS Indicated	

002378



ELEVATION

171.52

DESCRIPTION

SAND WITH A SILT SEAM

CLAY

SAND WITH SILT, CLAY, SILTY SAND and CLAYEY SAND LAYERS

GRAVEL

Depth = 52.5'

NOTES

1. Test performed according to ASTM 3441-75
2. 1.0 kg/cm^2 = 1.0 ton/ft^2
3. 1.0 meter = 3.28 feet

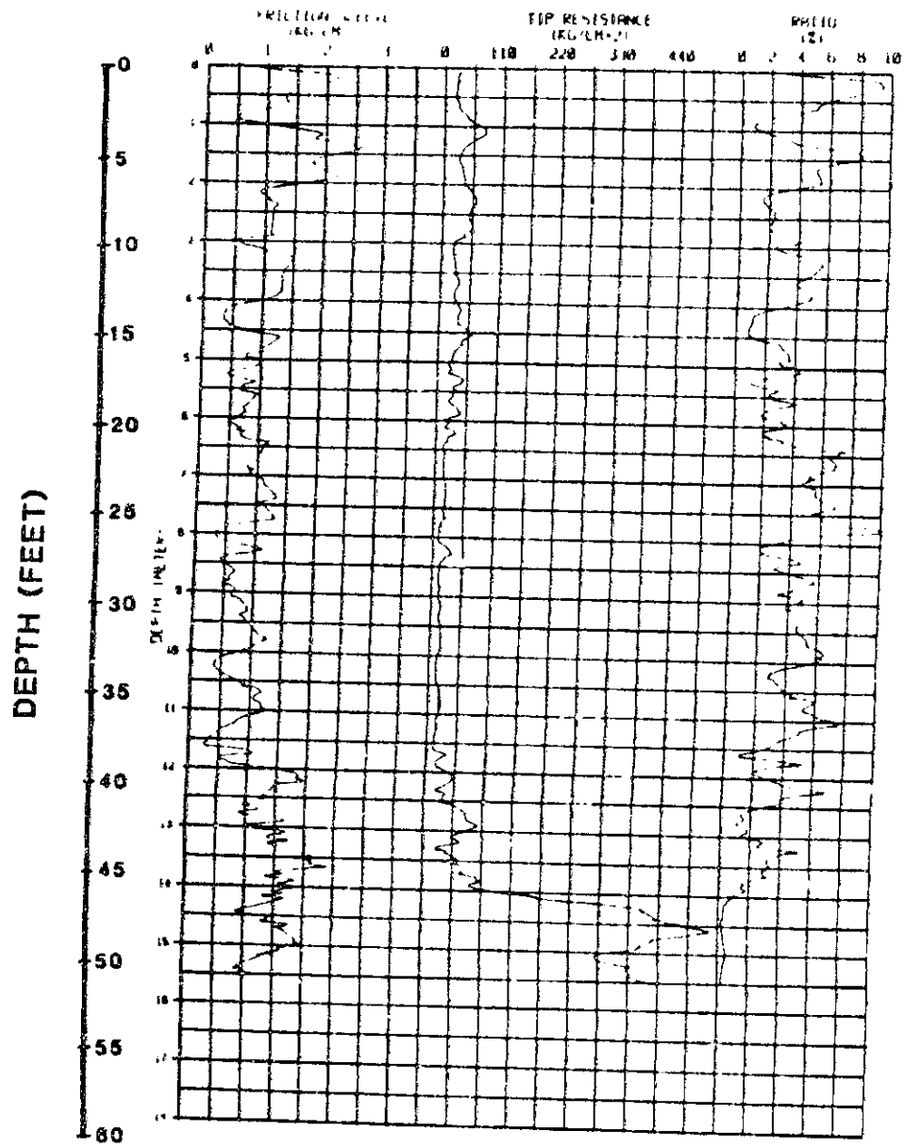
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-11
Sheridan Disposal Services

DRAWN BY	DATE	PROJECT NO
JDA	7/23/84	288-01
CHECKED	SCALE	DRAWING NO
CRF	As Indicated	

302379



ELEVATION

169.60

DESCRIPTION

CLAY WITH SAND AND SILTY SAND SEAMS

SAND WITH CLAY AND GRAVEL LAYERS

Depth = 50.8'

NOTES

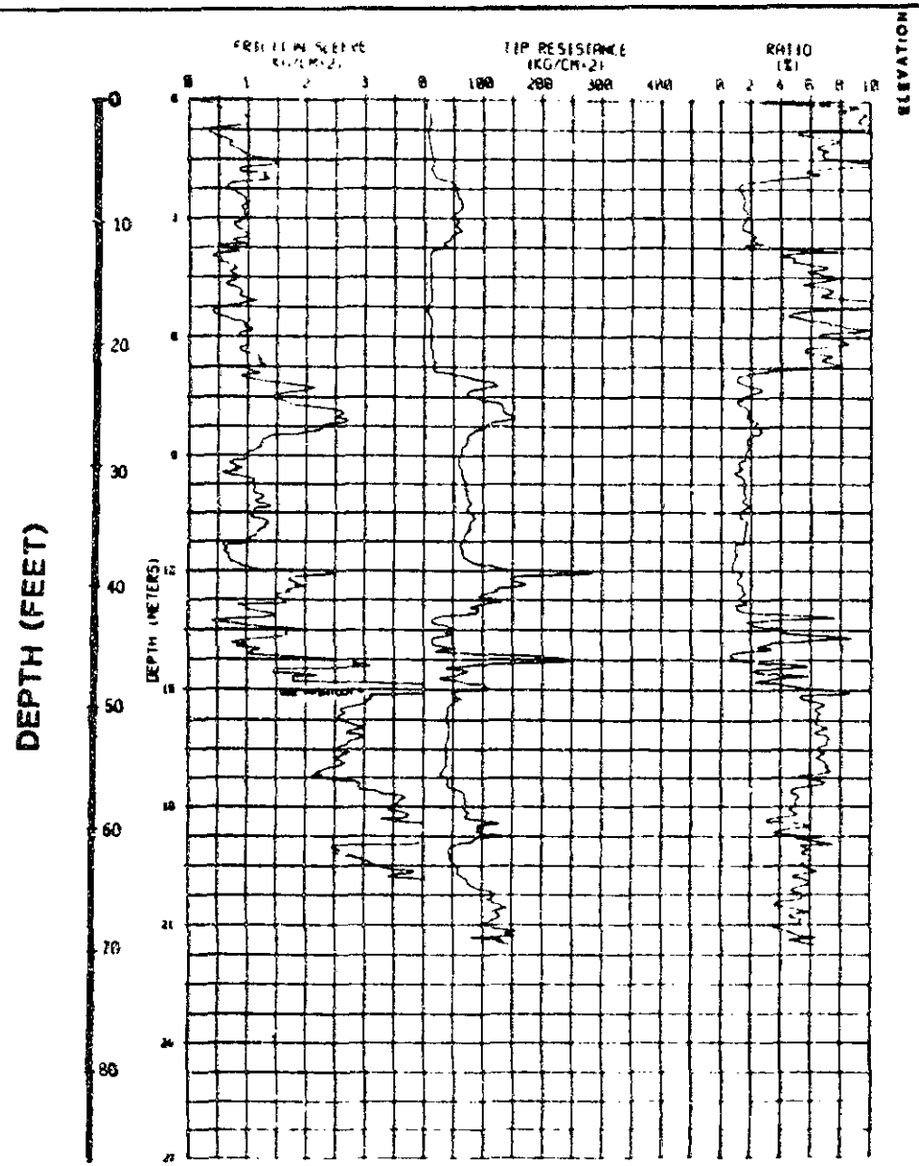
1. Test performed according to ASTM 3441-75
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-12
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	7/23/84	288-01
CHECKED	SCALE	DRAWING NO.
SOV	As Indicated	



DESCRIPTION

165 46

- CLAY
- SAND
- CLAY
- SAND WITH SILTY SAND AND GRAVEL SEAMS
- LAYERS OF CLAY, SAND, SILT AND GRAVEL
- CLAY WITH SAND SEAMS
- Depth = 70.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

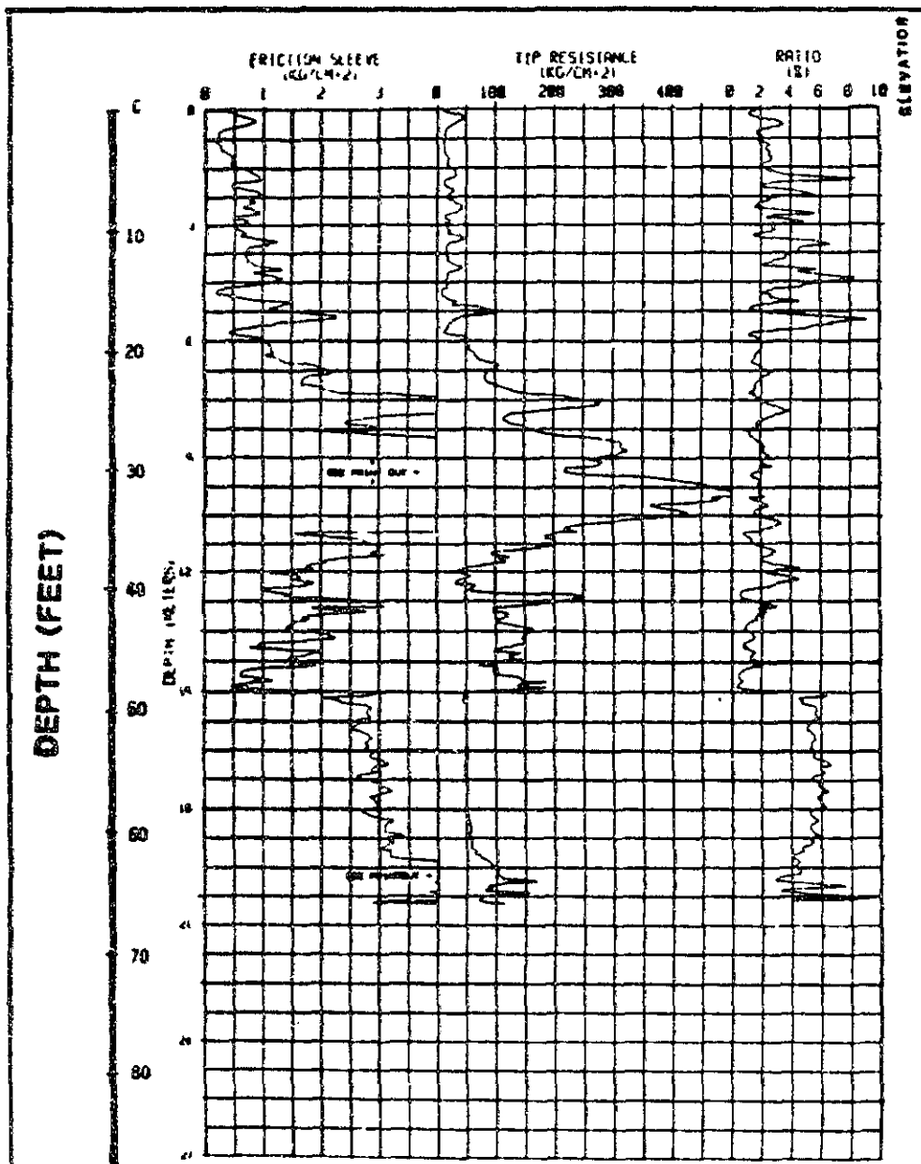
REV.	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-13
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	7/23/84	288 01
CHECKED	SCALE	DRAWING NO.
CDR	As Indicated	

002581



DESCRIPTION

165.34

LAYERS OF SAND, CLAYEY SAND, SILT CLAY AND GRAVEL

SILT SEAM

SAND

CLAY

Depth = 66.9'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 ≅ 1.0 ton/ft^2
3. 1.0 meter ≅ 3.28 feet

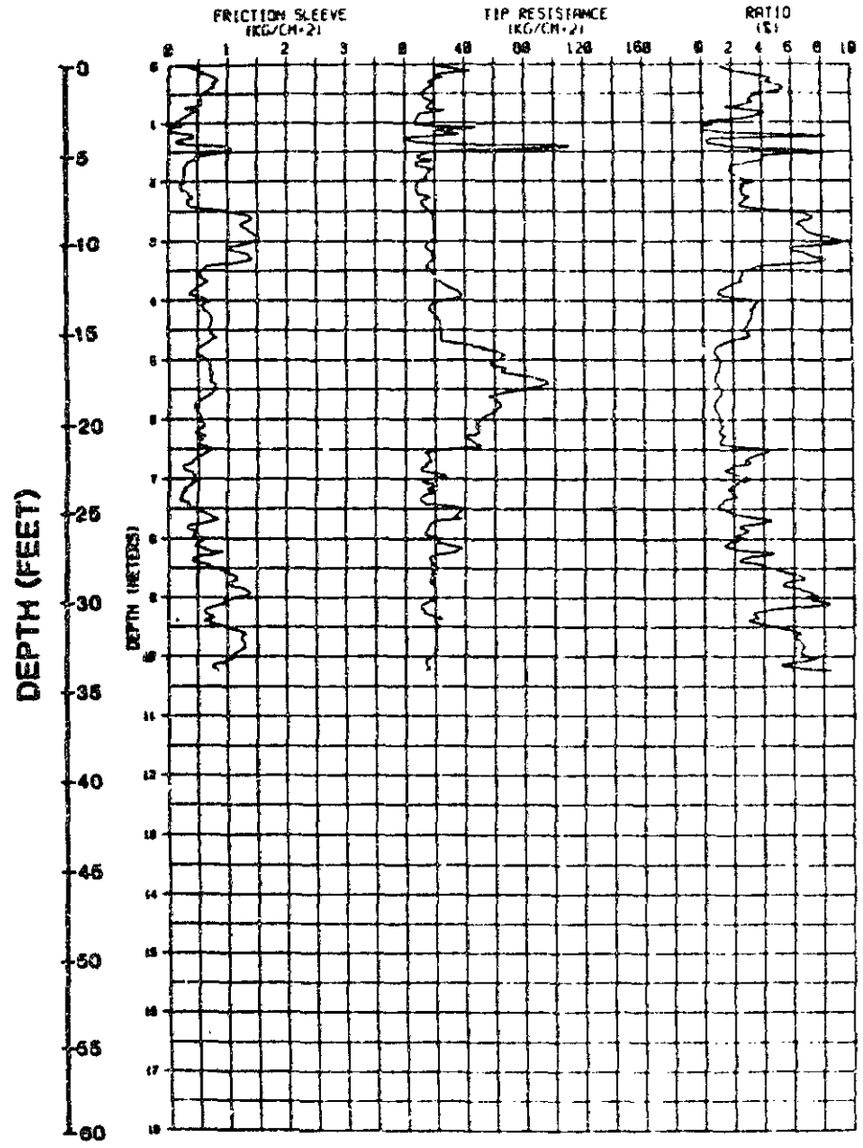
REV	DESCRIPTION	DATE	BY

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

Cone Penetrometer Data
Location C-14
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	7/23/84	288-01
CHECKED	SCALE	DRAWING NO.
CRJ	As Indicated	

002382



ELEV. 177.2

DESCRIPTION

DIKE FILL

CLAY

SAND WITH SILT AND CLAY LAYERS

Depth = 33.5'

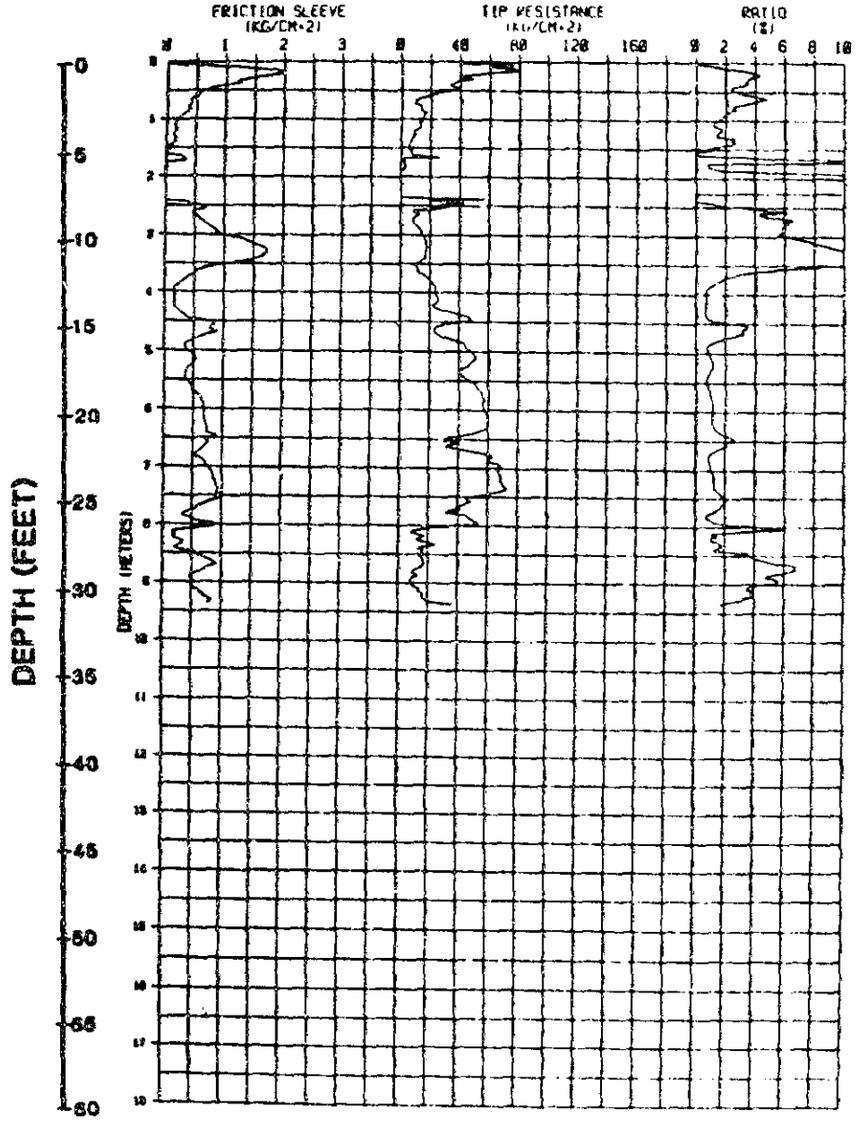
NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 Kg/cm^2 = 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-15
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	7/26/84	288-01
CHECKED	SCALE	DRAWING NO.
	As Indicated	



ELEV. 176.0

DESCRIPTION

DIKE FILL

SLUDGE

CLAY

SAND WITH SILT AND CLAY LAYERS

Depth = 30.7'

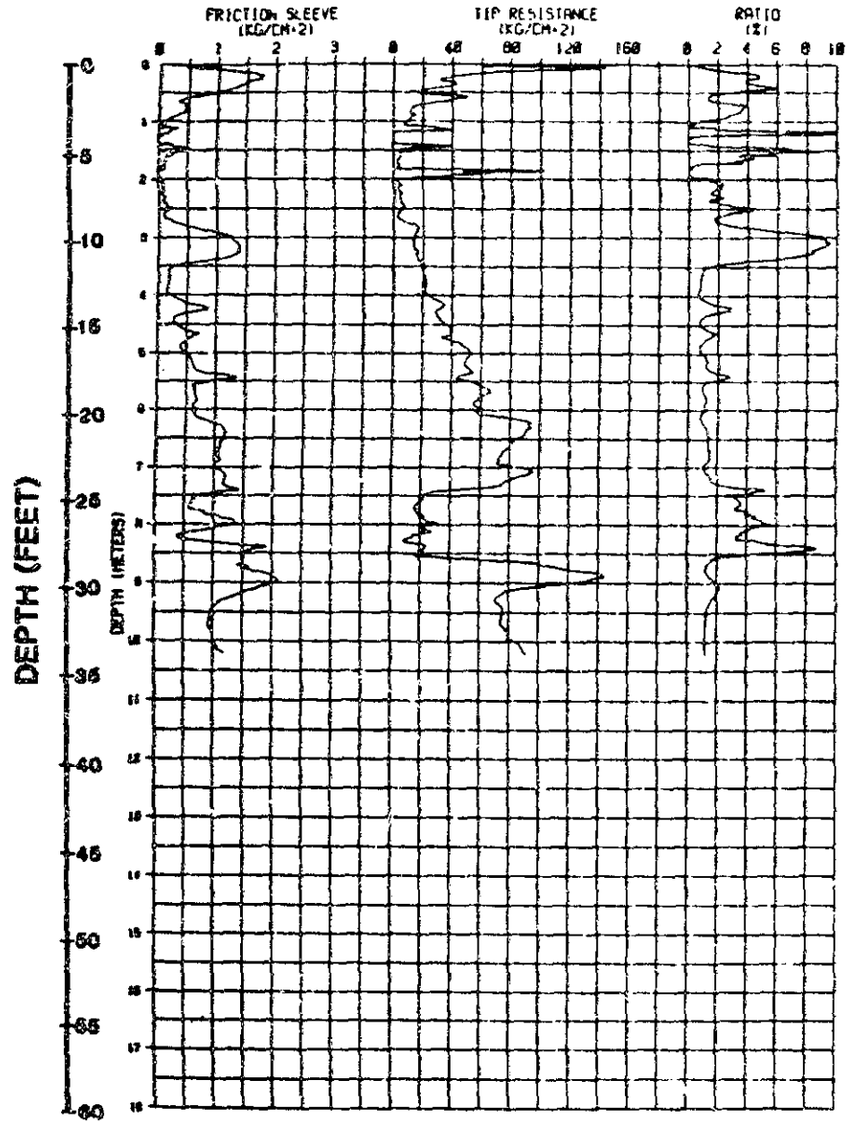
NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 = 1.0 tsf
3. 1.0 meter ≈ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-16
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO
JDA	4/18/84	2R8-01
CHECKED	SCALE	DRAW'G NO.
	As Indicated	



ELEV.

DESCRIPTION

DIKE FILL

SLUDGE

CLAY

SAND WITH SILT SEAMS

CLAY

SAND

Depth = 33.4 '

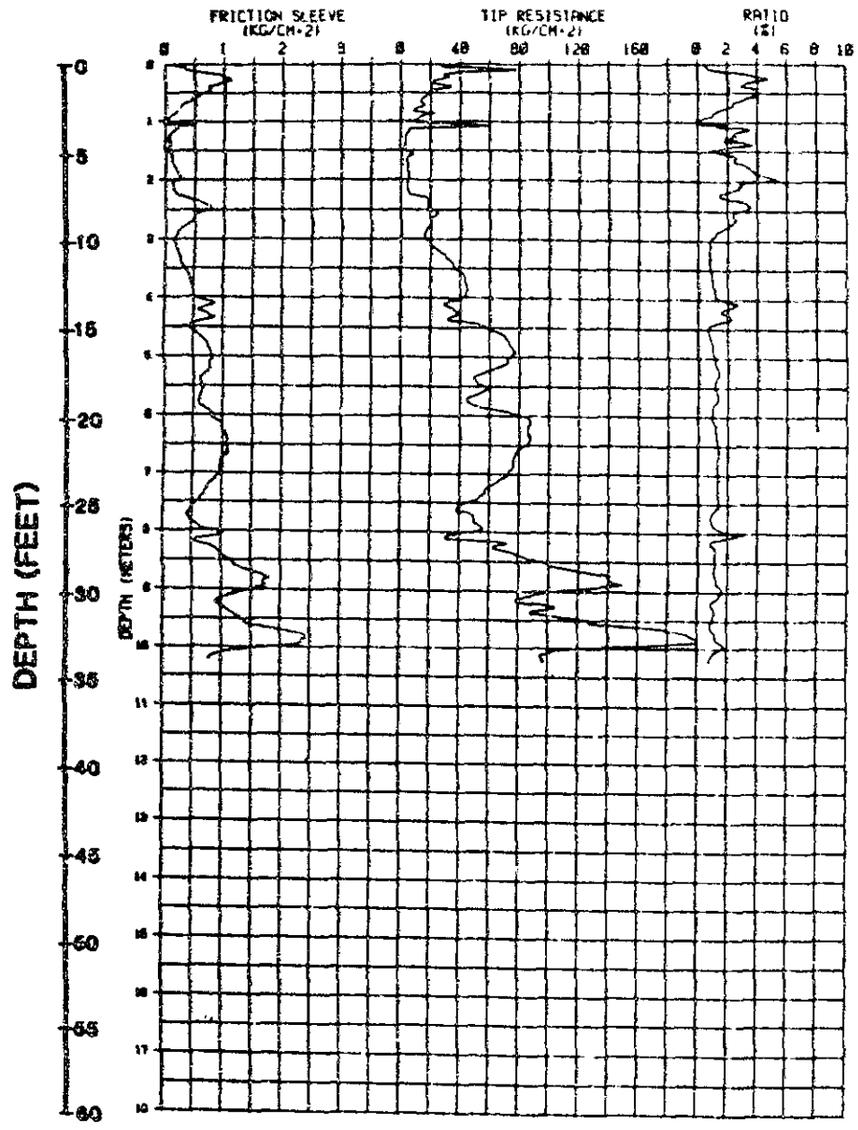
NOTES

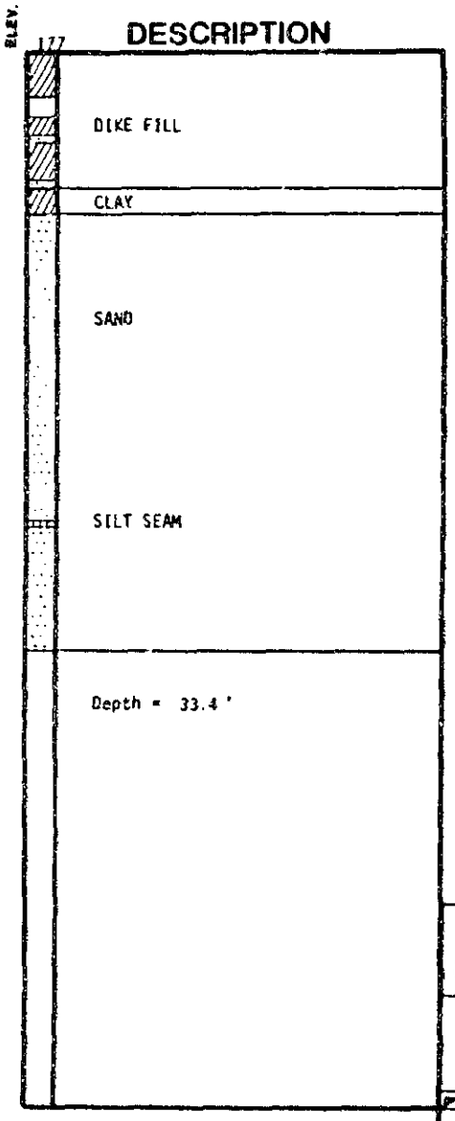
1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 = 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-17
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	4/16/84	288-01
CHECKED	SCALE	DRAWING NO.
	As Indicated	





DESCRIPTION

NOTES

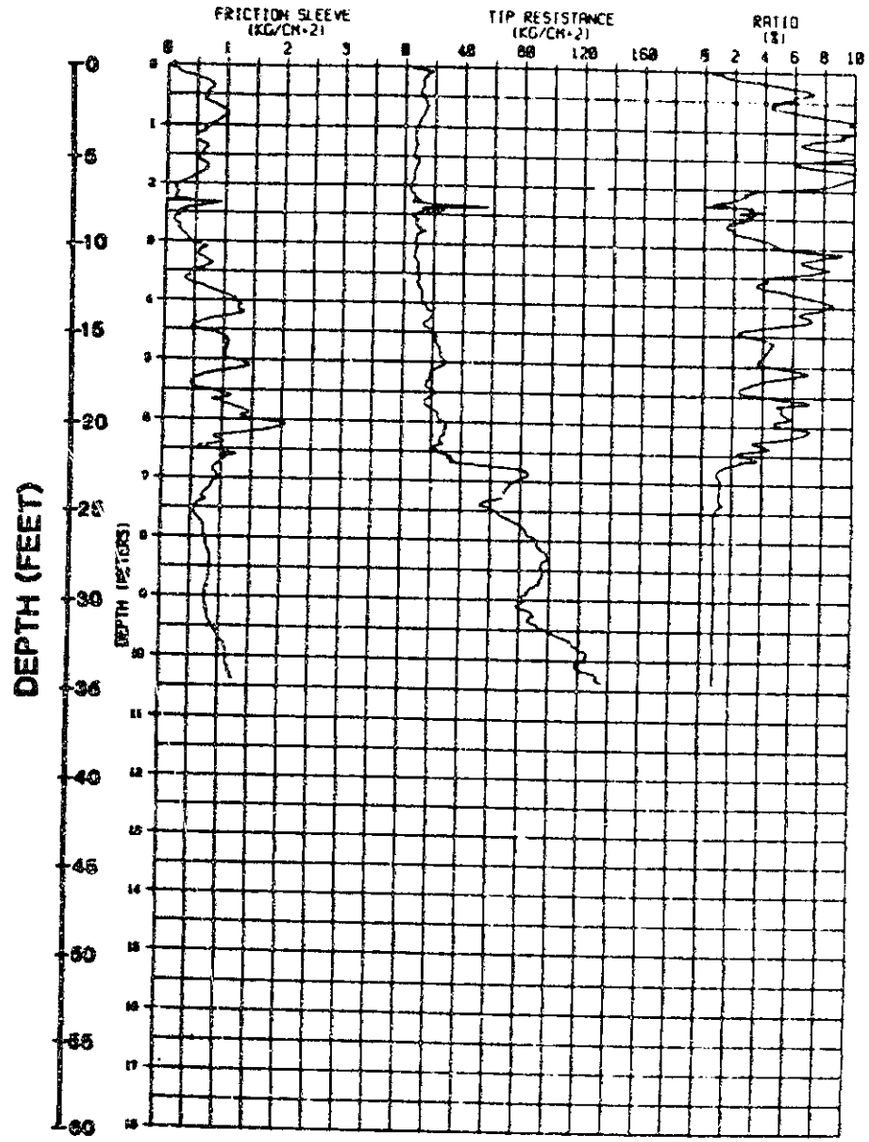
1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 = 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-18
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	4/18/84	288-01
CHECKED	SCALE	DRAWING NO.
	As Indicated	

002386



ELEV. 176.3

DESCRIPTION

DIKE FILL

CLAY WITH SILTY CLAY, SILTY SAND AND SILT SEAMS

SAND

Depth = 34.1'

NOTES

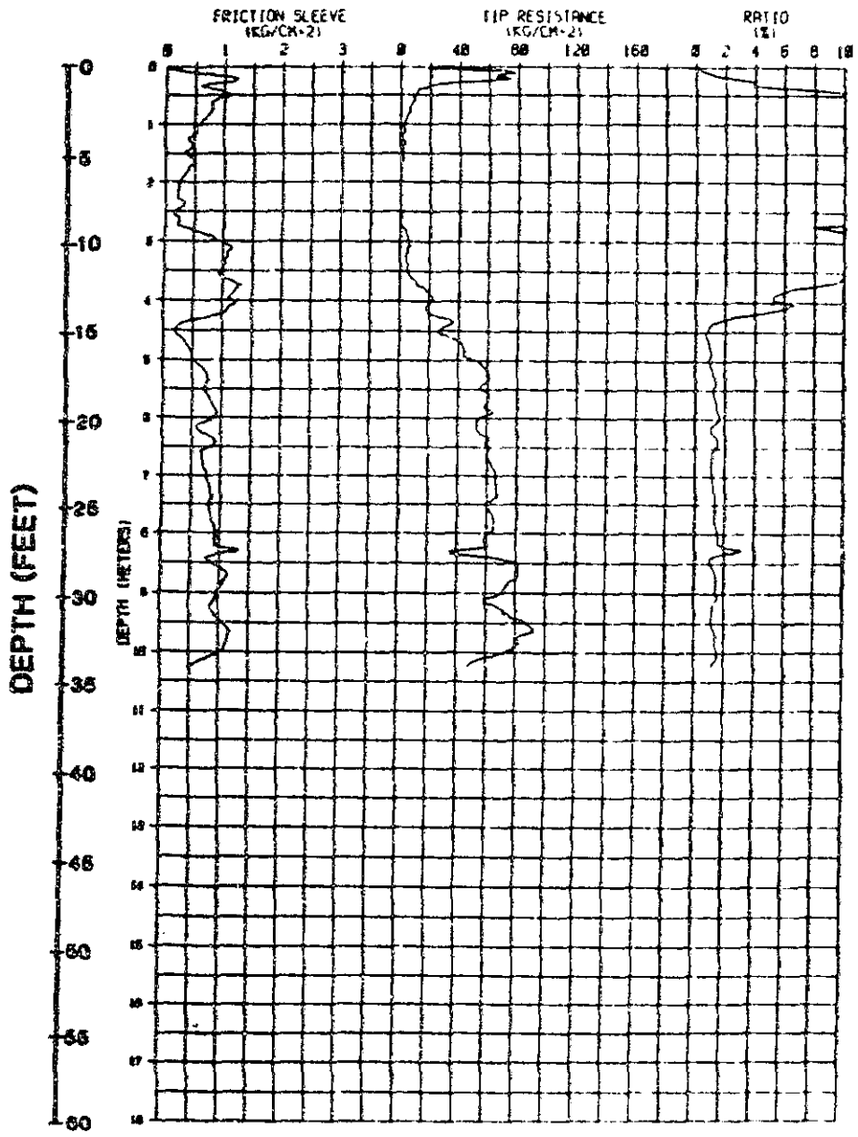
1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 = 1.0 tsf
3. 1.0 meter ≅ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

Cone Penetrometer Data
Location C-19
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	4/18/84	288-01
CHECKED	SCALE	DRAWING NO.
	As Indicated	

002387



ELEV. 177.2

DESCRIPTION

- BIKE FILL
- SLUDGE
- CLAY
- SAND
- SILT SEAM

Depth = 33.5'

NOTES

1. Test performed according to ASTM 3441-75T
2. 1.0 kg/cm^2 = 1.0tsf
3. 1.0 meter ≅ 3.28 feet

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

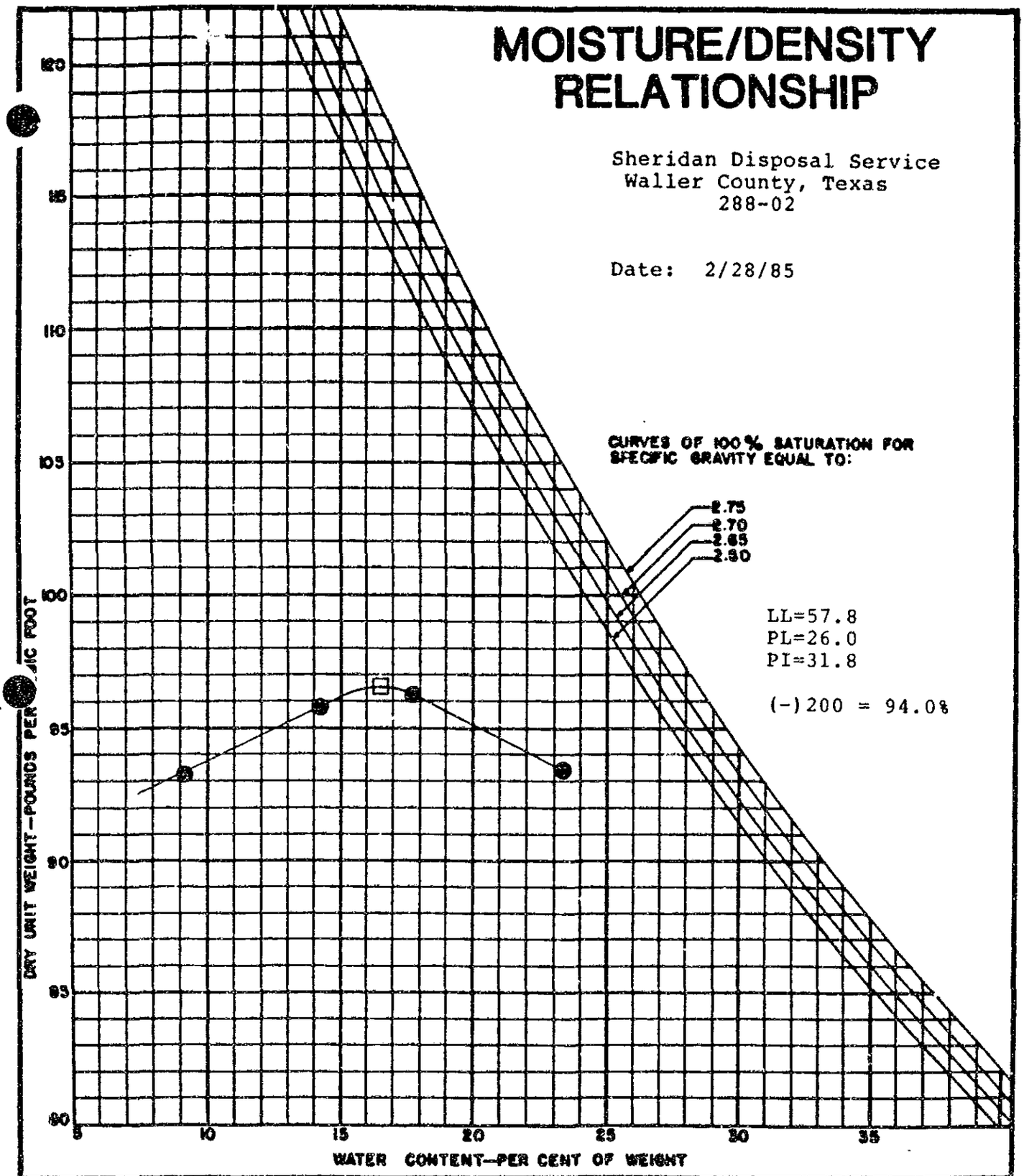
Cone Penetrometer Data
Location C-20
Sheridan Disposal Service

DRAWN BY	DATE	PROJECT NO.
JDA	4/18/84	286-01
CHECKED	SCALE	DRAWING NO.
	As Indicated	

MOISTURE/DENSITY RELATIONSHIP

Sheridan Disposal Service
Waller County, Texas
288-02

Date: 2/28/85



MOISTURE DENSITY RELATION	METHOD OF TEST	MAX. DRY DENSITY PCF	OPTIMUM MOISTURE CONTENT%	SOIL DESCRIPTION OR CLASSIFICATION AND SAMPLE LOCATION
Sample 1	ASTM D 698	96.6	16.5	Reddish Brown Clay Borrow Pit - Sheridan Site

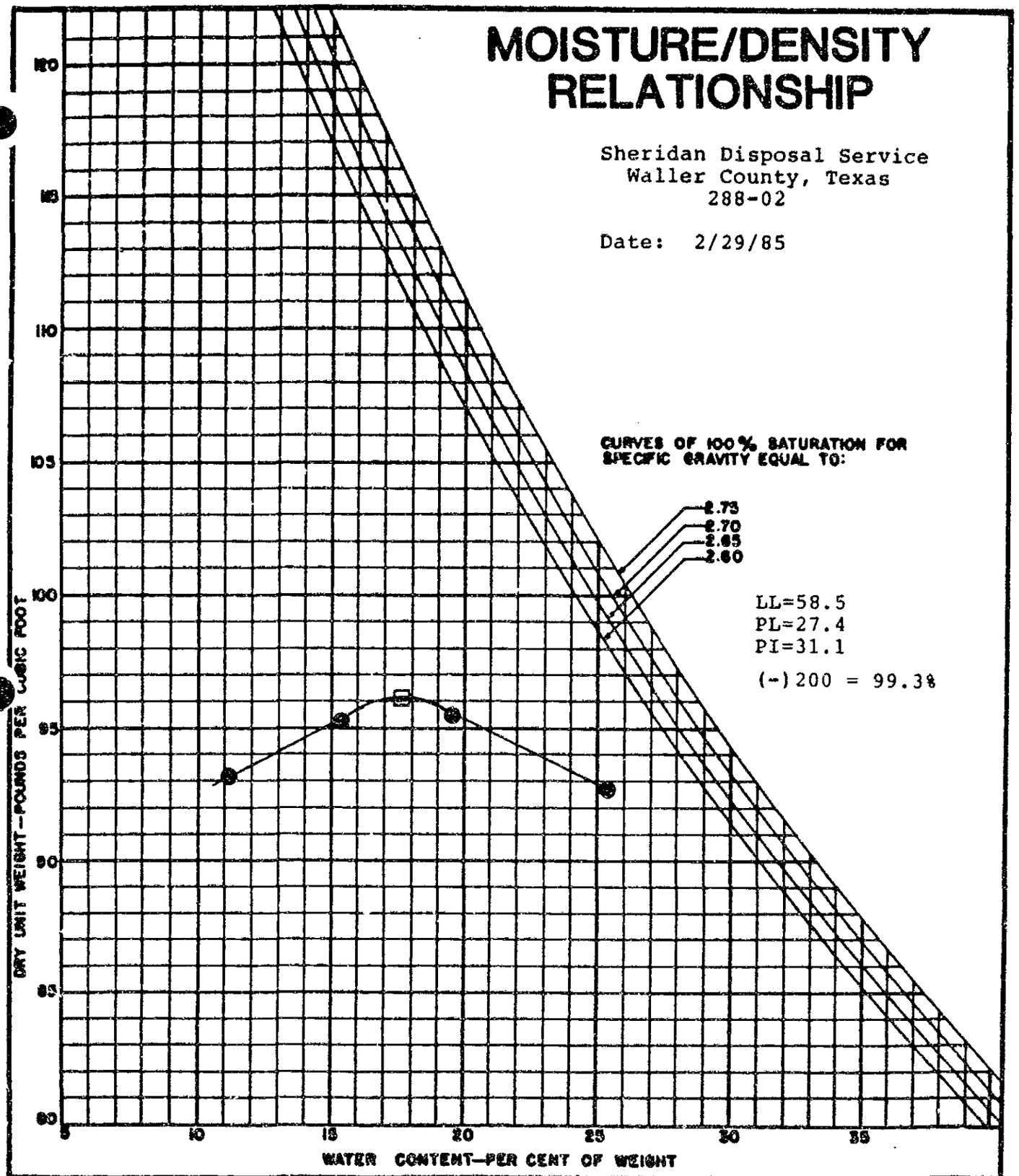
RESOURCE ENGINEERING

002389

MOISTURE/DENSITY RELATIONSHIP

Sheridan Disposal Service
Waller County, Texas
288-02

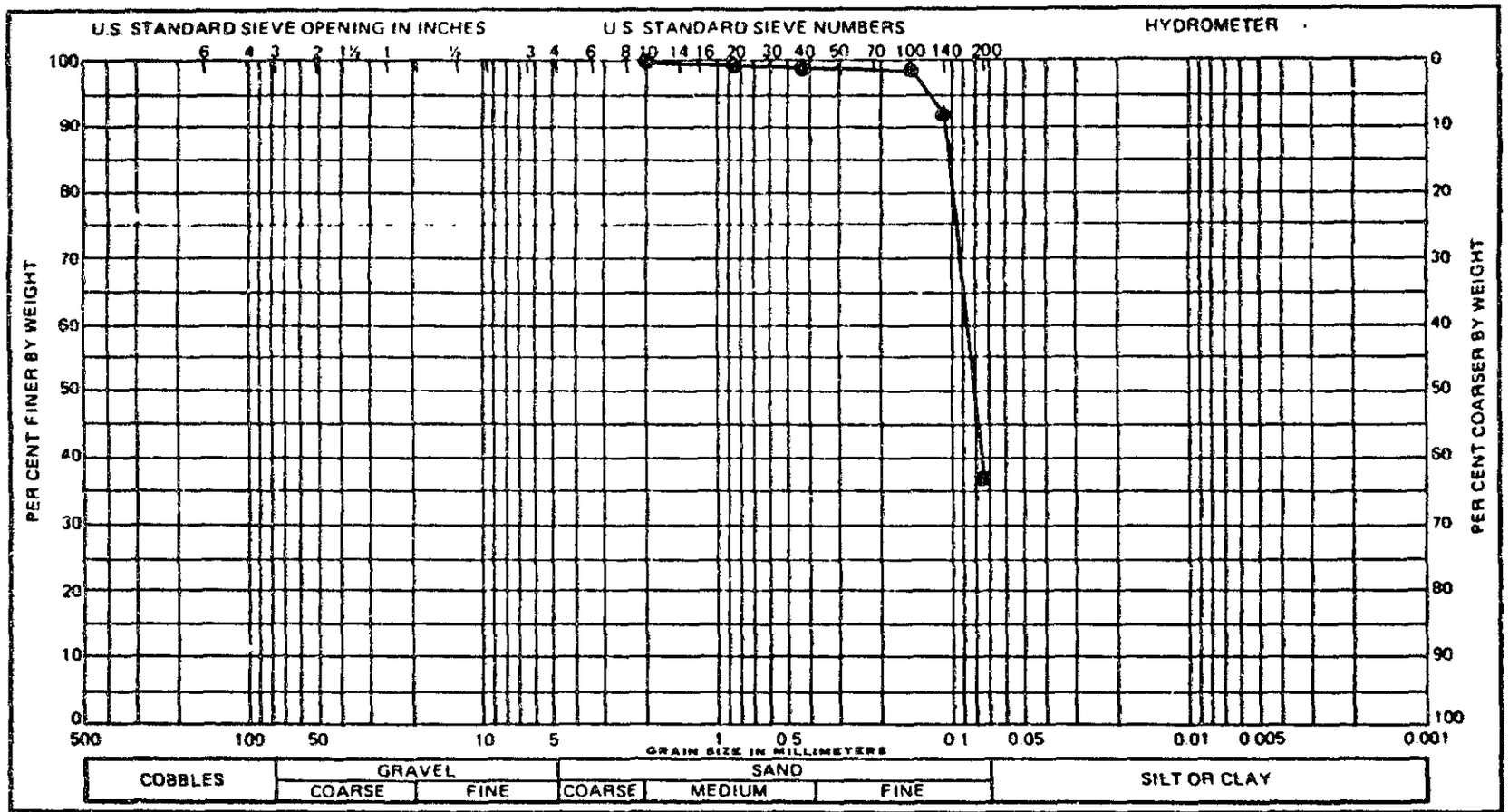
Date: 2/29/85



MOISTURE DENSITY RELATION	METHOD OF TEST	MAX. DRY DENSITY PCF	OPTIMUM MOISTURE CONTENT %	SOIL DESCRIPTION OR CLASSIFICATION AND SAMPLE LOCATION
Sample 1	ASTM D 698	96.1	17.6	Reddish Brown Clay Borrow Pit - Sheridan Site

RESOURCE ENGINEERING

002390



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-7	11	17'-18.5'	SILTY SAND				

Project Sheridan Disposal Service
Waller County, Texas

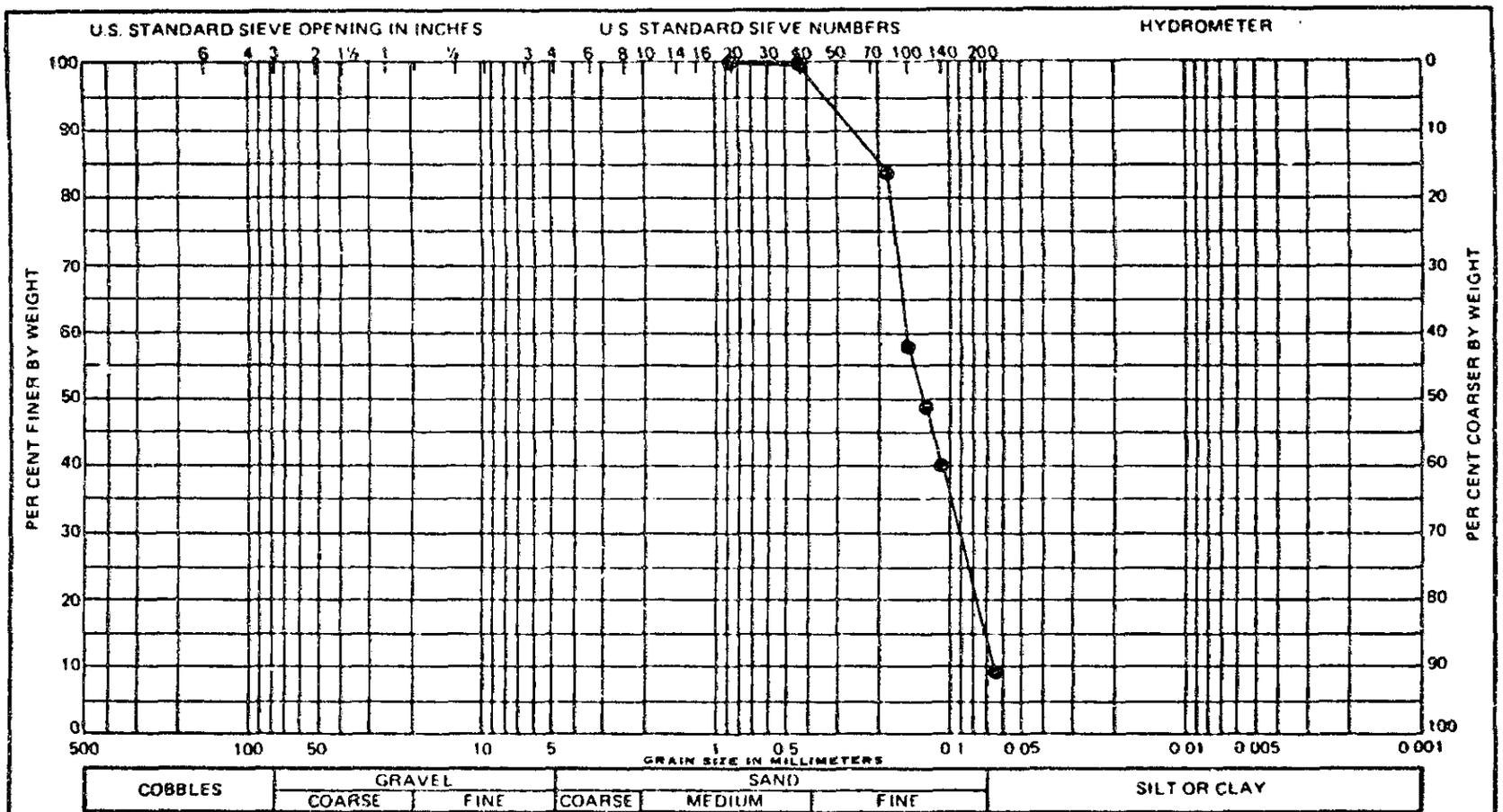
288-01

Date 4-11-84

REI

REPORT OF SOIL ANALYSIS

002391



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-7	16	24.5'-26'	SAND				

Project Sheridan Disposal Service

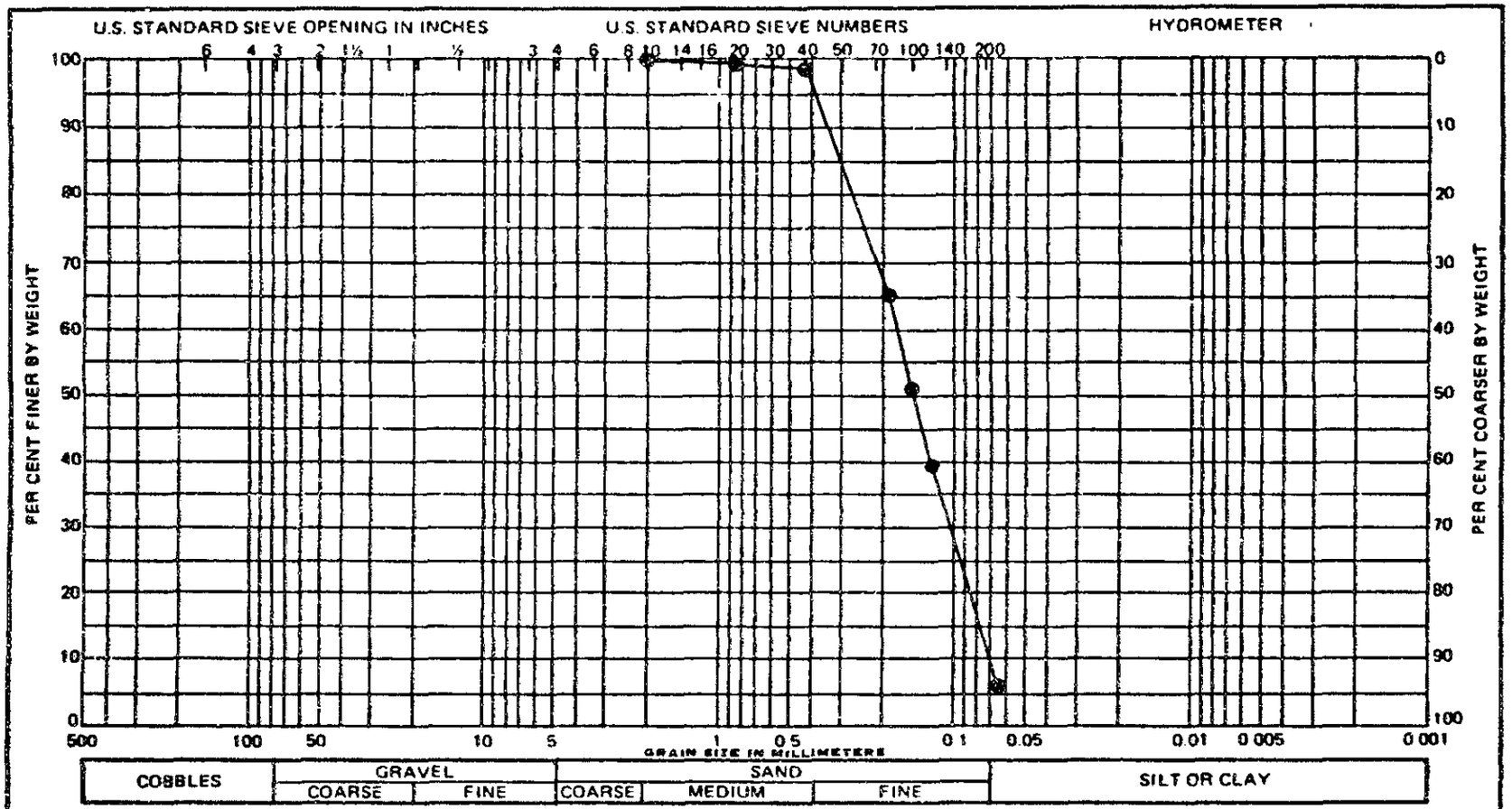
Waller County, Texas

288-01

Date 4-11-84

REI

REPORT OF SOIL ANALYSIS



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-7	24	36.5'-38'	SAND				

Project Sheridan Disposal Service

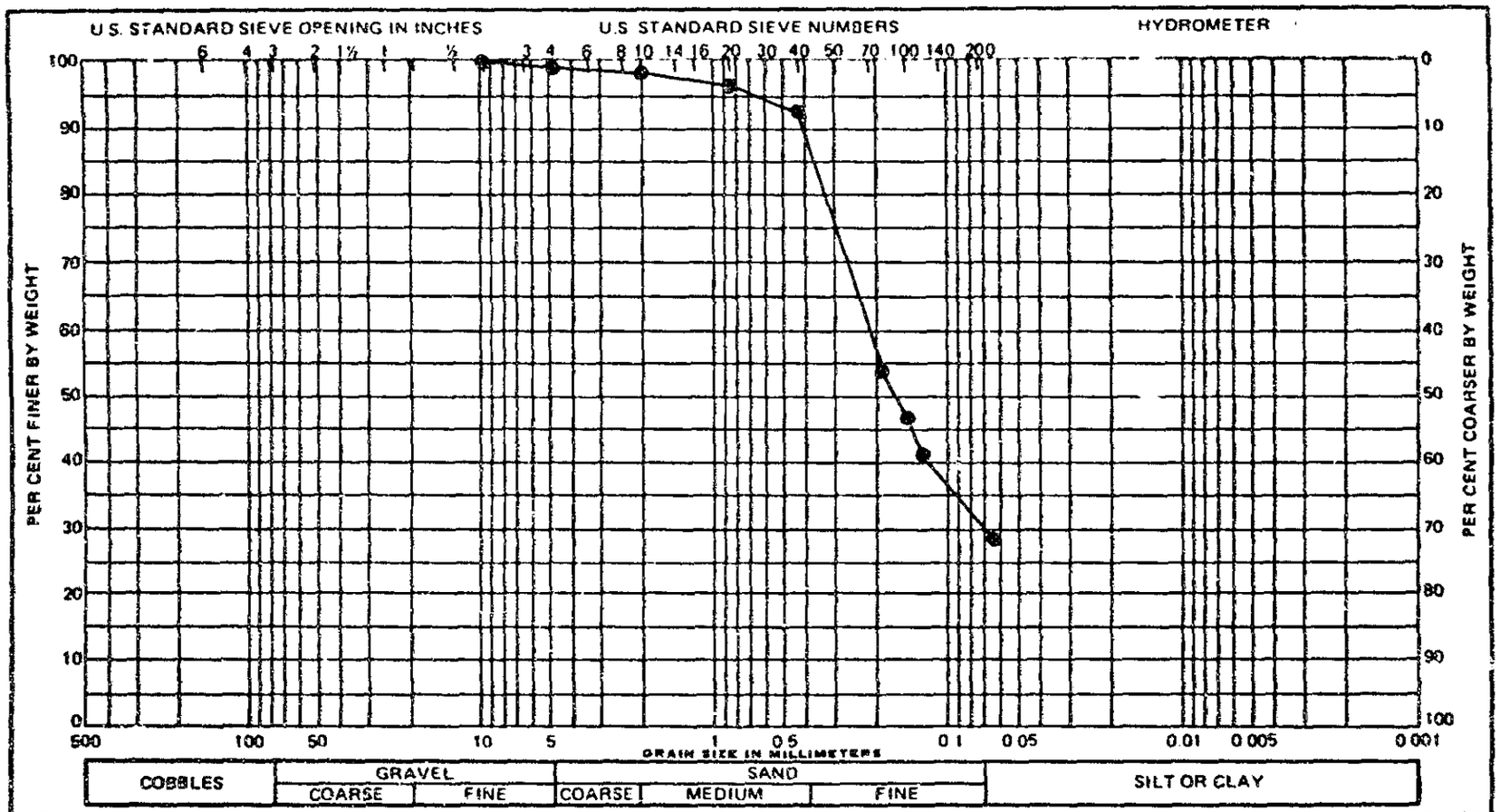
Waller County, Texas

288-01

Date 4-11-84

REI

REPORT OF SOIL ANALYSIS



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-7	28	425'-44'	SILTY SAND with trace gravel				

Project Sheridan Disposal Service
Waller County, Texas

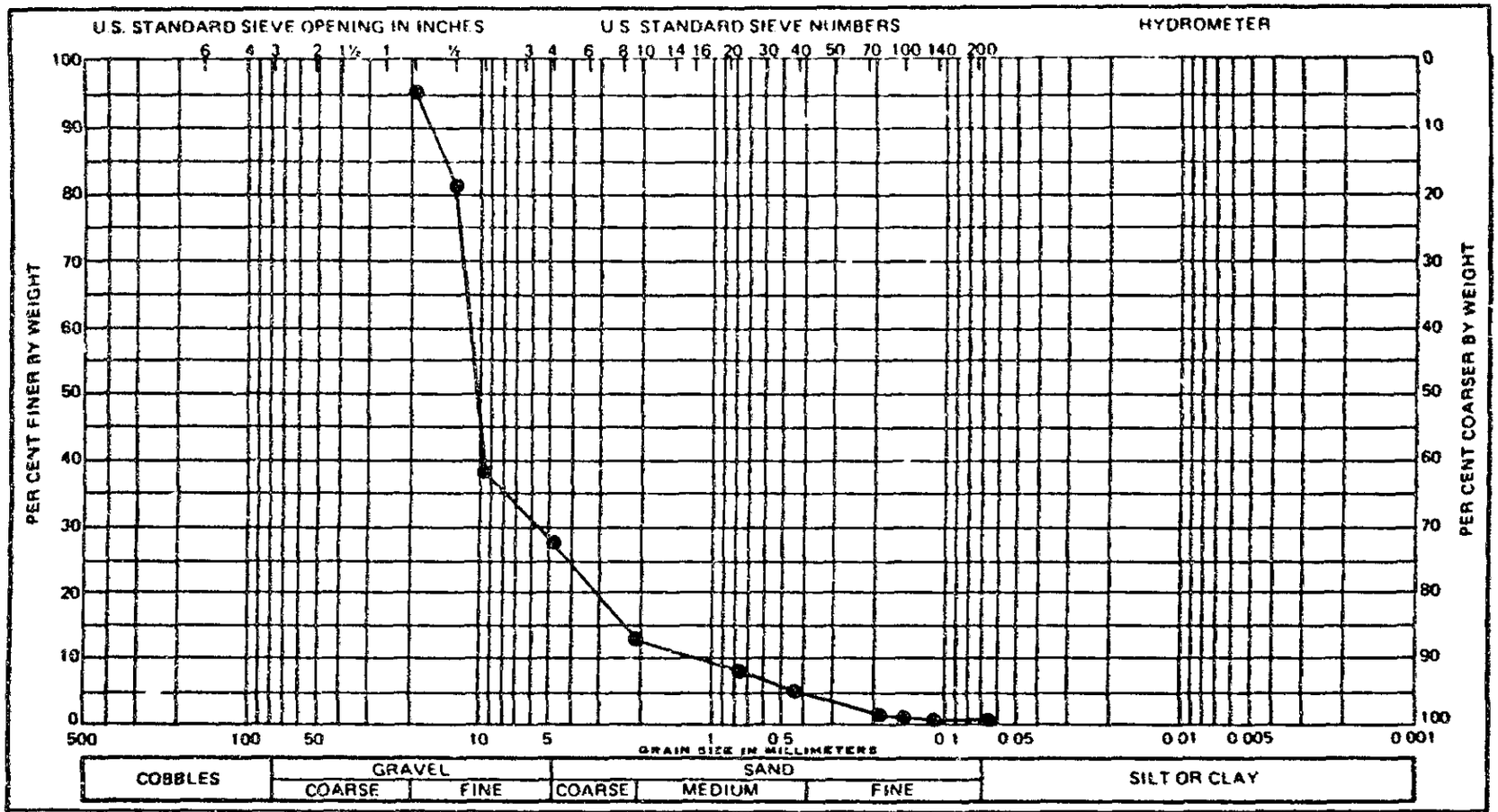
288-01

REPORT OF SOIL ANALYSIS

Date 4-11-84

REI

002394



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-7	32	485'-50'	SANDY GRAVEL				

Project Sheridan Disposal Service

Waller County, Texas

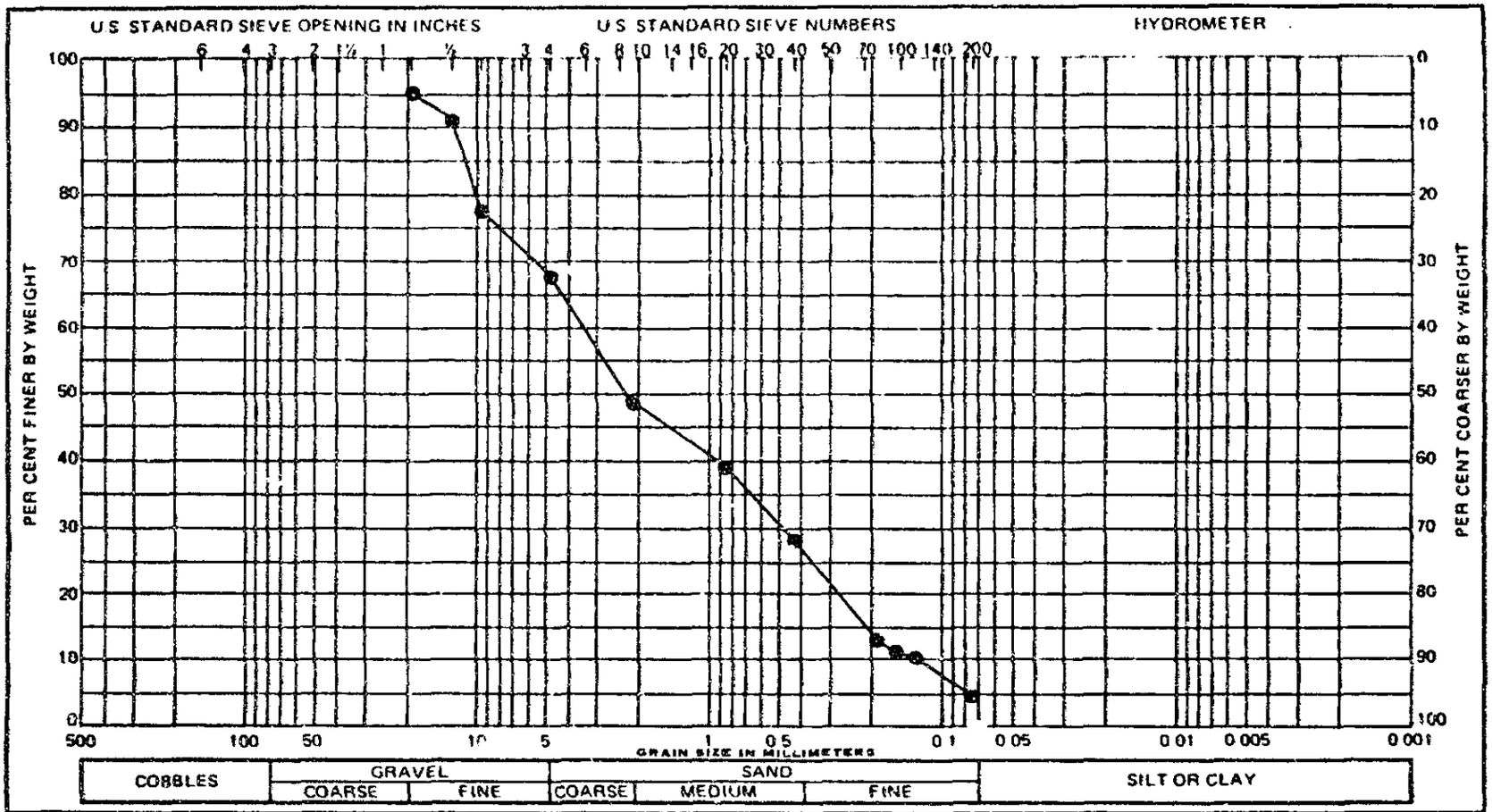
288-01

Date 4-11-84

REI

REPORT OF SOIL ANALYSIS

002305



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
W-7	35	53'-54.5'	SAND with GRAVEL				

Project Sheridan Disposal Service
Waller County, Texas

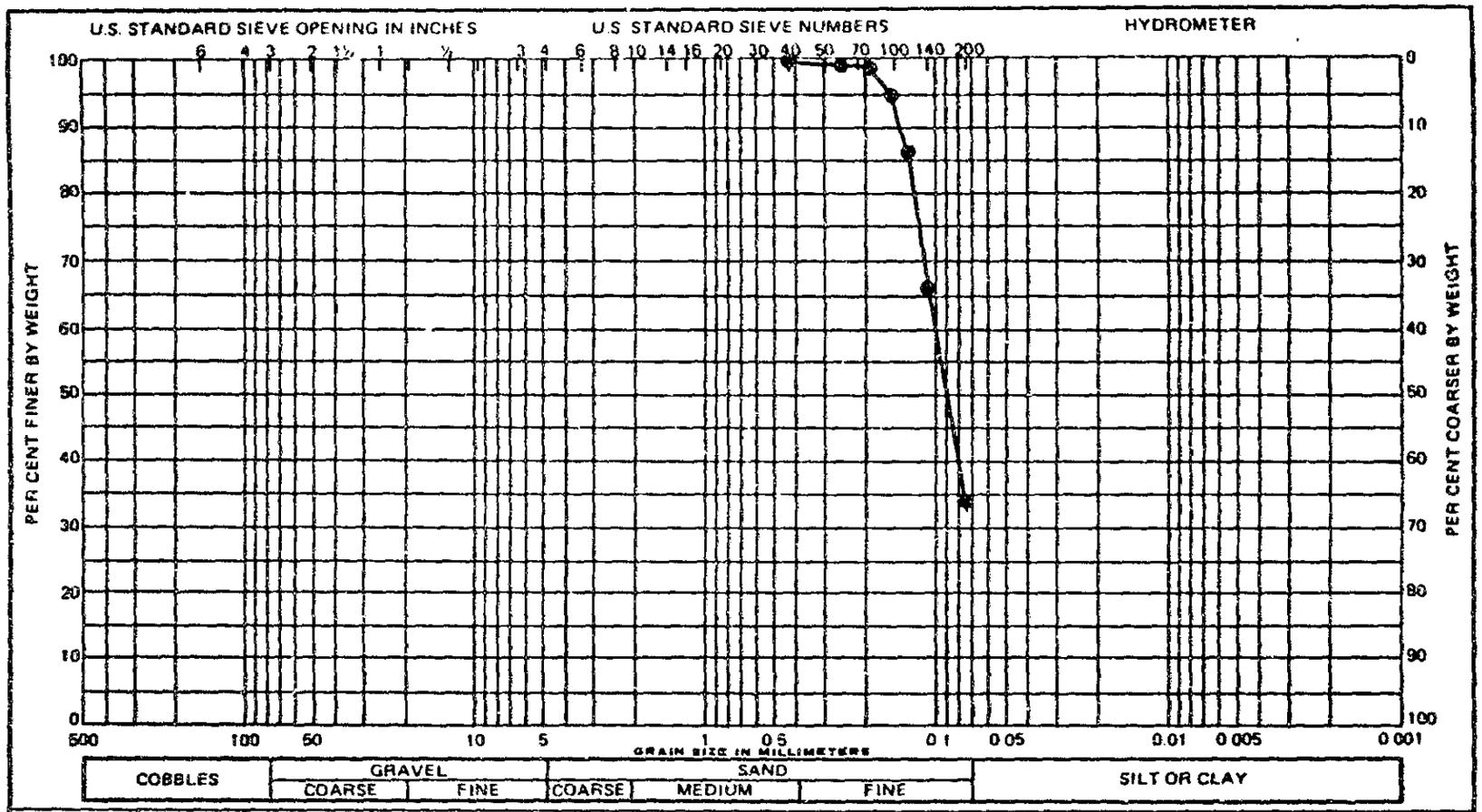
288-01

Date 4-11-84

REI

REPORT OF SOIL ANALYSIS

002396



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-10	3	13.5'15'	SILTY SAND				

Project Sheridan Disposal Service

Waller County

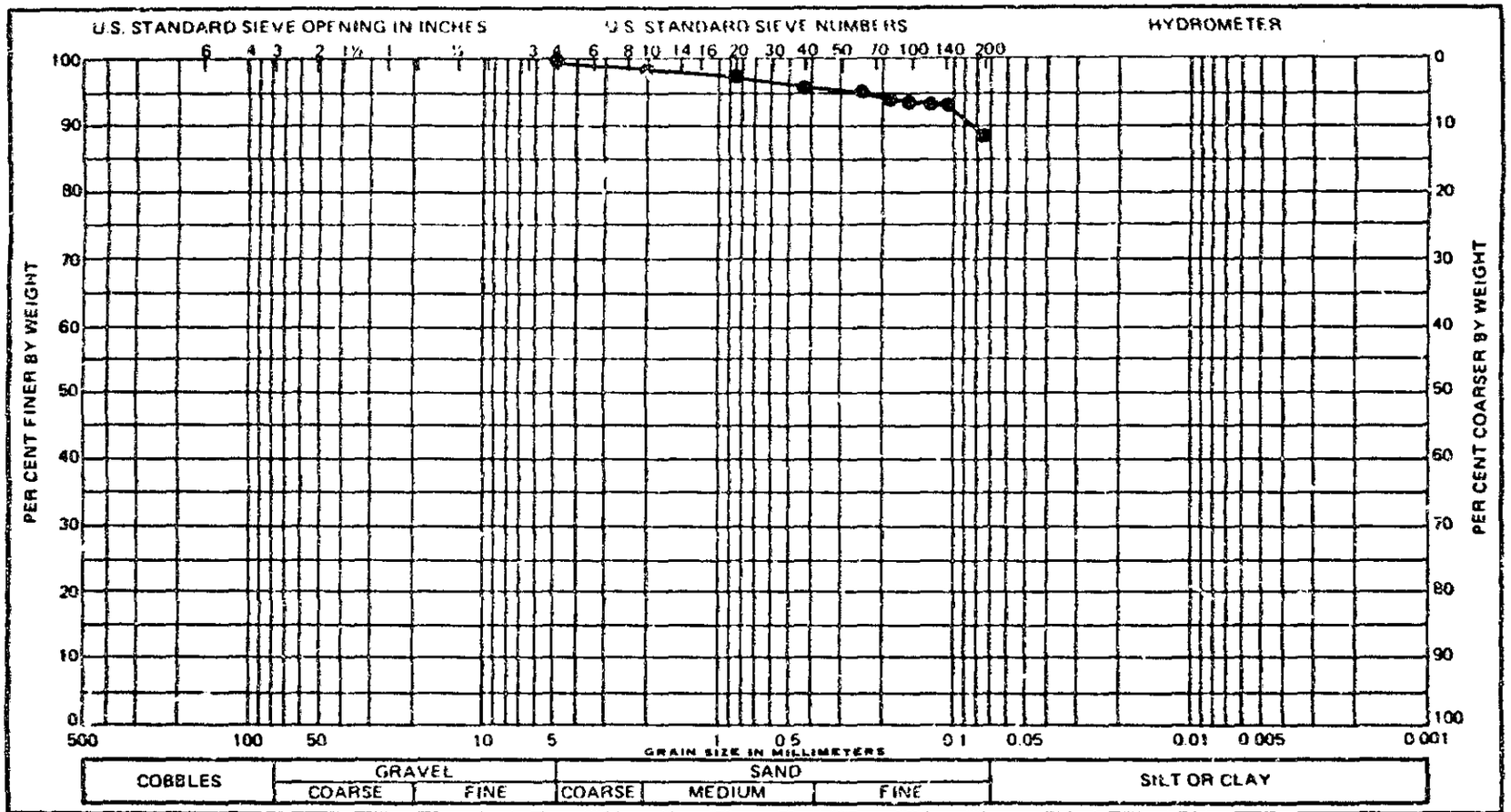
288-01

REI

REPORT OF SOIL ANALYSIS

Date 4/20/84

002397



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-10	4	18.5'-20'	CLAY				

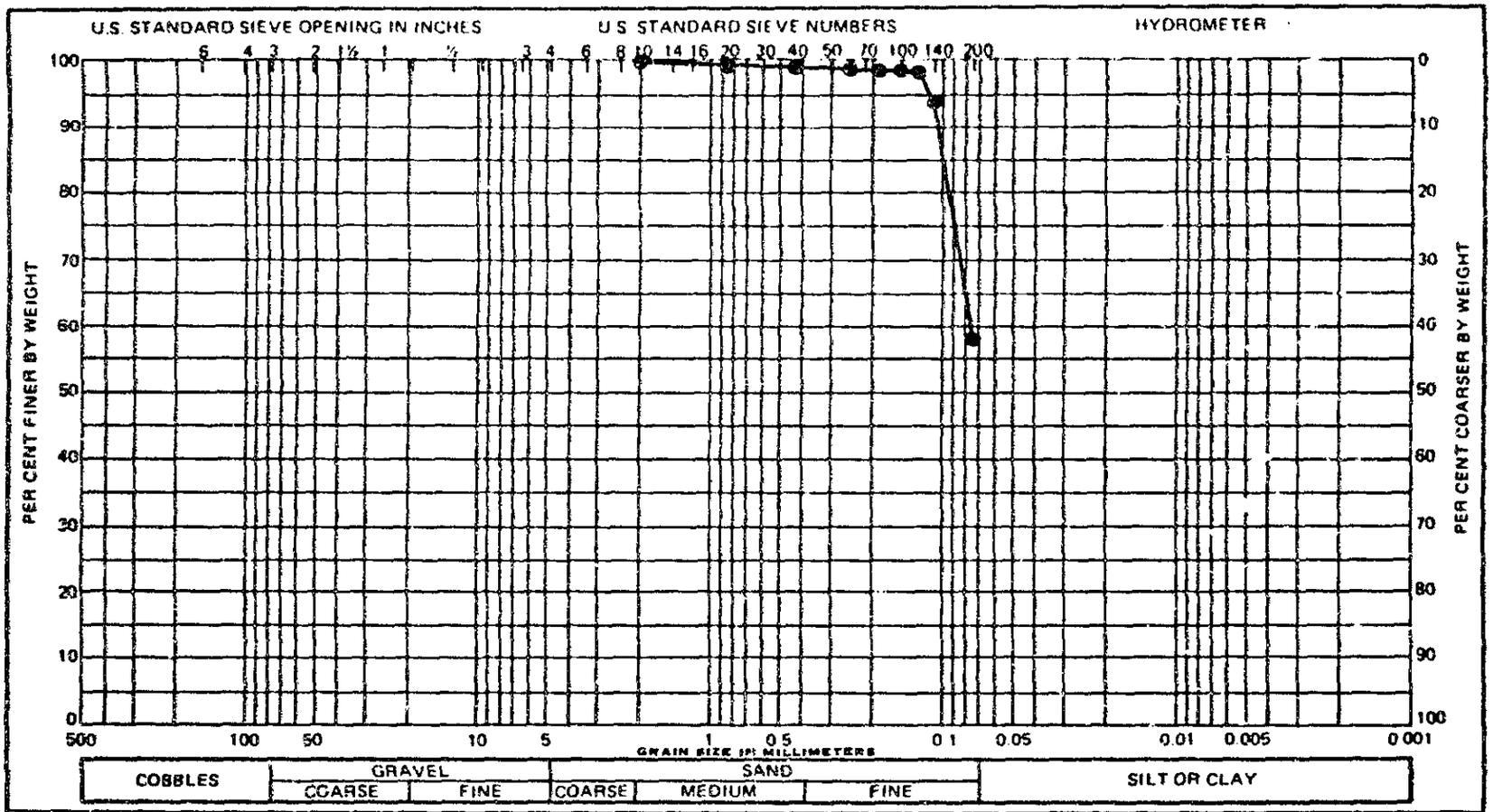
Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 4/20/84

002398



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-10	5	23'-25'	SANDY CLAY				

Project Sheridan Disposal Service

Waller County

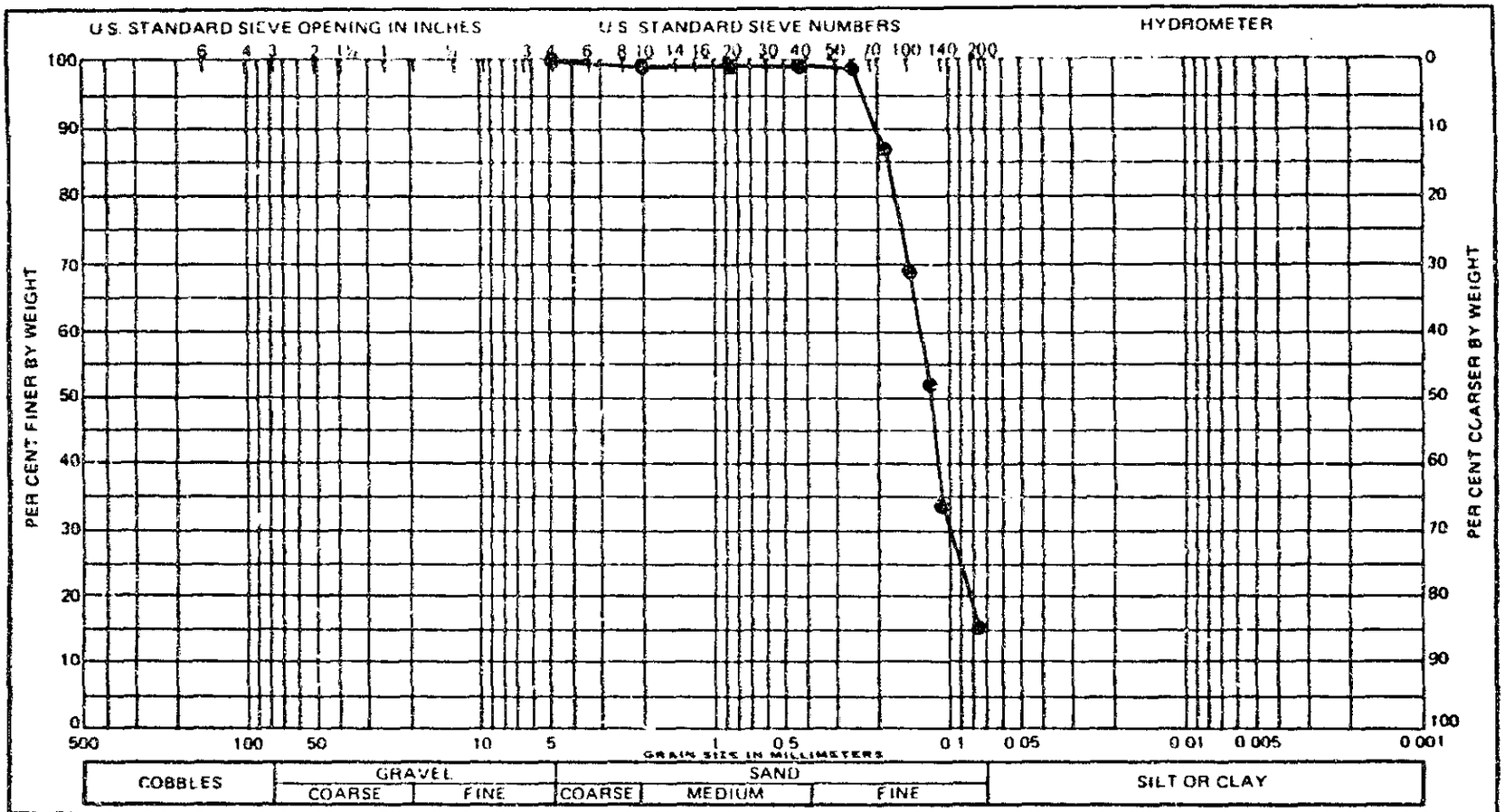
288-01

REI

REPORT OF SOIL ANALYSIS

Date 4/20/84

002399



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-10	7	33.5'-35'	SILTY SAND				

Project Sheridan Disposal Service

Waller County

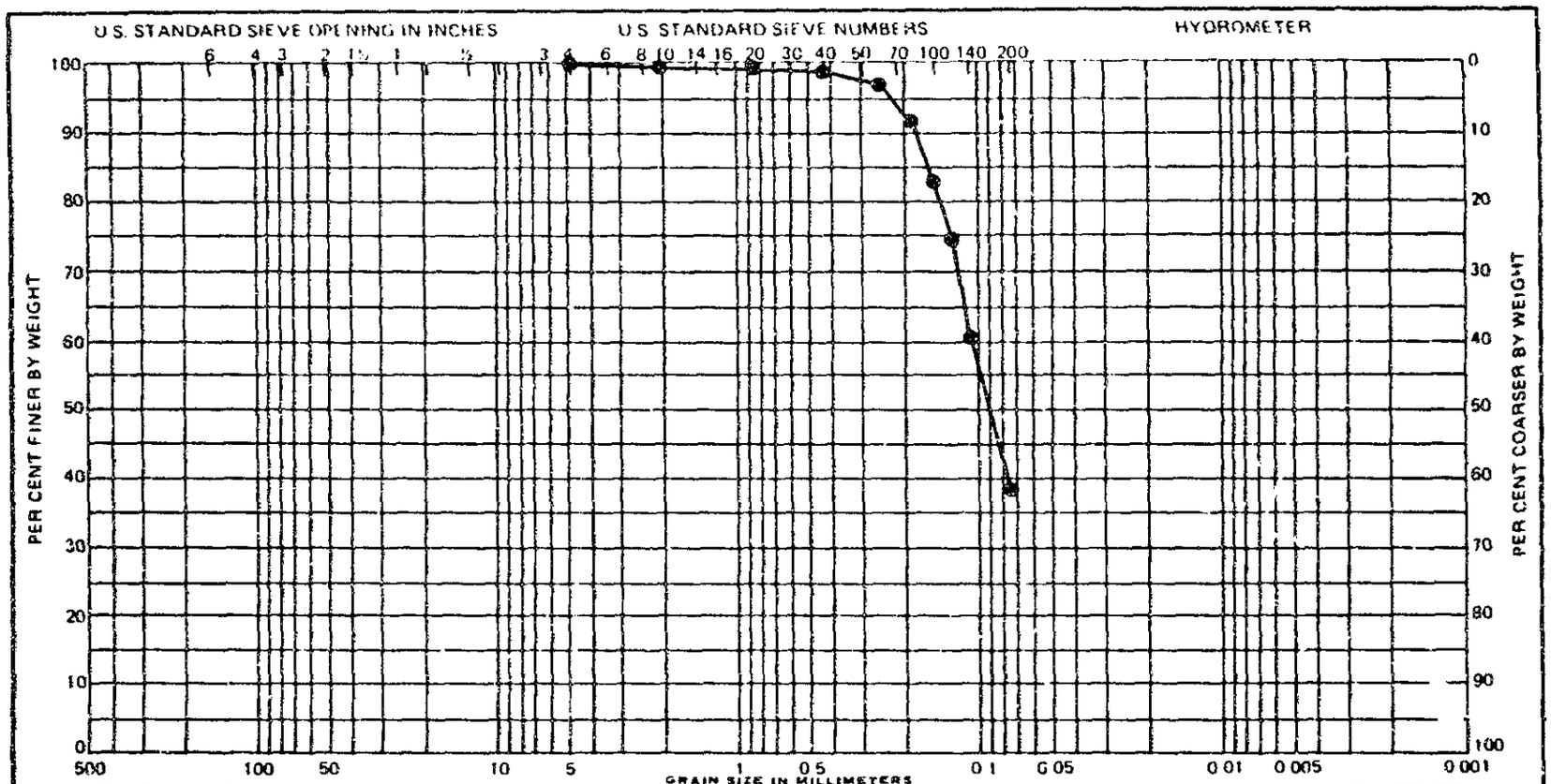
288-01

REI

REPORT OF SOIL ANALYSIS

Date 4/20/84

002400



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
W-10	8	43'-44.5'	SILTY SAND				

Project Sheridan Disposal Service

Waller County

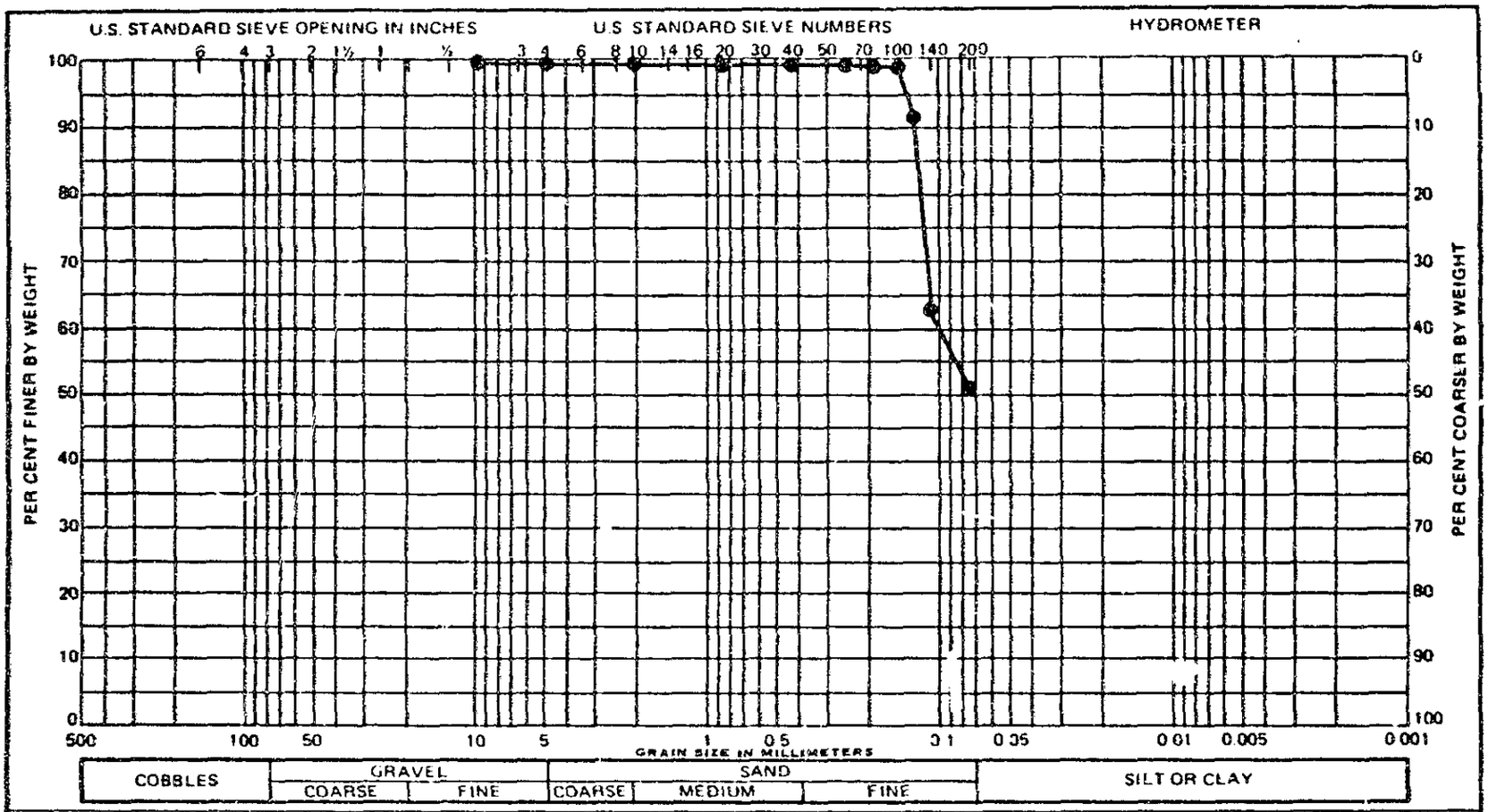
288-01

REI

REPORT OF SOIL ANALYSIS

Date 4/20/84

002401



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
W-13	11	43.5'-45'	SILTY SAND /SANDY SILT				

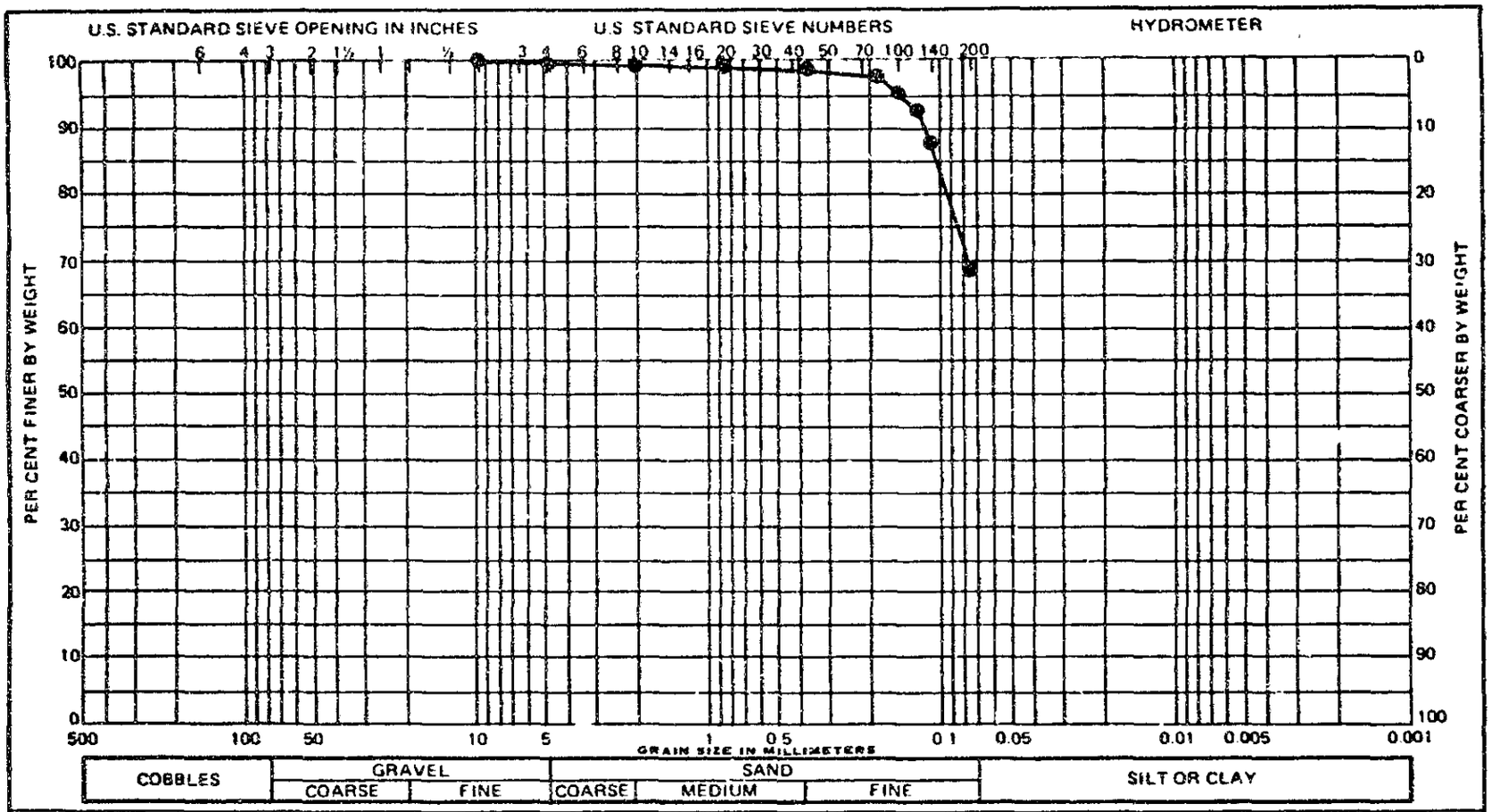
Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84

002402



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-13	18	23.5'-25'	SANDY SILT				

Project Sheridan Disposal Service

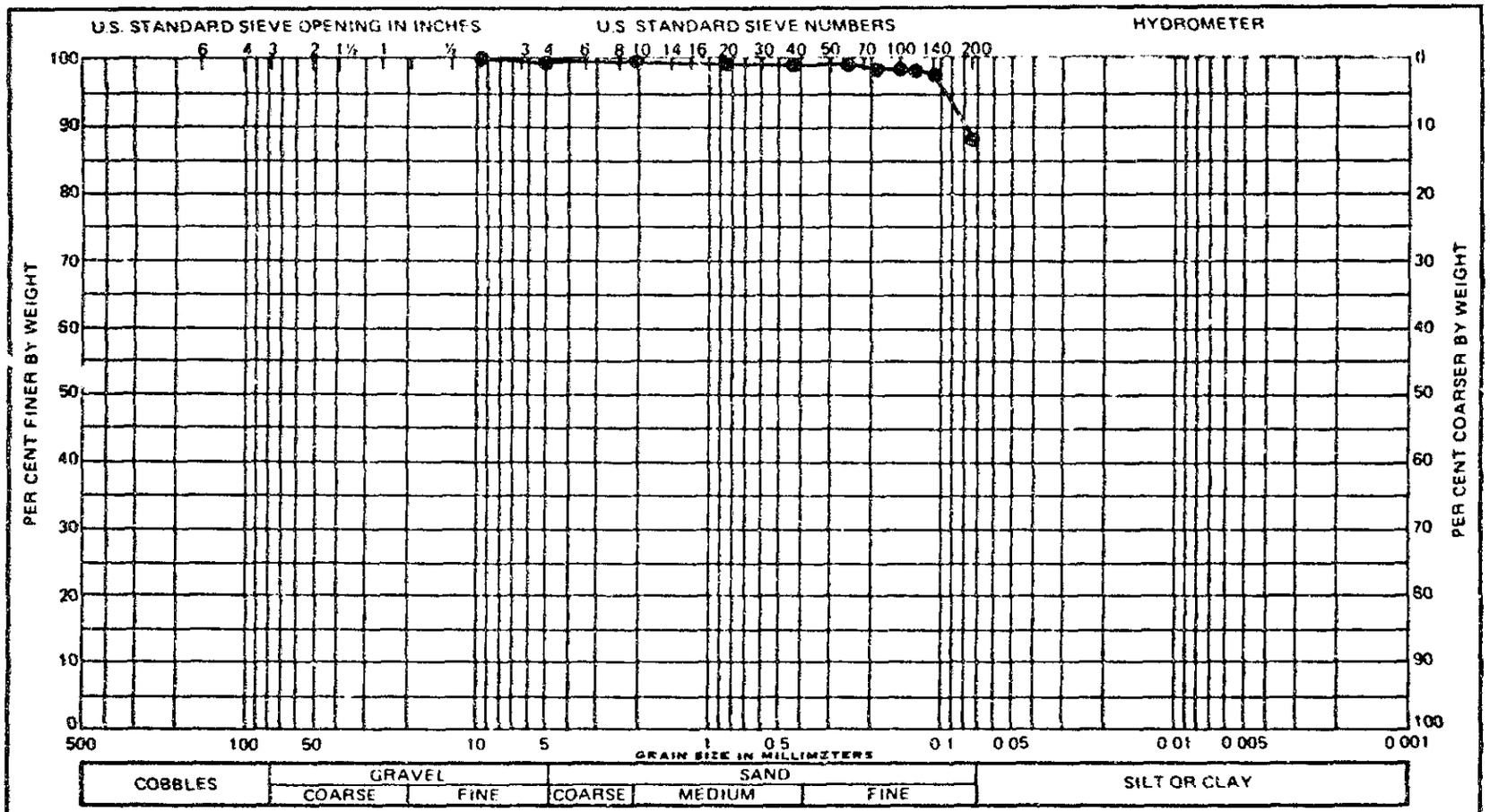
Waller County

288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



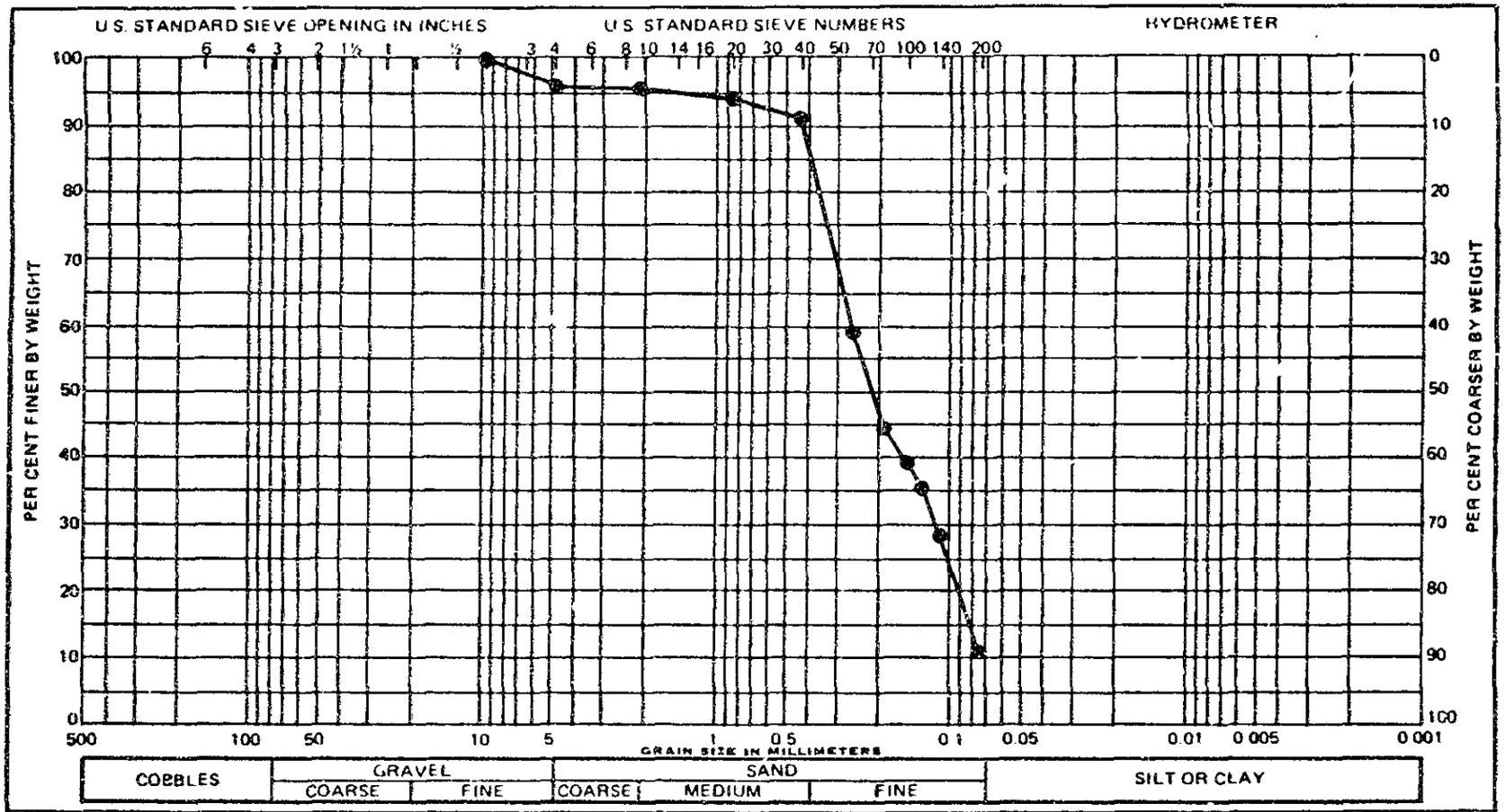
Boring No.	Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
W-14	4	18'-19.5'	SILT				

Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



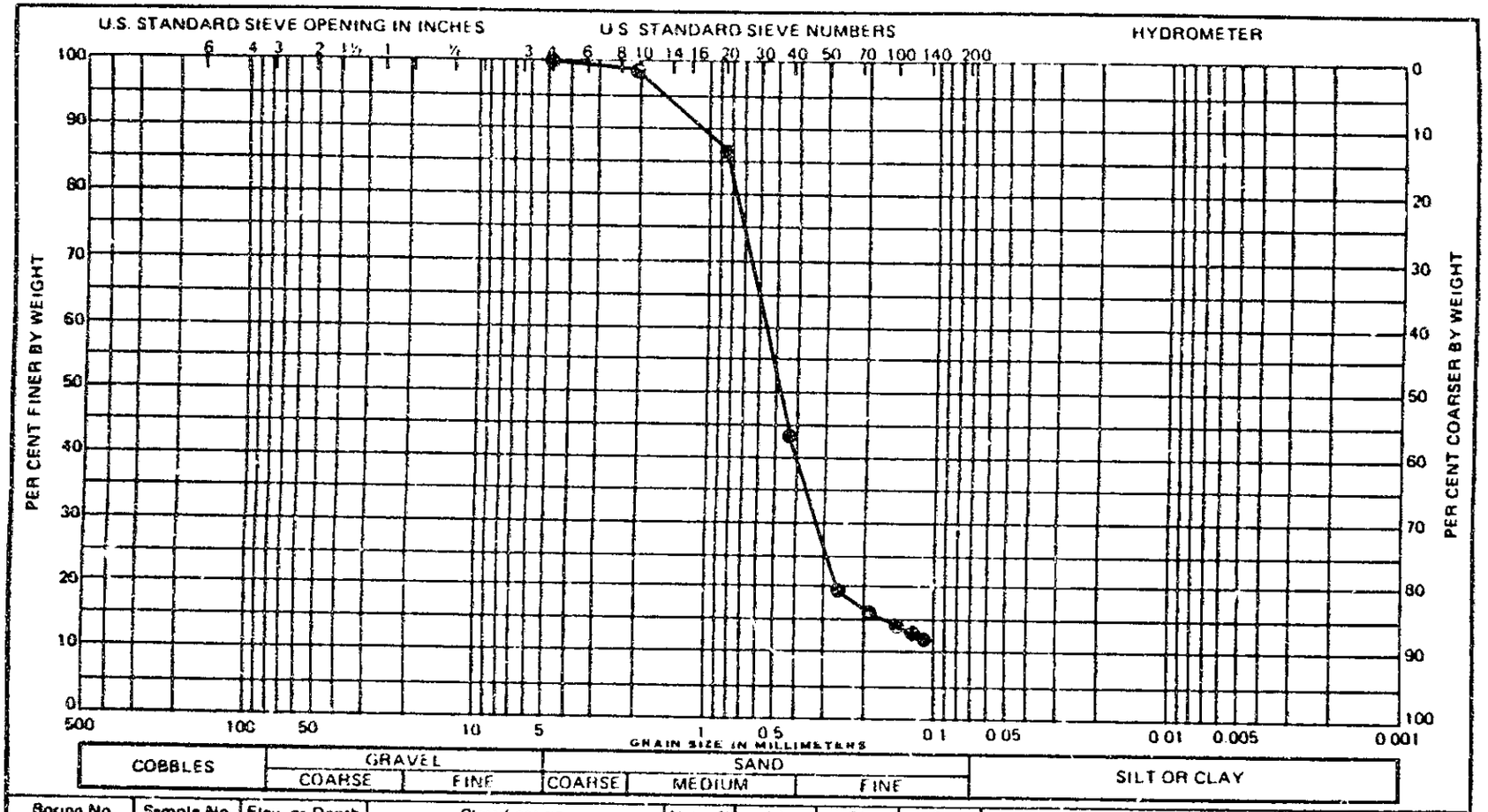
Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-14	5	48'-49.5'	SAND				

Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-14	8	98.5'-100'	SAND				

Project Sheridan Disposal Service
Waller County
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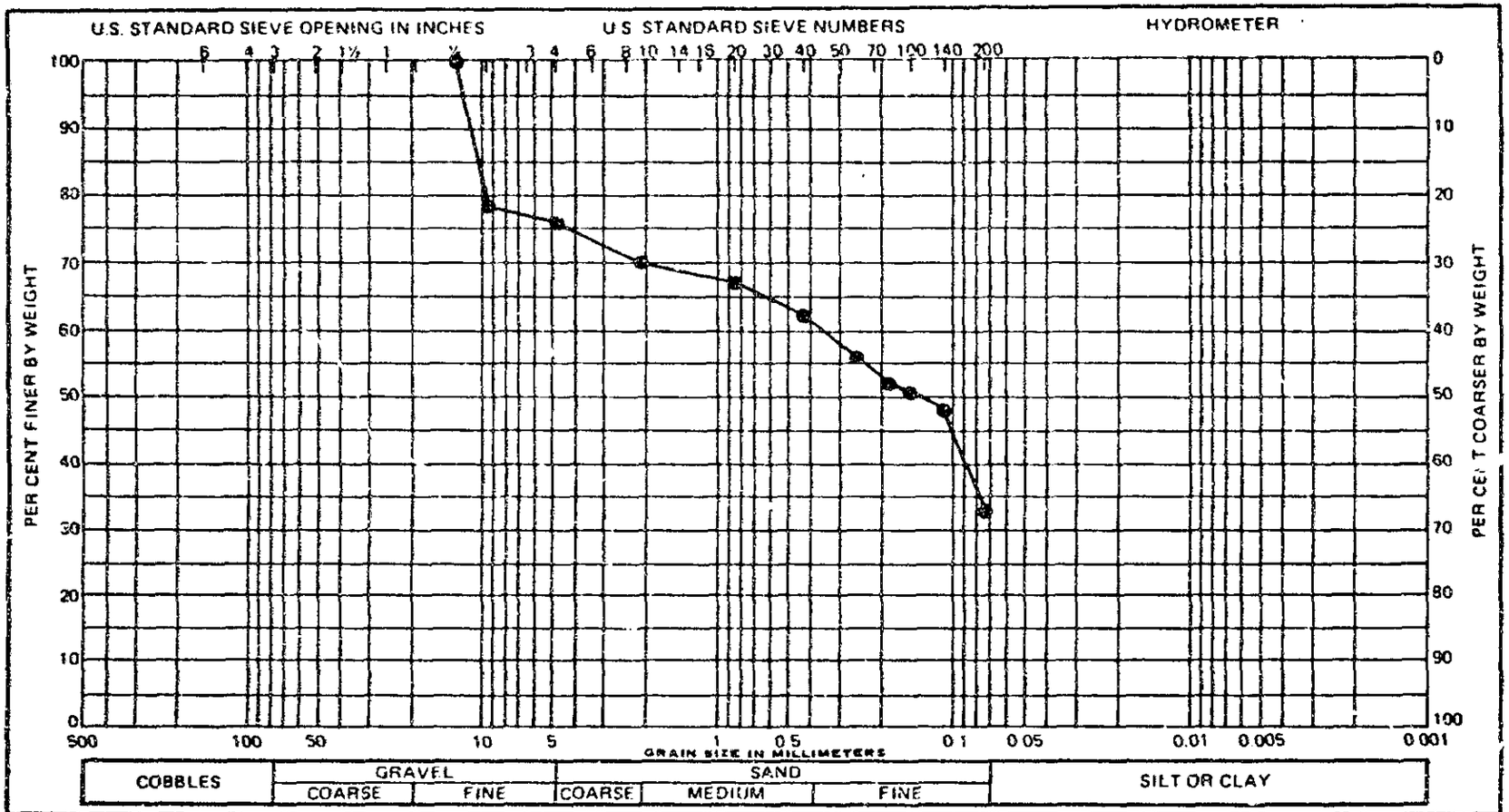
REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-15	9	48.5'-50'	SILTY SAND				

Project Sheridan Disposal Service

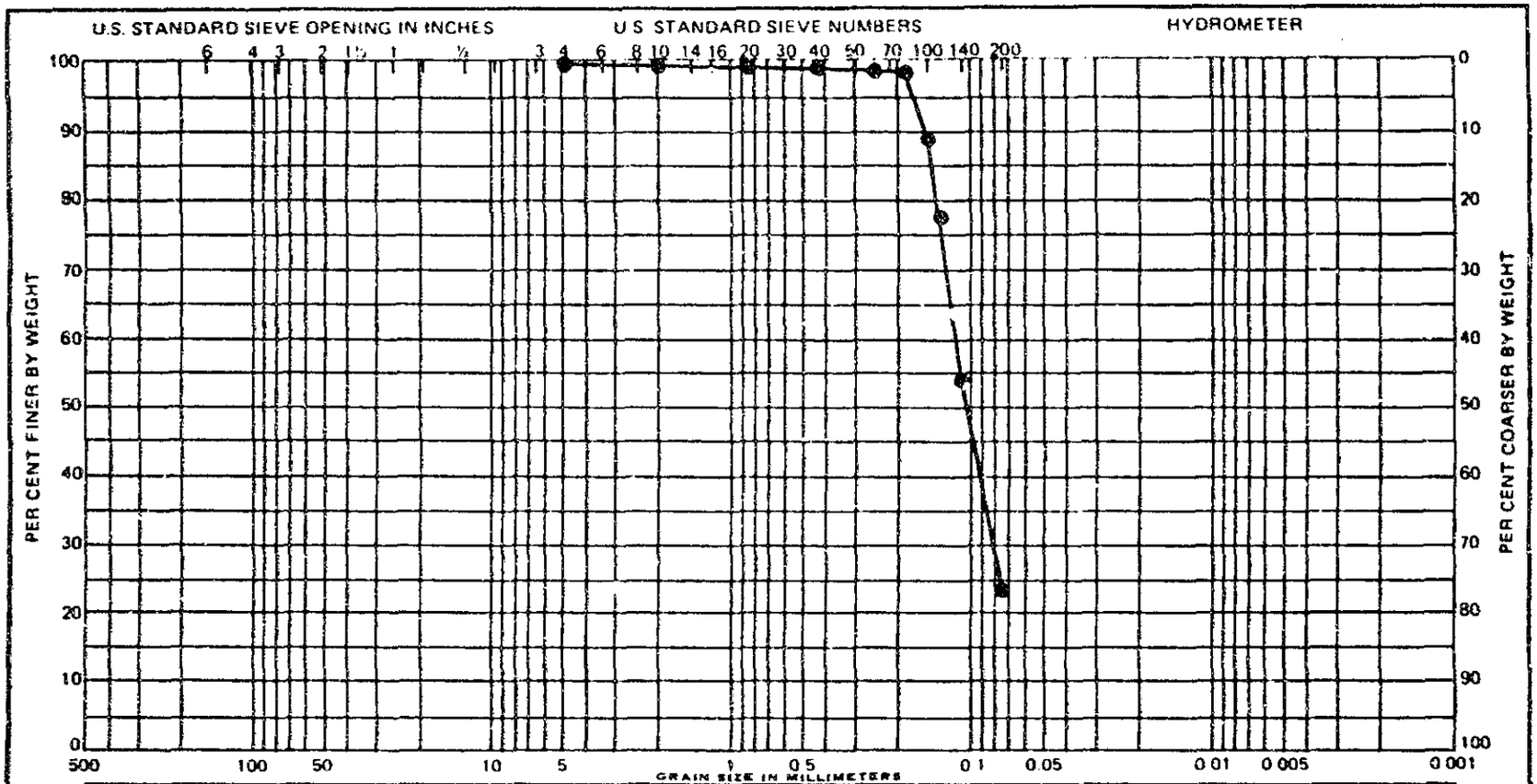
Waller County

288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-16	5	18.5'-20'	SILTY SAND				

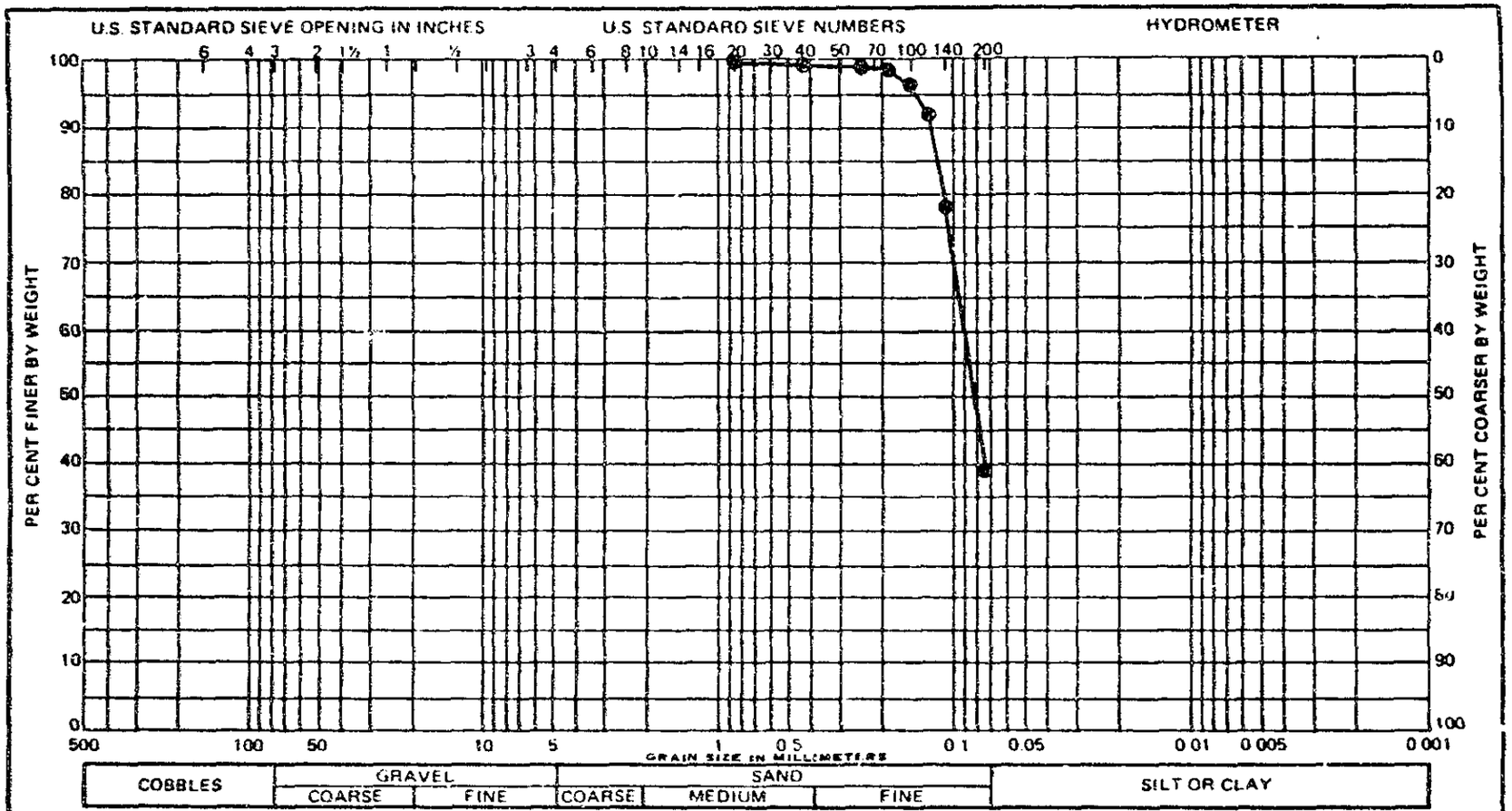
Project Sheridan Disposal Service, Waller County 288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84

002408



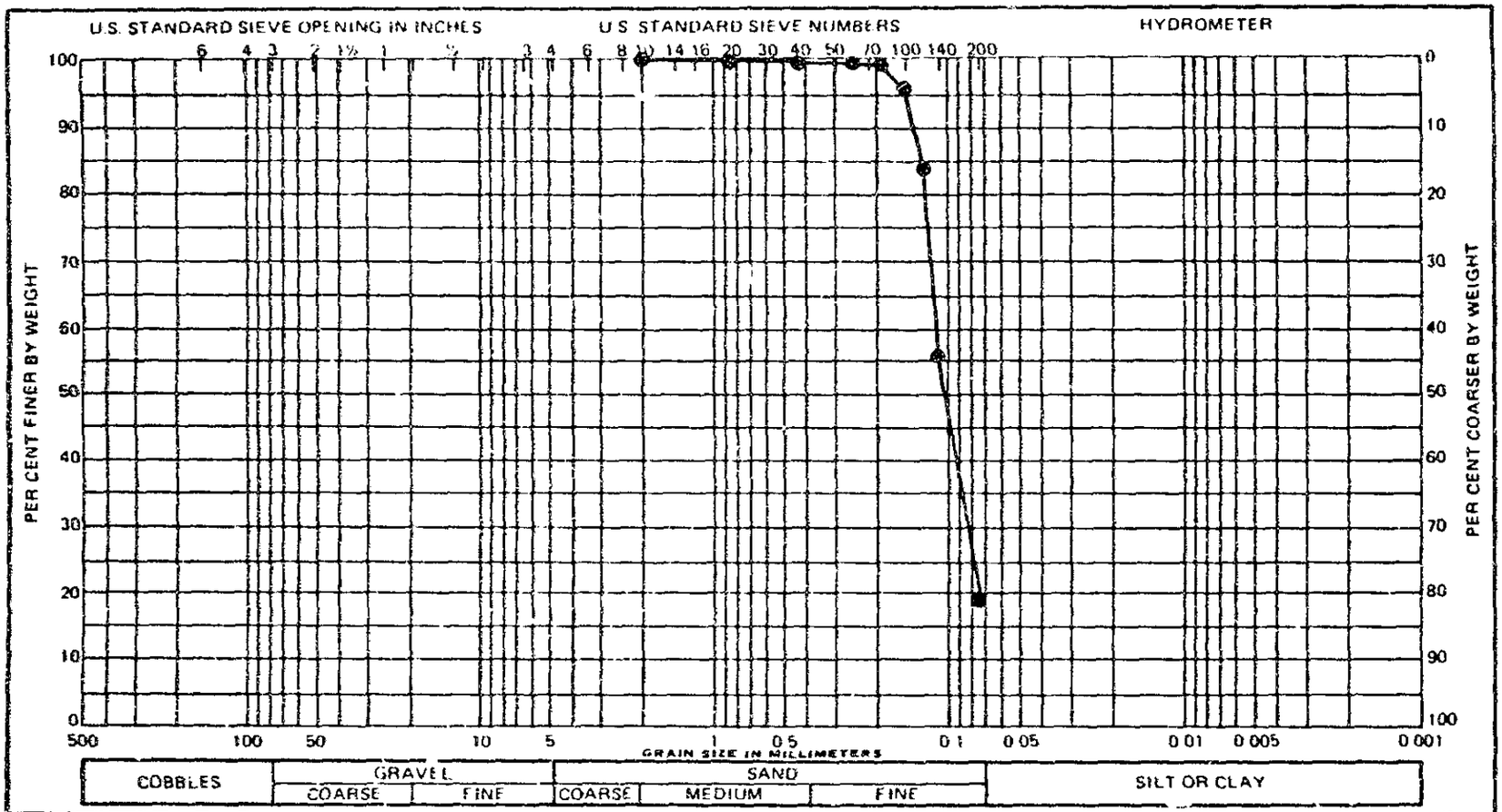
Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-16	6	28.5'-30'	SILTY SAND				

Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-16	7	38.5'-40'	SILTY SAND				

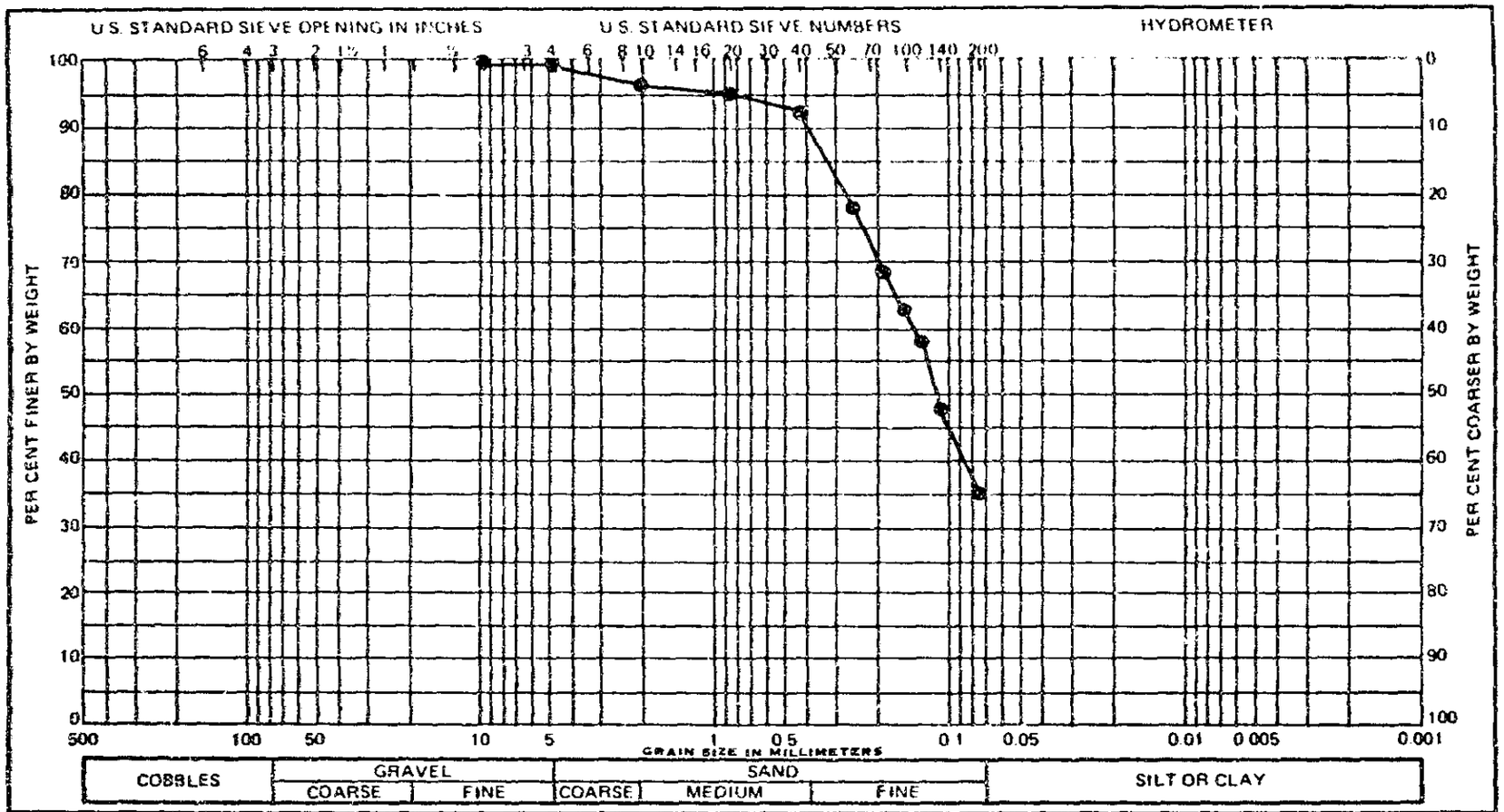
Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84

002410



Boring No.	Sample No	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-16	8	48.5'-50'	SILTY SAND				

Project Sheridan Disposal Service

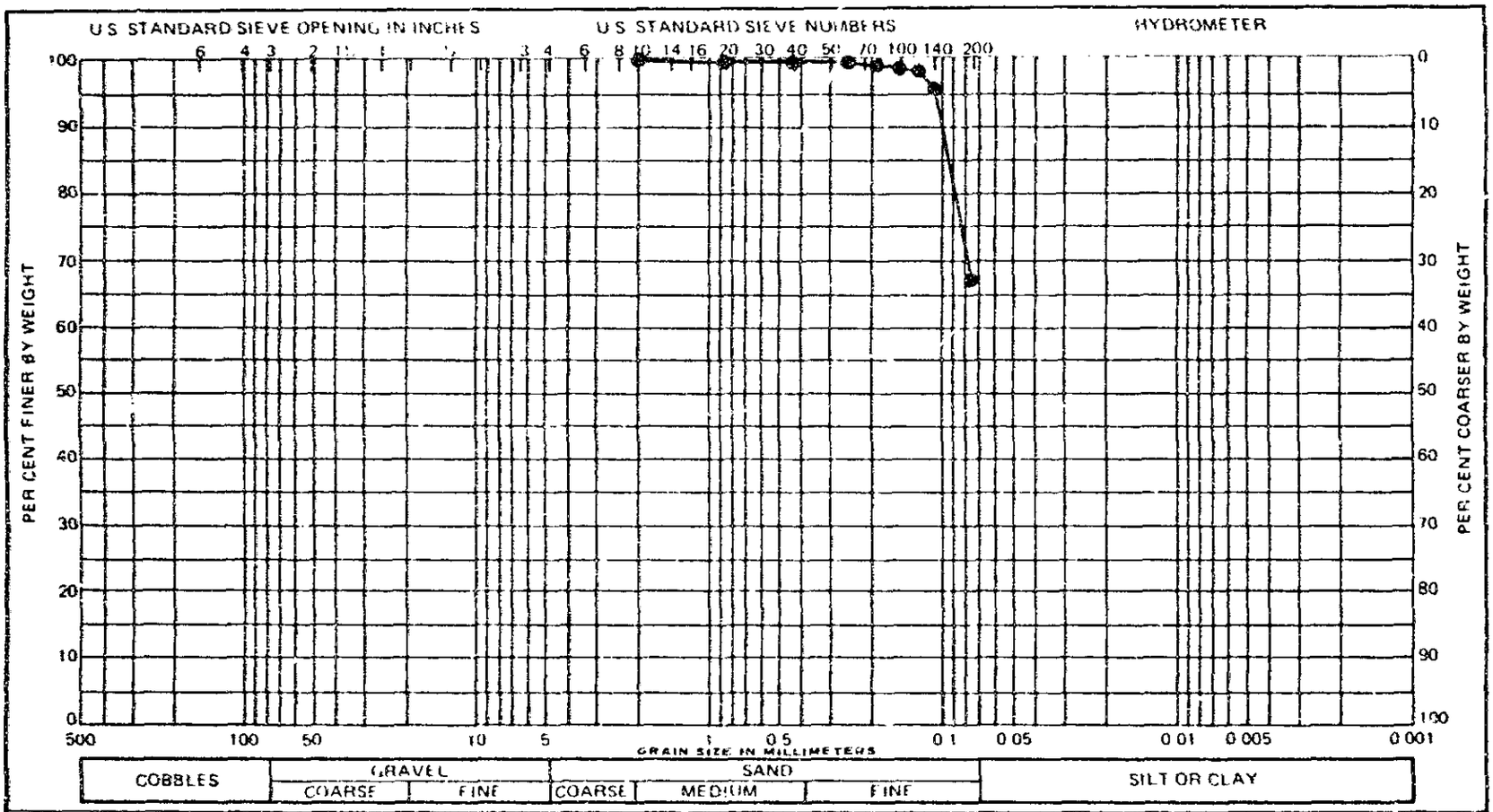
Waller County

288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84



Boring No.	Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
W-17	2	8'-10'	SANDY CLAY				

Project Sheridan Disposal Service

Waller County

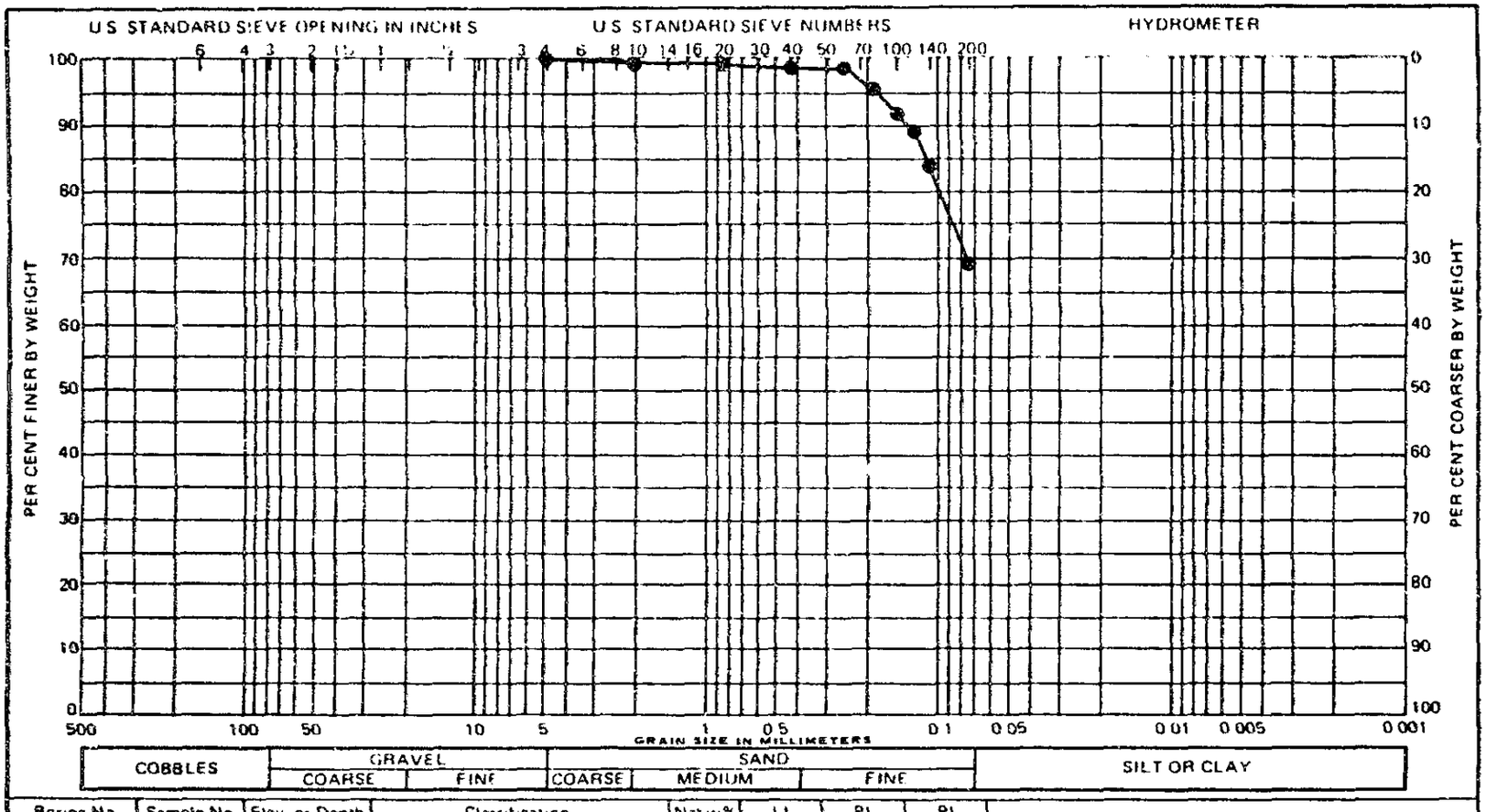
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84

002412



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI
W-17	4	18'-19.5'	SANDY SILT				

Project Sheridan Disposal Service
Waller County
288-01

REI

REPORT OF SOIL ANALYSIS

Date 7/2/84

APPENDIX 4B

MONITOR WELL CONSTRUCTION DETAILS

002414

MW-1 became plugged with silt. It was blown out and reconstructed with 1 inch PVC. The new total depth is 40.5 feet.

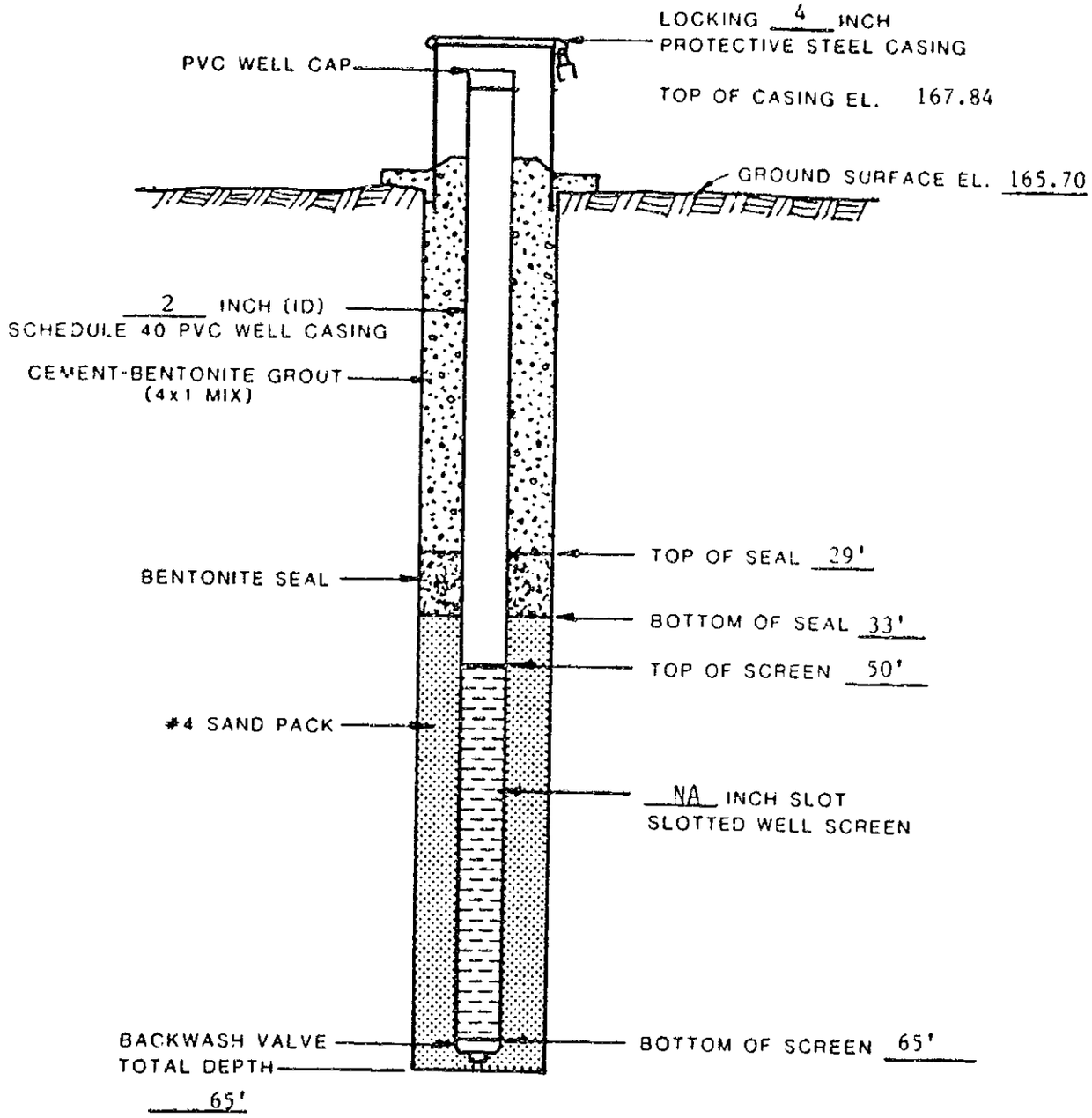
002415

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-1

DATE INSTALLED: 7/14/83



RESOURCE ENGINEERING INC.

ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION

MW-1 (ORIGINAL)

DRAWN BY:	DATE:	PROJECT NO.

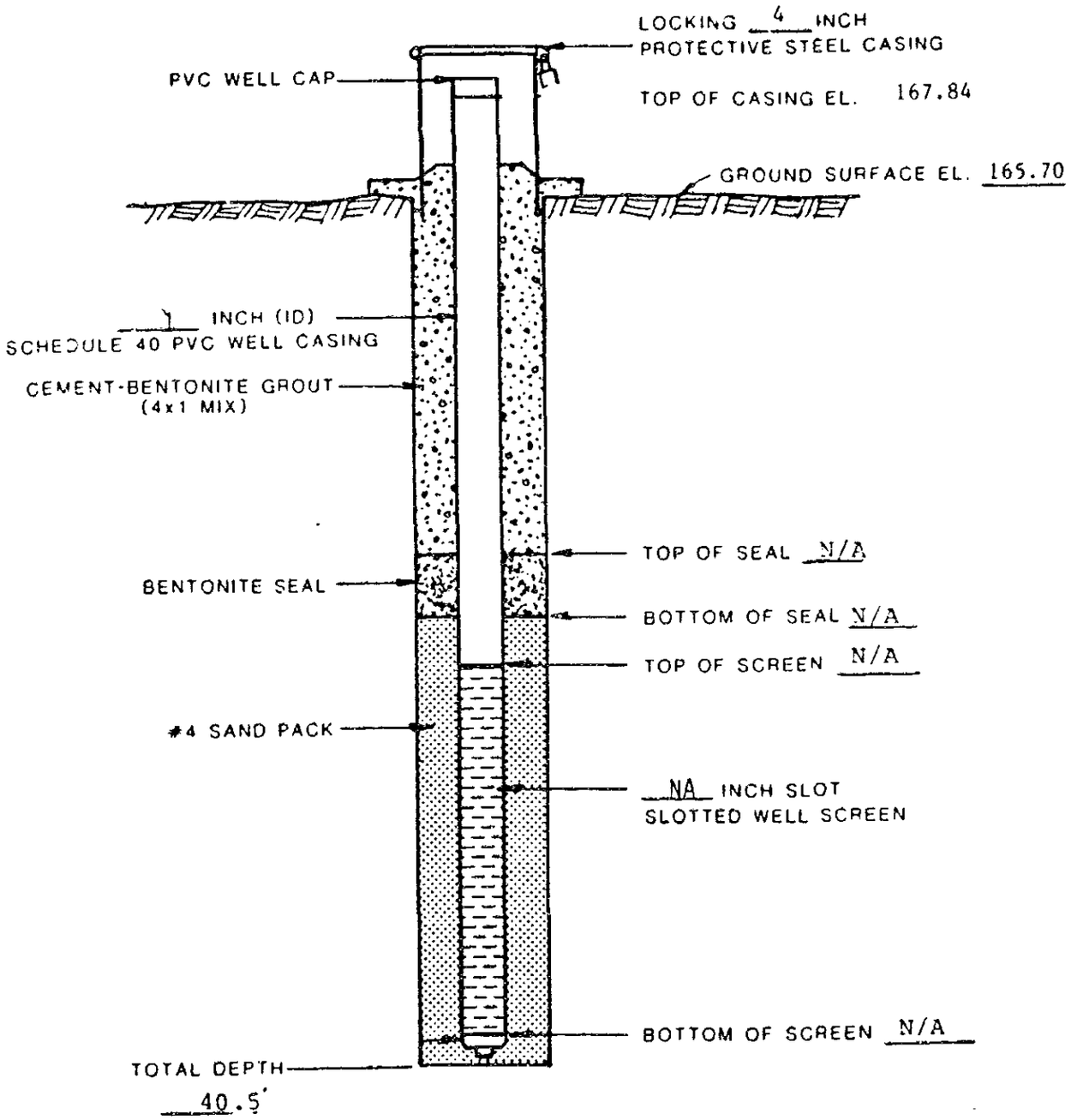
002416

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-1

DATE INSTALLED: 7/14/83



002417

RESOURCE ENGINEERING INC.

ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

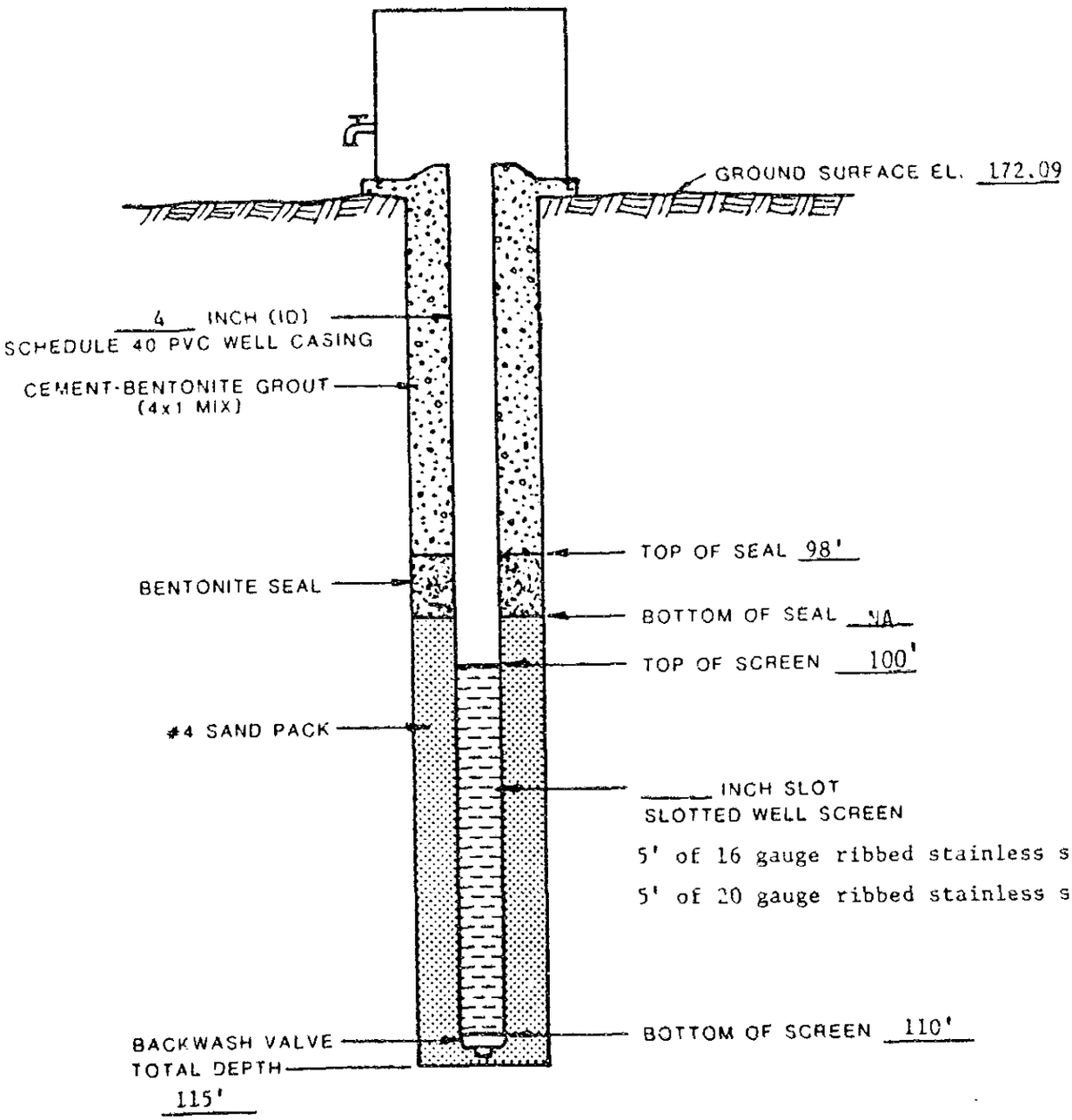
DETAILS OF MONITOR WELL CONSTRUCTION MW-1 (REVISED)

DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: _____ BORING NUMBER: MW-2

PROJECT NUMBER: 288-04 DATE INSTALLED: 1/6/72

CURRENTLY USED FOR A STOCK WATERING WELL



RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-2

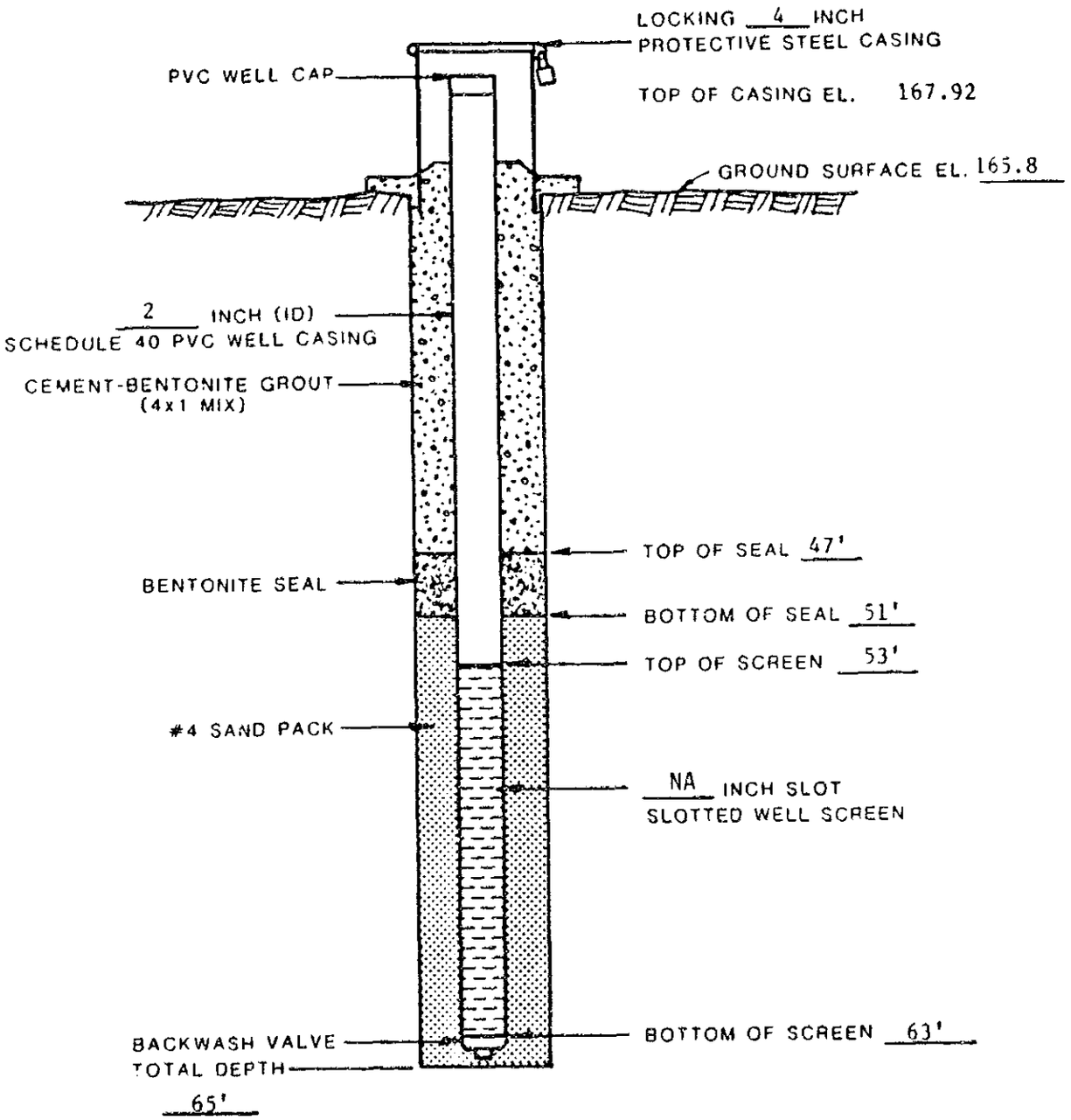
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-3

DATE INSTALLED: 7/13/83



RESOURCE ENGINEERING INC.

ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

DETAILS OF
MONITOR WELL CONSTRUCTION
MW-3

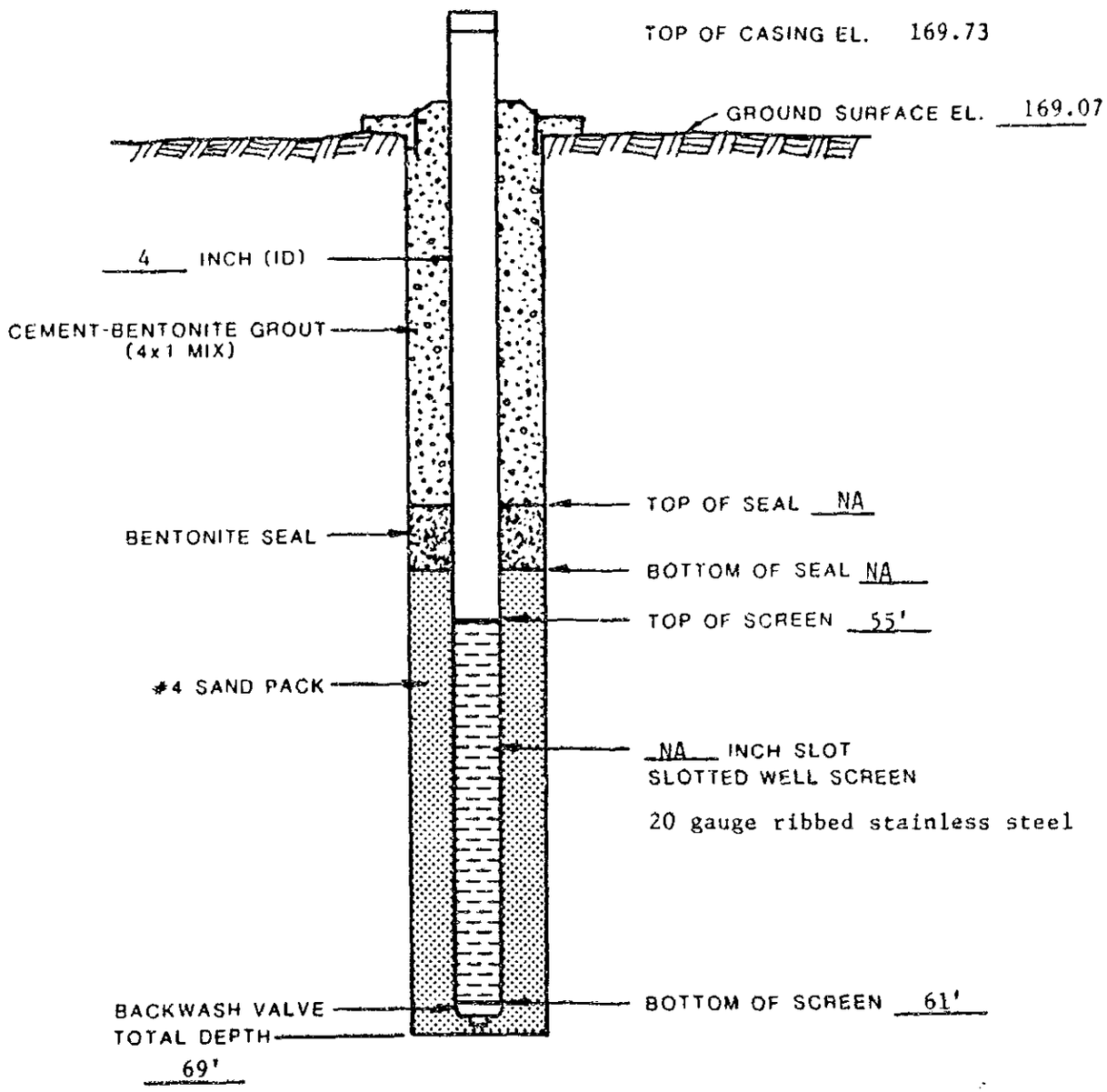
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

BORING NUMBER: MW-4

PROJECT NUMBER: 288-04

DATE INSTALLED: 1/7/72



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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-4

DRAWN BY: | DATE: | PROJECT NO.

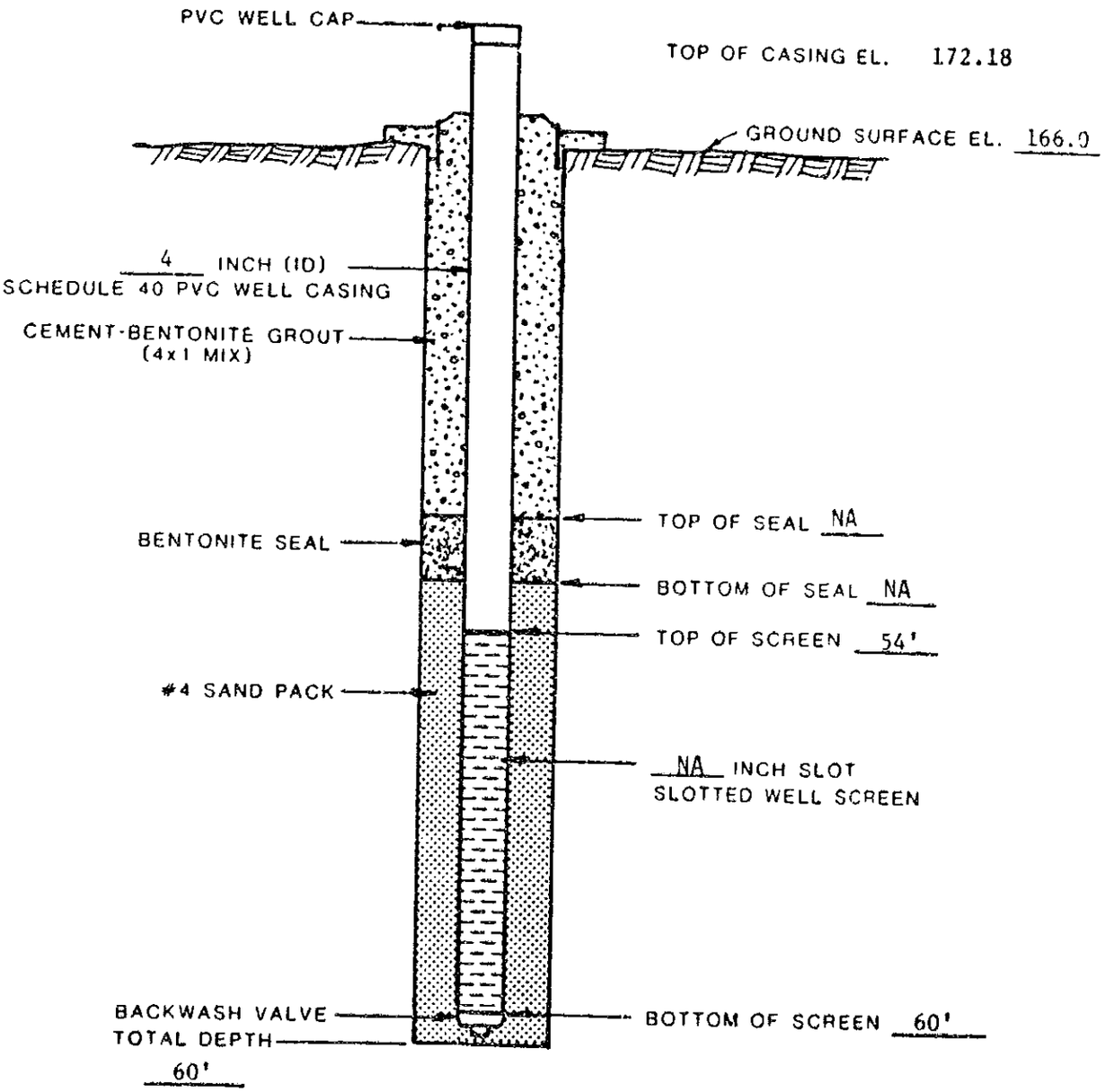
02420

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-5

DATE INSTALLED: 5/63



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DETAILS OF MONITOR WELL CONSTRUCTION MW-5

DRAWN BY: | DATE: | PROJECT NO.

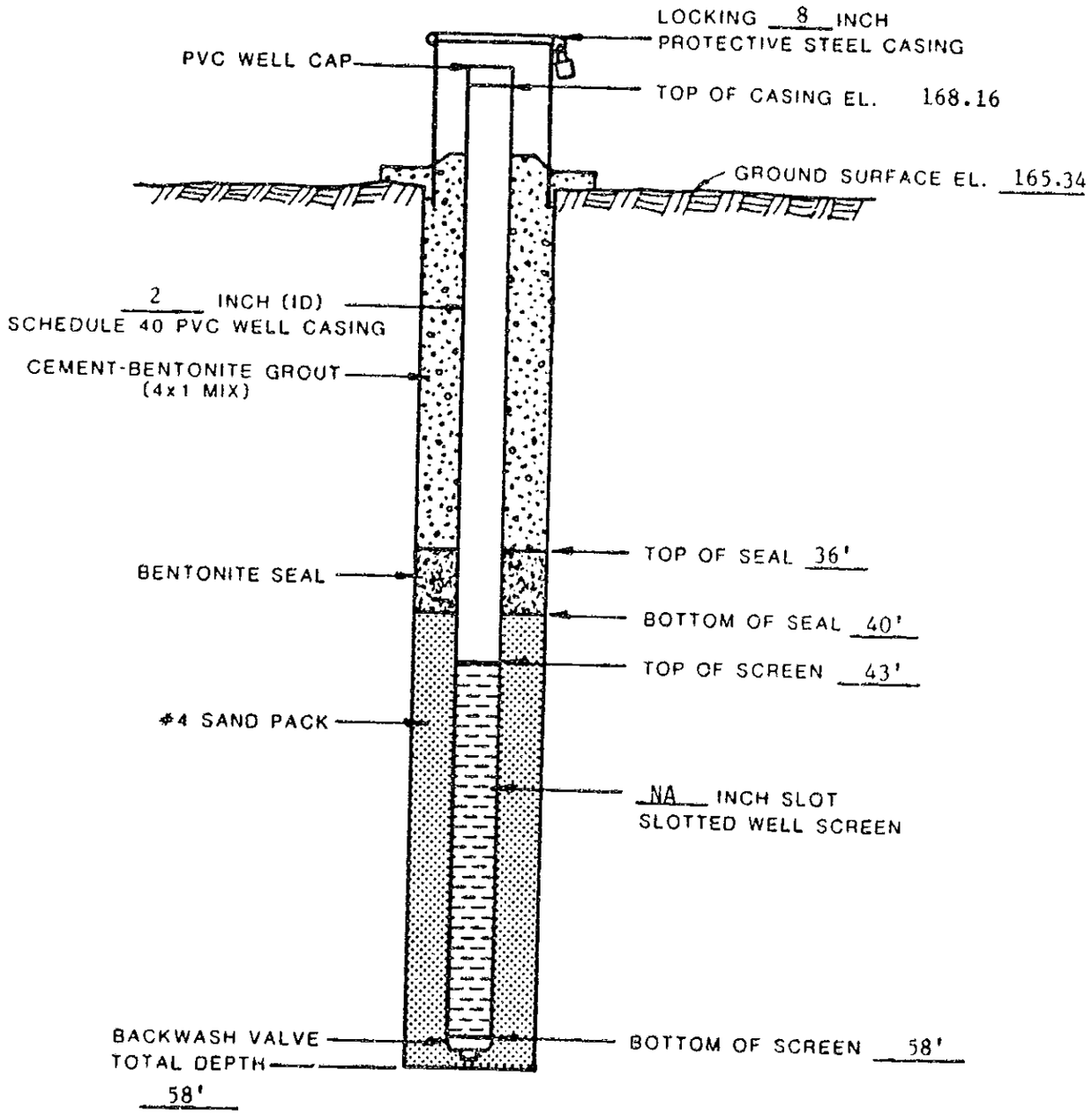
002421

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-6

DATE INSTALLED: 7/14/83



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DETAILS OF MONITOR WELL CONSTRUCTION MW-6

DRAWN BY:	DATE:	PROJECT NO.

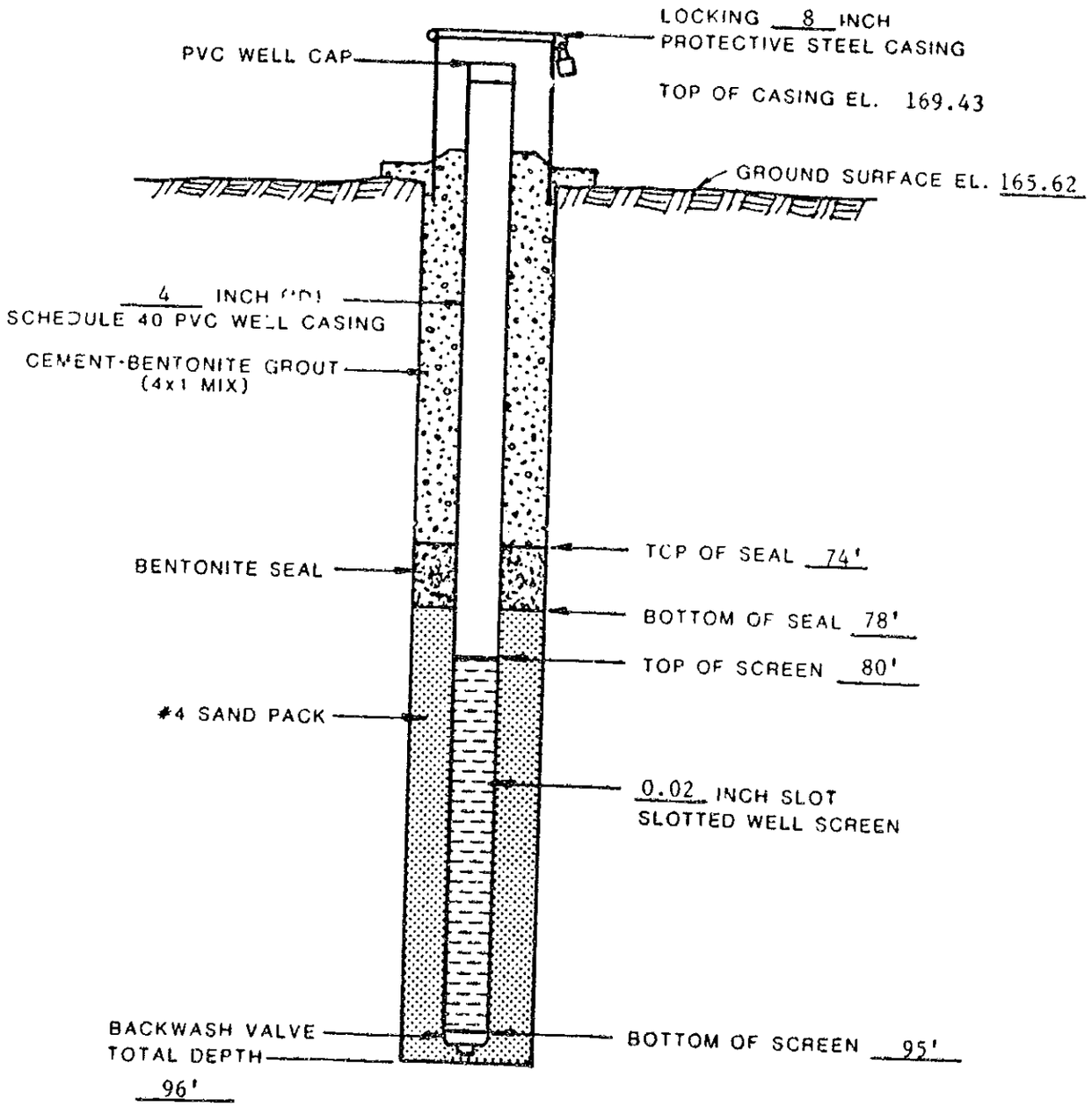
J02422

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-7

DATE INSTALLED: 3/29/84



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HOUSTON TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-7

DRAWN BY: | DATE: | PROJECT NO.

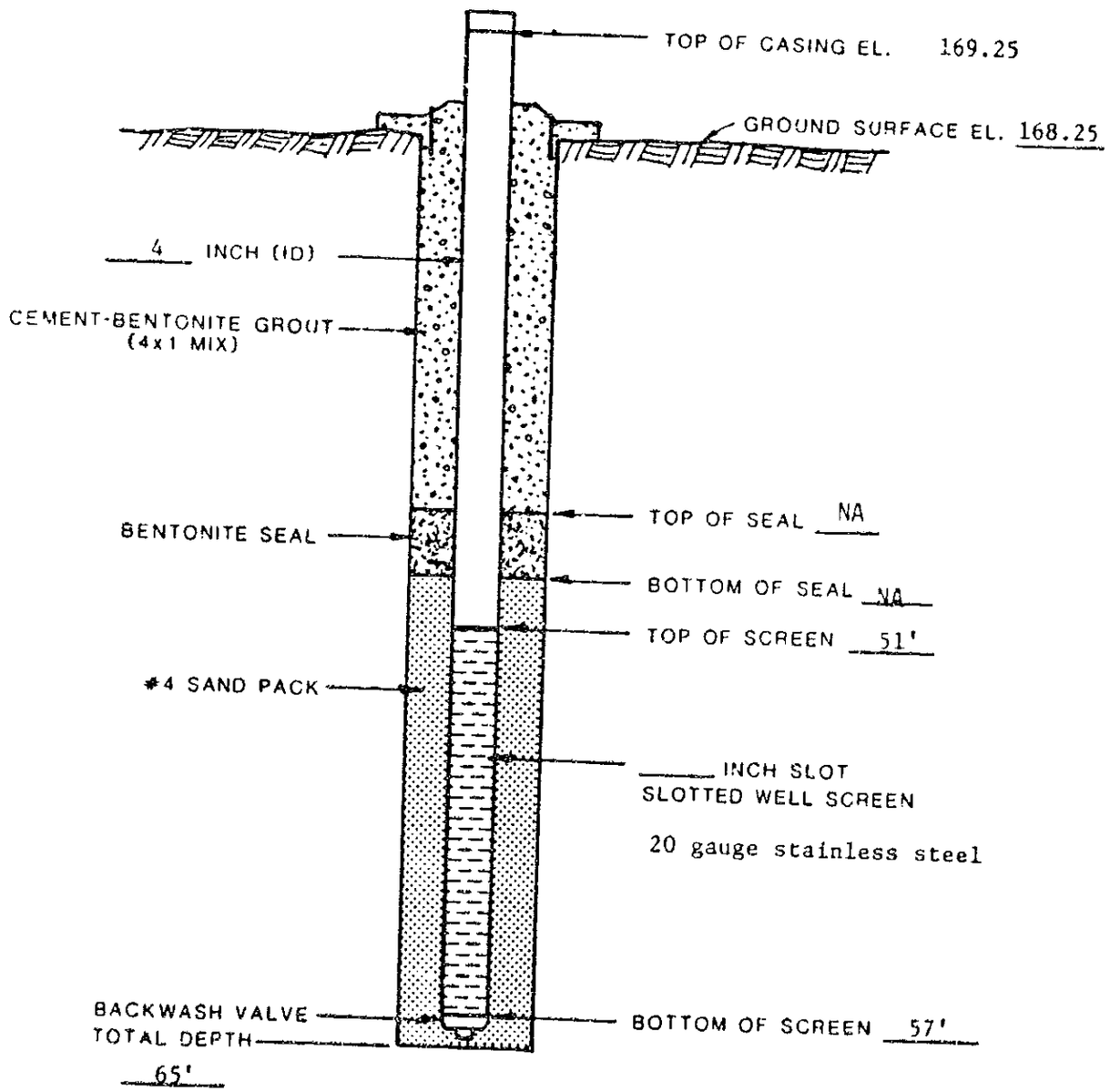
302423

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-8

DATE INSTALLED: 1/7/82



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DETAILS OF MONITOR WELL CONSTRUCTION MW-8

DRAWN BY:	DATE:	PROJECT NO.

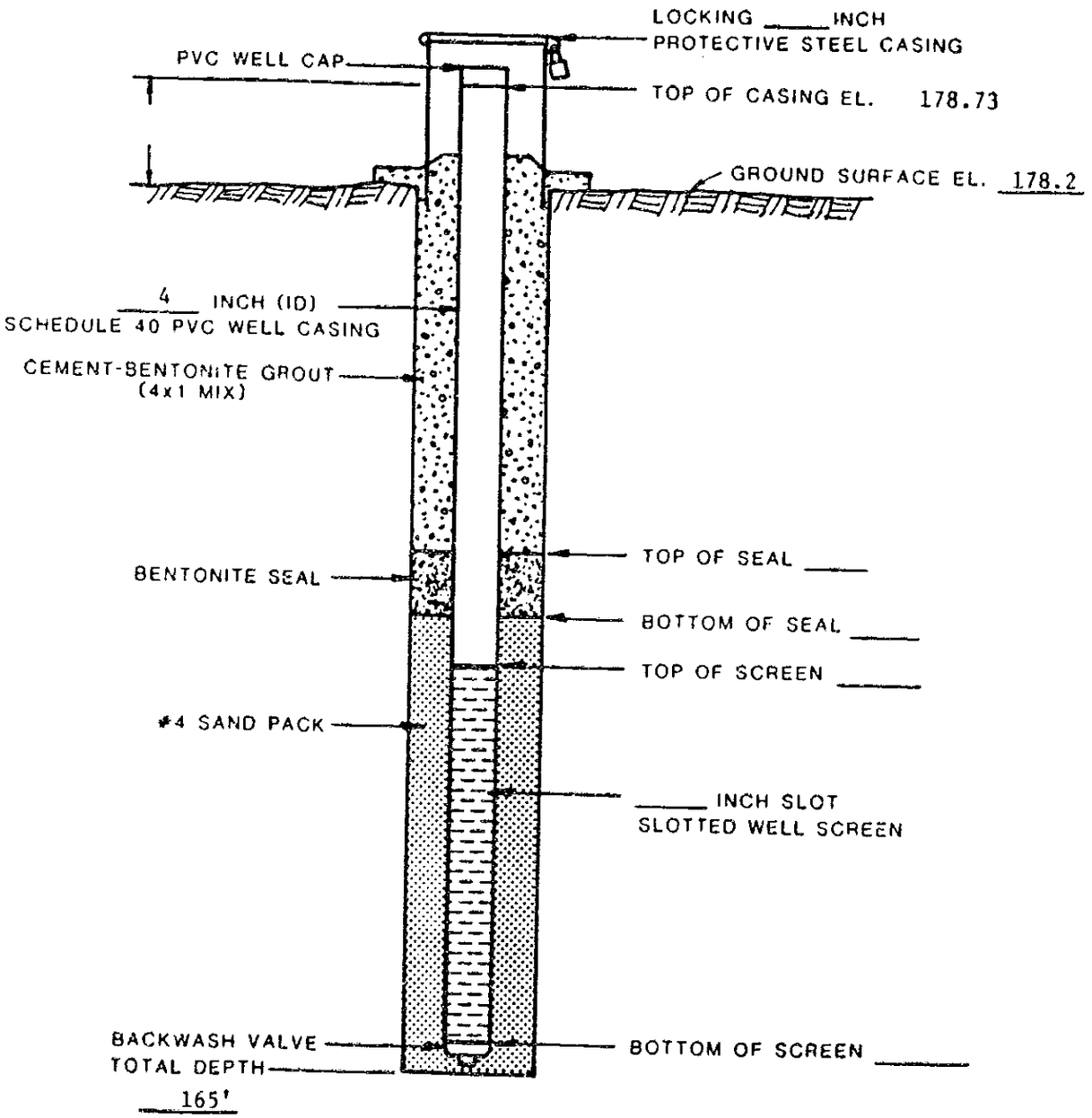
PROJECT NAME: Sheridan

BORING NUMBER: Well-9

PROJECT NUMBER: 288-04

DATE INSTALLED: _____

PRODUCTION WELL, CONSTRUCTION DETAILS UNKNOWN



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DETAILS OF MONITOR WELL CONSTRUCTION MW-9

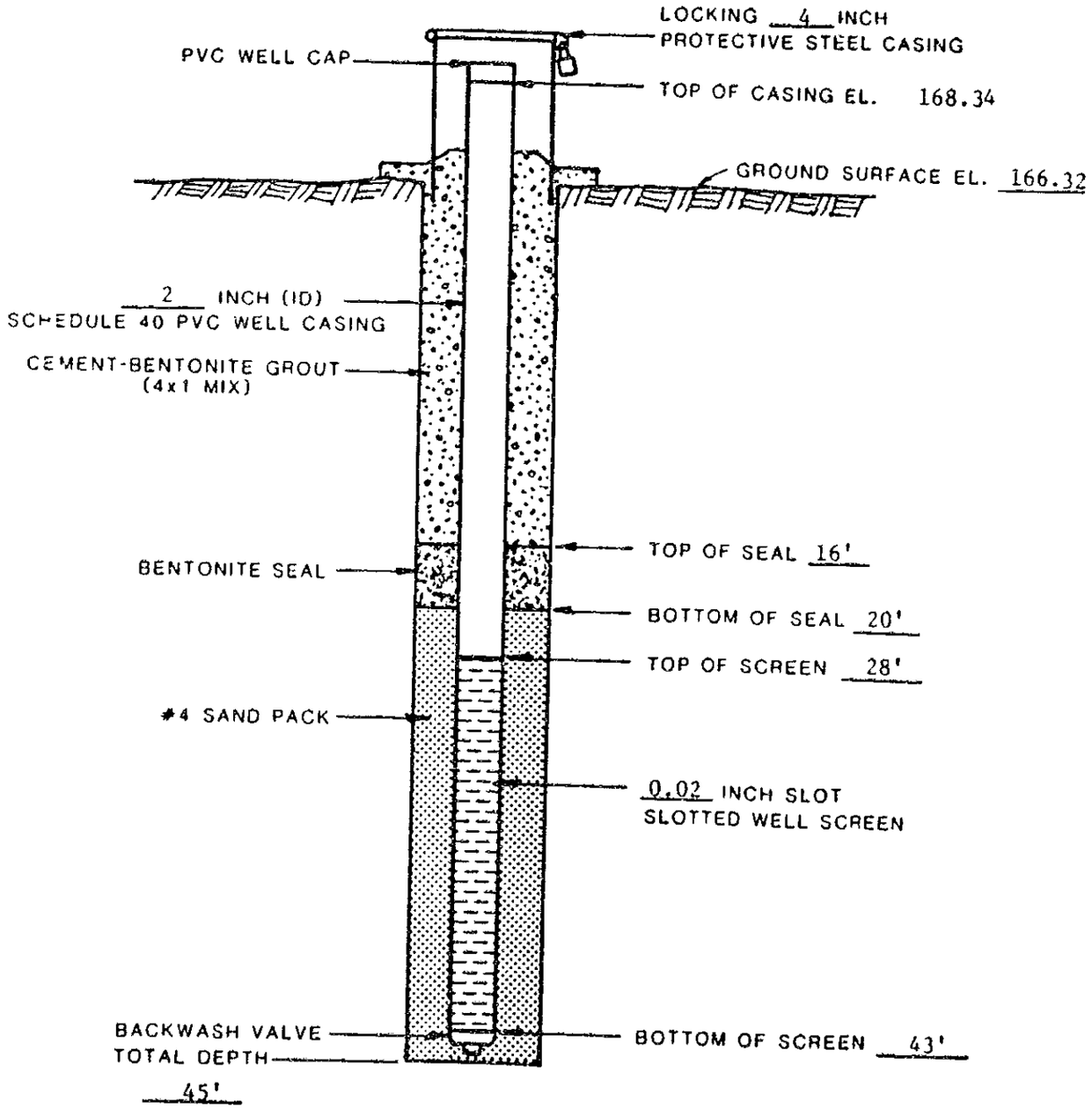
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-10

DATE INSTALLED: 3/31/84



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DETAILS OF MONITOR WELL CONSTRUCTION MW-10

DRAWN BY: | DATE: | PROJECT NO.

002420

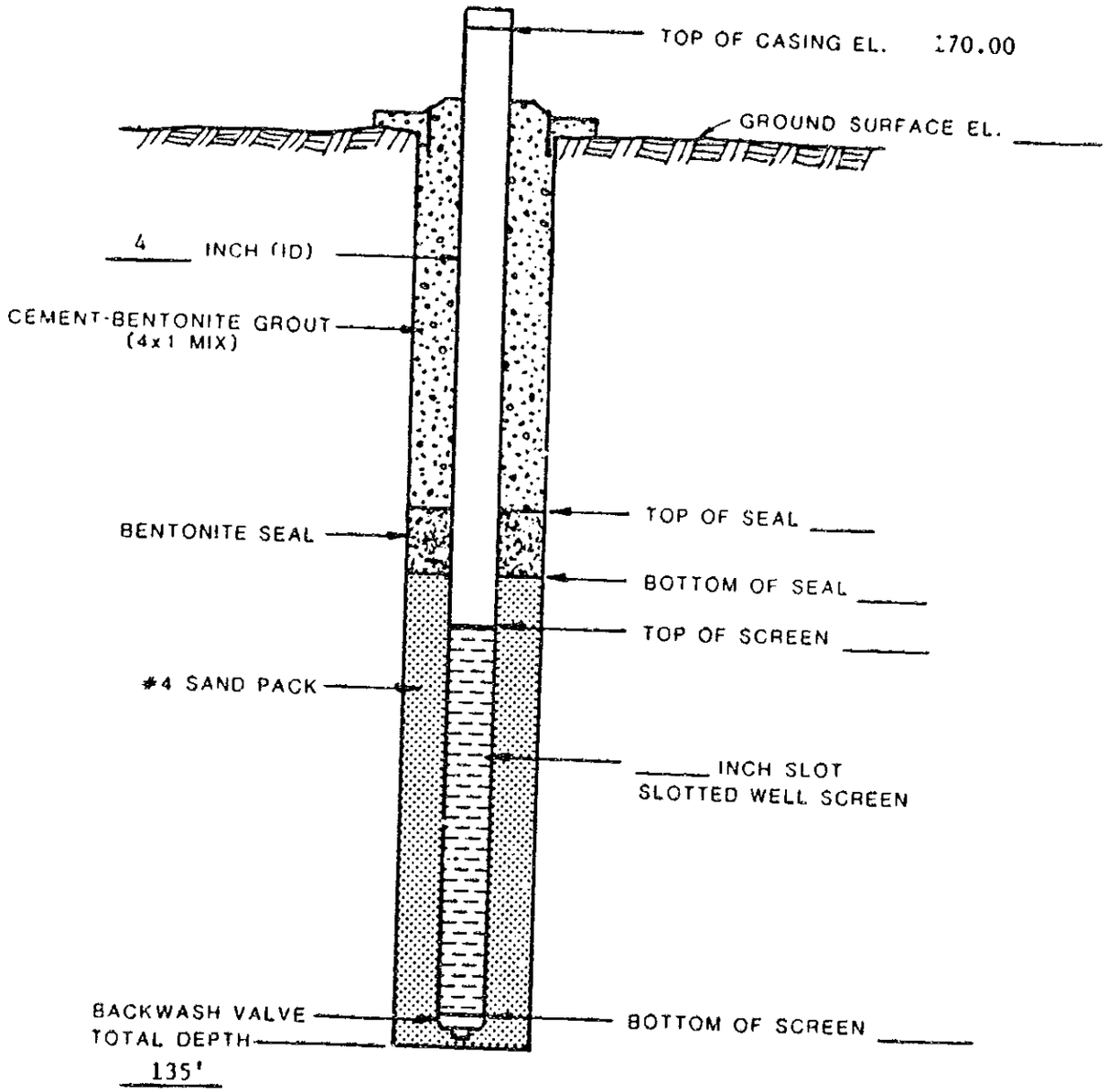
PROJECT NAME: Sheridan

BORING NUMBER: Well-11

PROJECT NUMBER: 288-04

DATE INSTALLED:

CONSTRUCTION DETAILS UNKNOWN



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HOUSTON TEXAS

DETAILS OF
MONITOR WELL CONSTRUCTION
MW-11

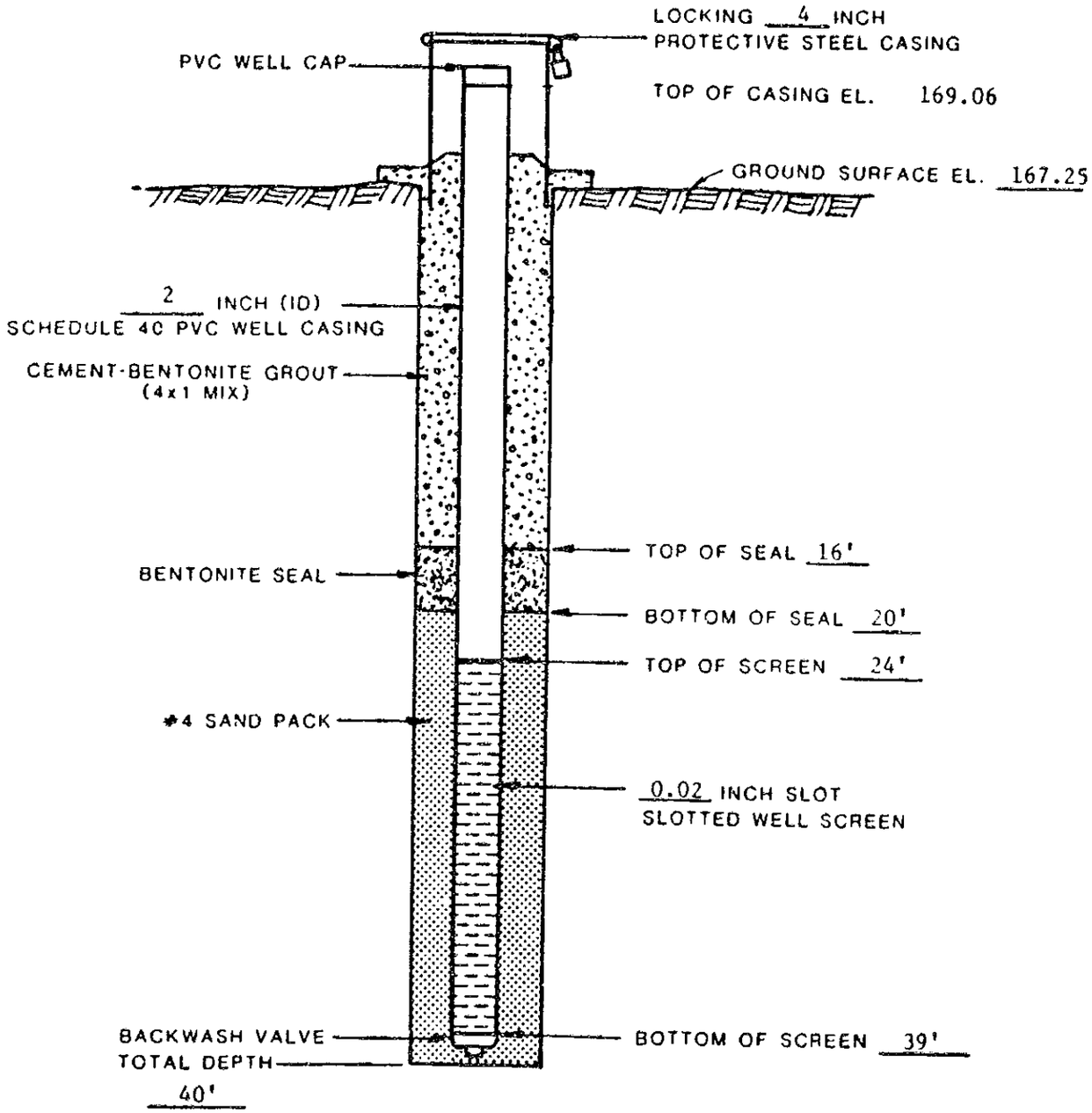
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-12

DATE INSTALLED: 4/3/84



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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-12

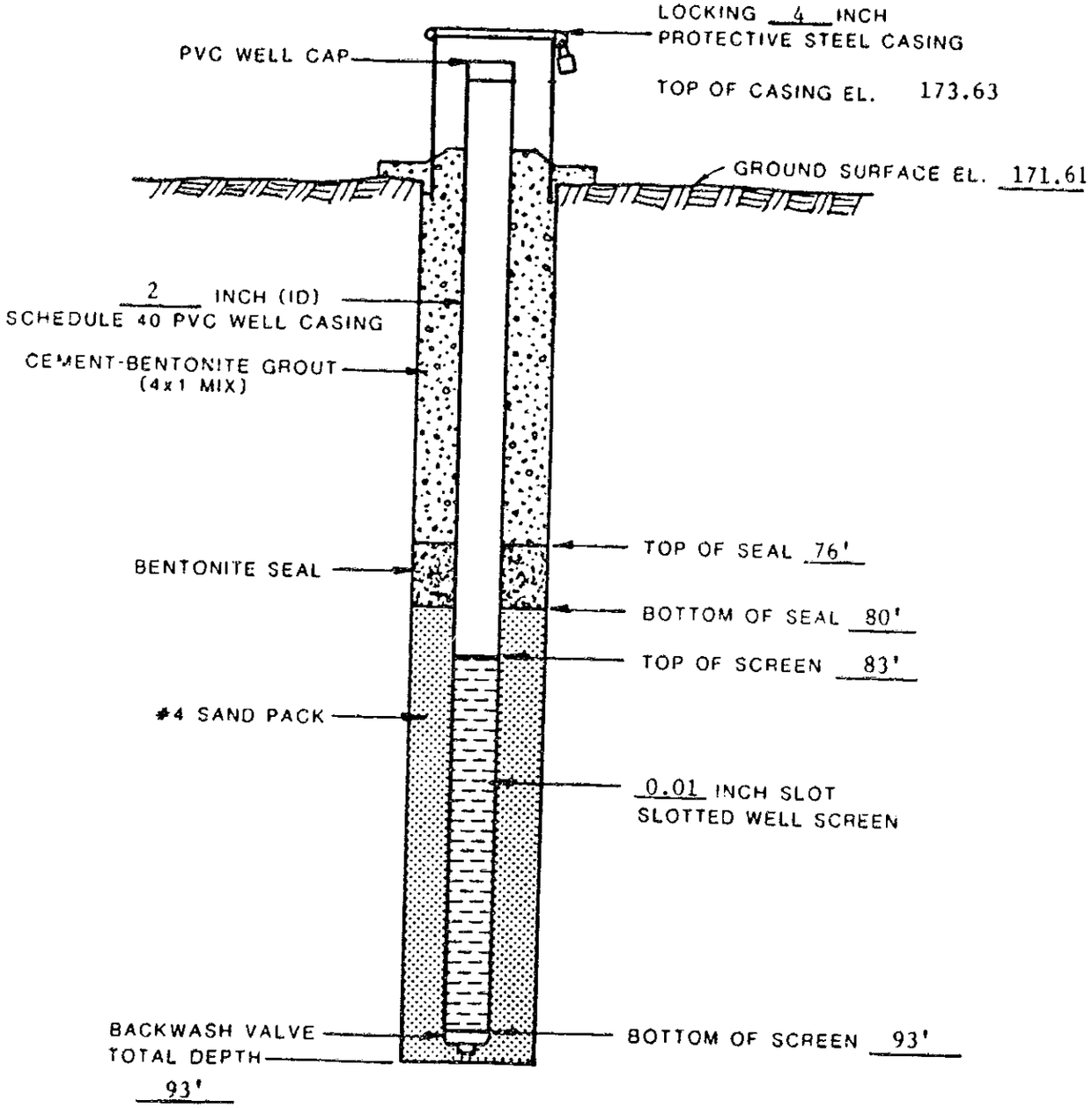
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-13

DATE INSTALLED: 6/7/84



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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-13

DRAWN BY:	DATE:	PROJECT NO.

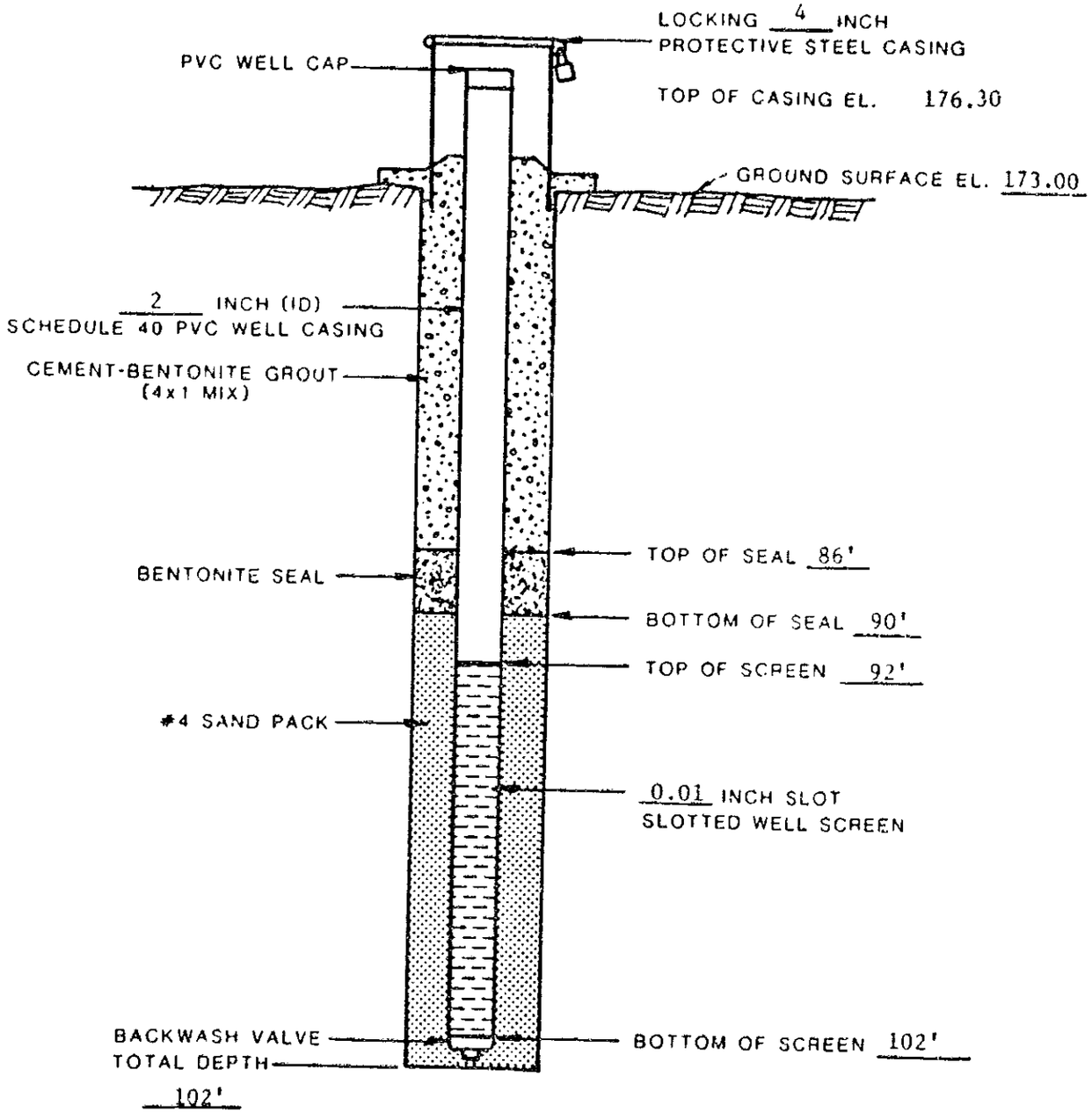
002420

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-14

DATE INSTALLED: 6/10/84



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DETAILS OF MONITOR WELL CONSTRUCTION MW-14

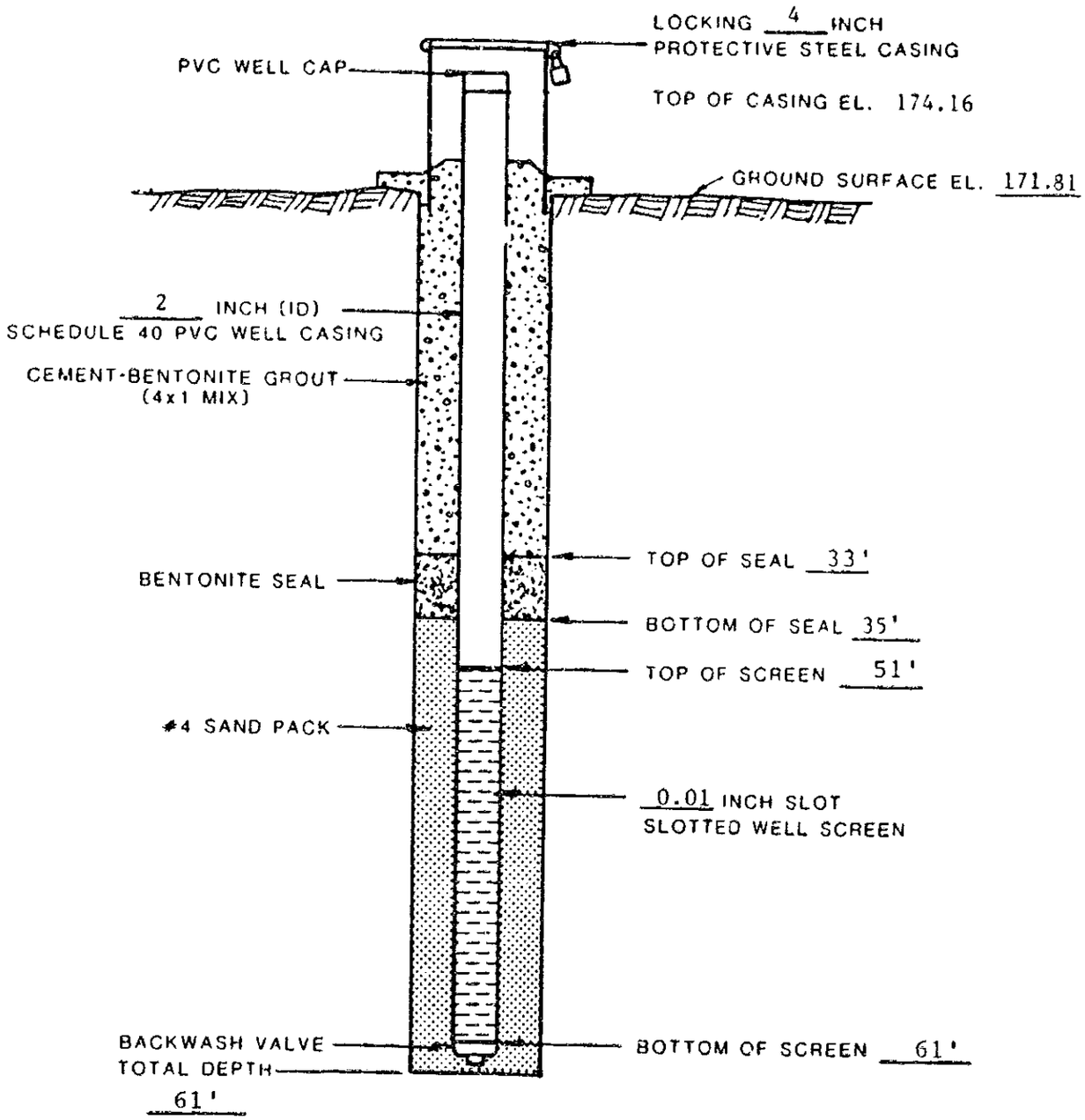
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-15

DATE INSTALLED: 6/9/84



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DETAILS OF MONITOR WELL CONSTRUCTION MW-15

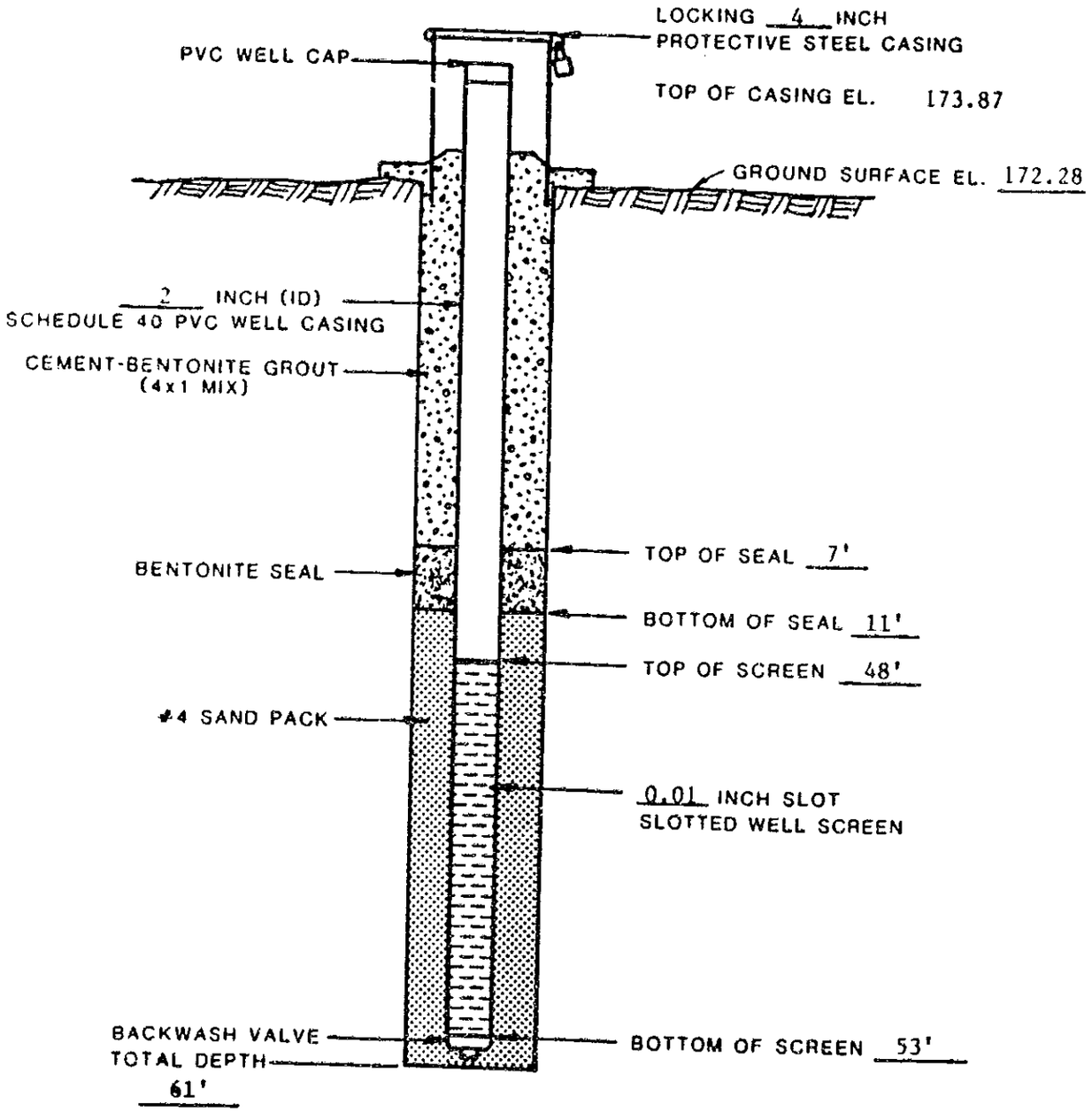
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-16

DATE INSTALLED: 6/9/84



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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-16

DRAWN BY:	DATE:	PROJECT NO.

302432

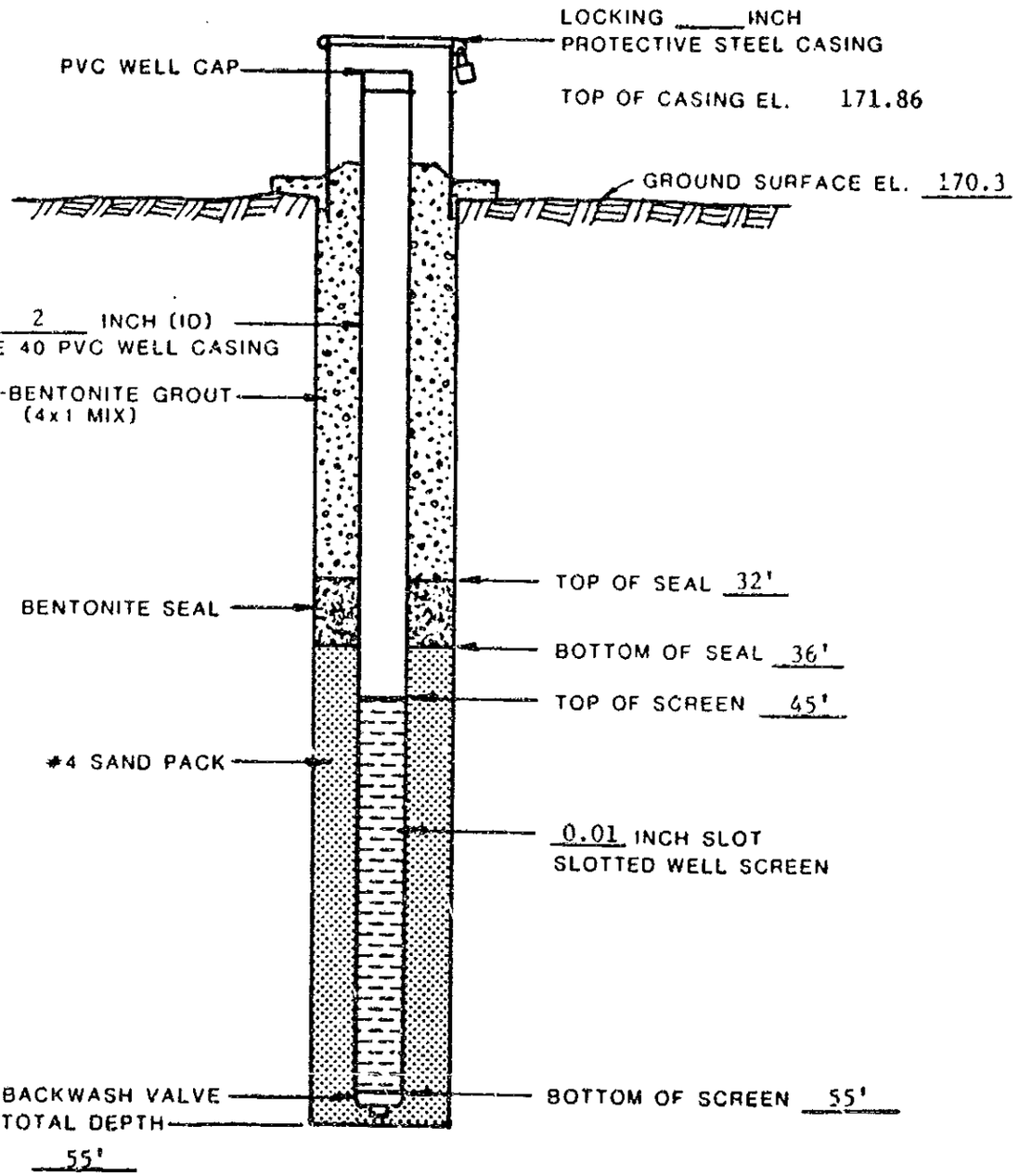
PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-17

DATE INSTALLED: 6/11/84

ACCIDENTLY DESTROYED



002433

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DETAILS OF MONITOR WELL CONSTRUCTION MW-17

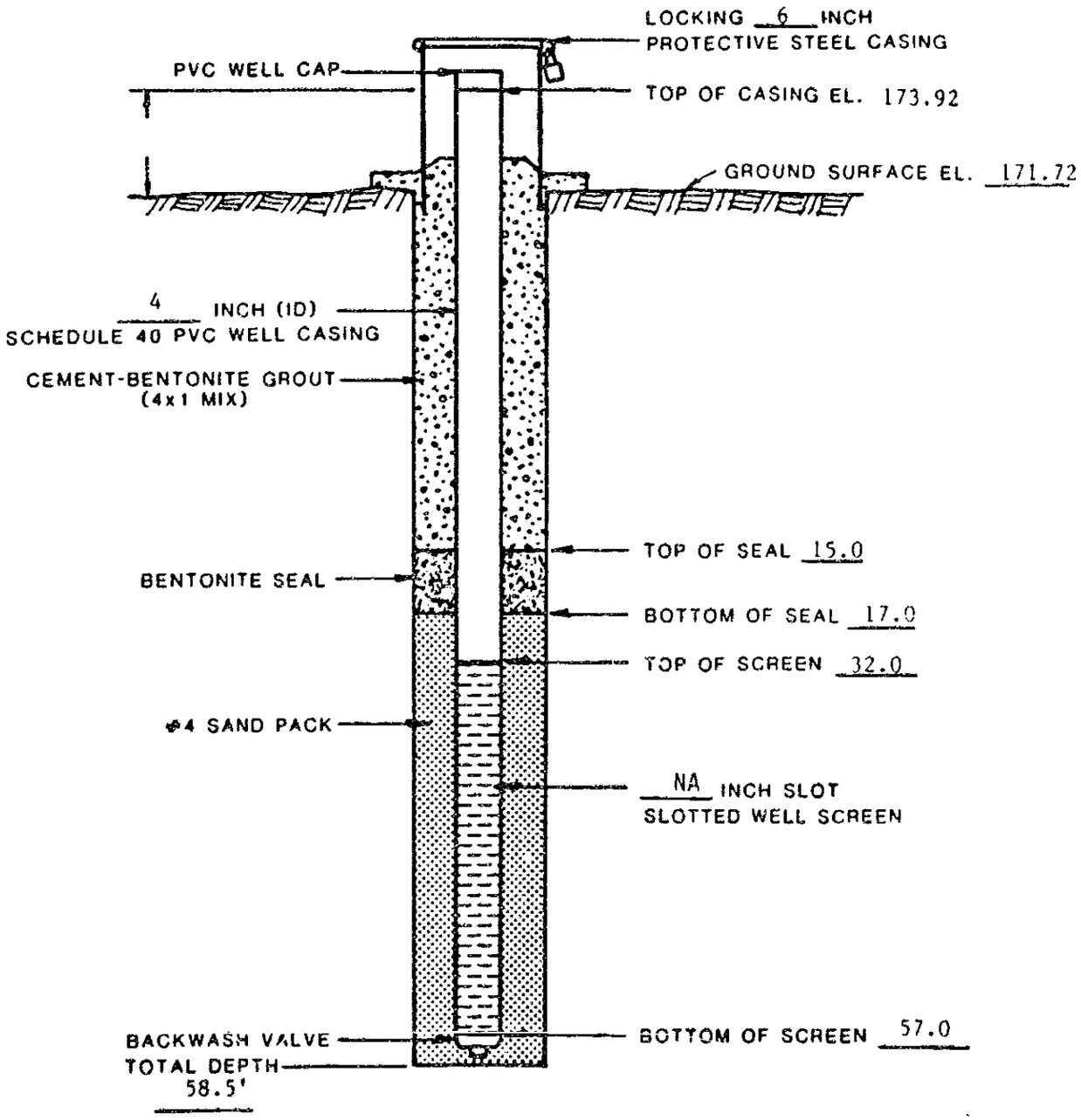
DRAWN BY	DATE	PROJECT NO.

PROJECT NAME: SHERIDAN

BORING NUMBER: MW-18

PROJECT NUMBER: 288-04

DATE INSTALLED: 8/1/84



002434

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DETAILS OF MONITOR WELL CONSTRUCTION MW-18

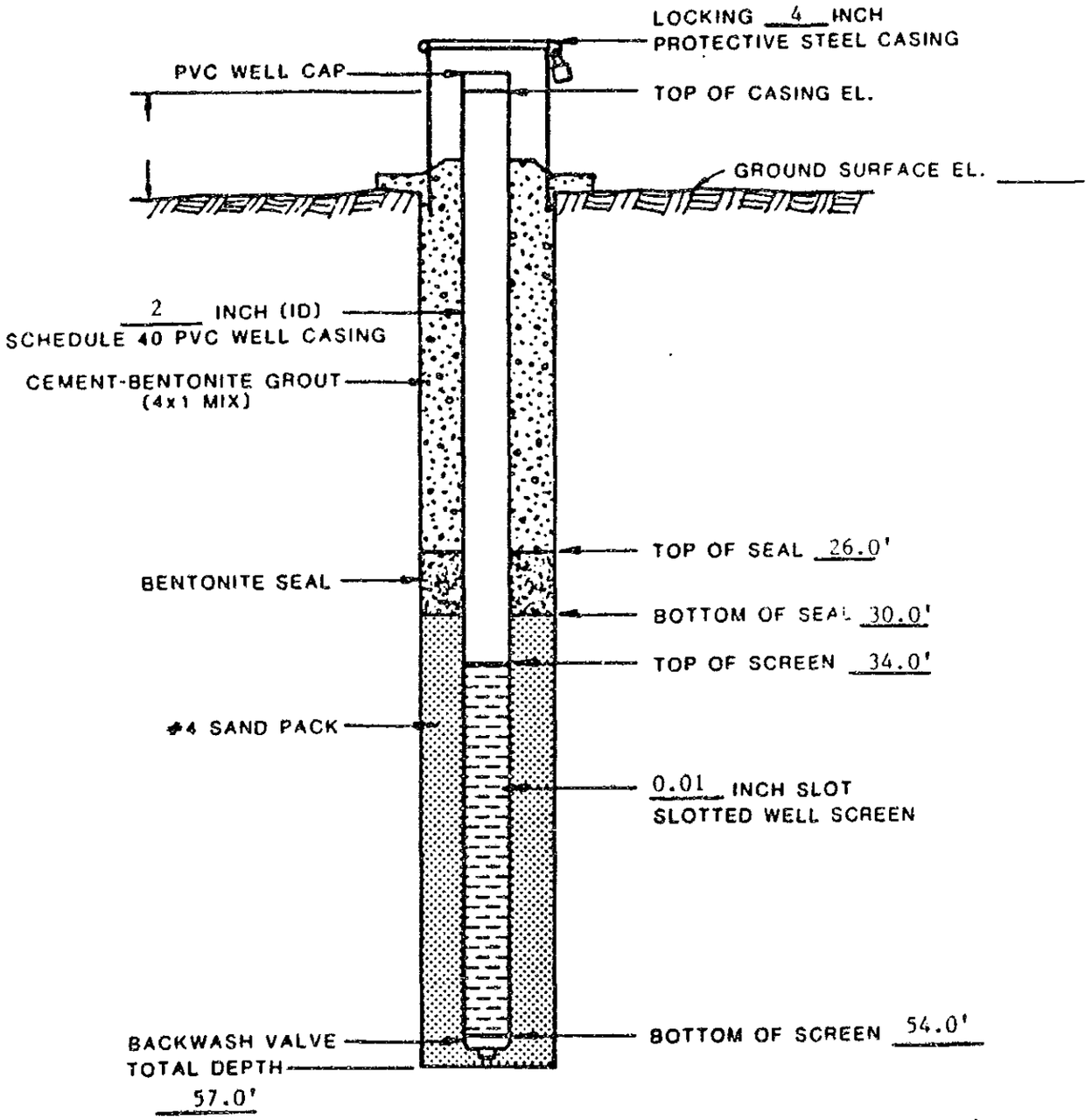
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: SHERIDAN

BORING NUMBER: MW-19

PROJECT NUMBER: 288-04

DATE INSTALLED: 3/5/85



002435

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DETAILS OF MONITOR WELL CONSTRUCTION MW-19

DRAWN BY:	DATE:	PROJECT NO.

Note: MW-20, 22, 26, 27, 28 have been installed with protective casing. The casing was cemented in place using a tremie pipe to fill the annulus, and allowed to set over night. The well was drilled through the protective casing to the bottom of the sand layer.

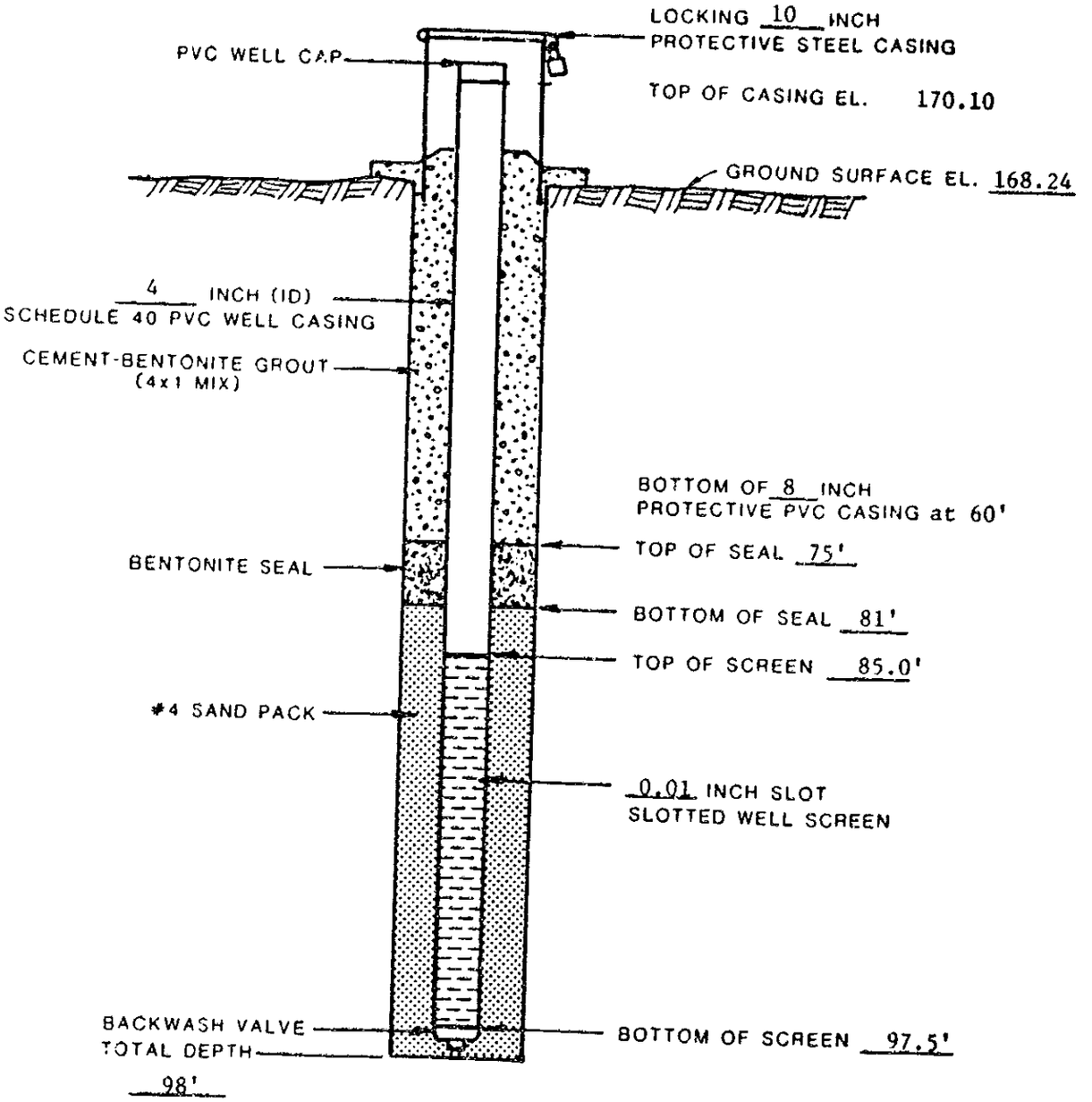
002436

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-20

DATE INSTALLED: 11/19/85



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DETAILS OF MONITOR WELL CONSTRUCTION MW-20

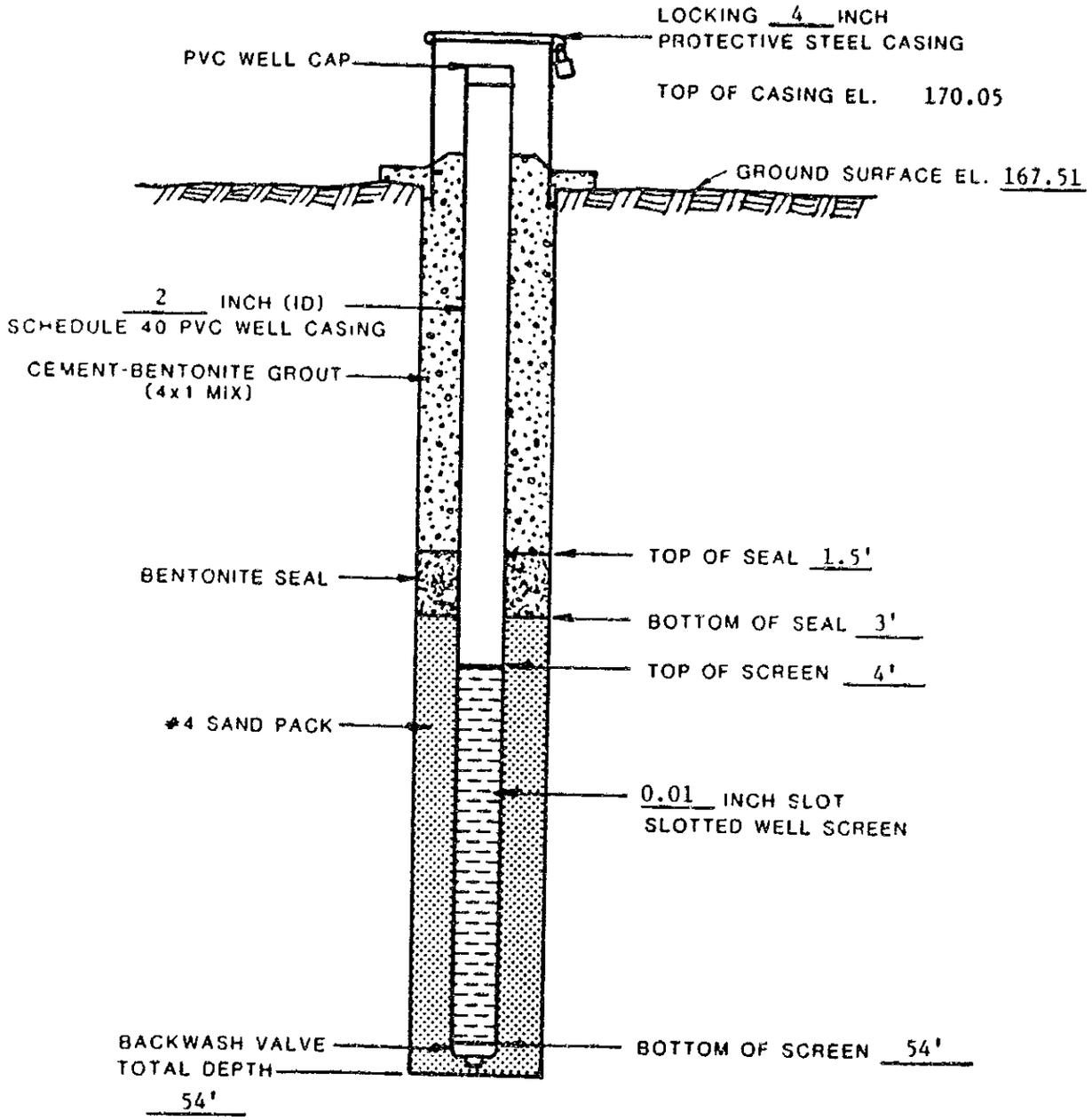
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-21

DATE INSTALLED: 11/19/85



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DETAILS OF MONITOR WELL CONSTRUCTION MW-21

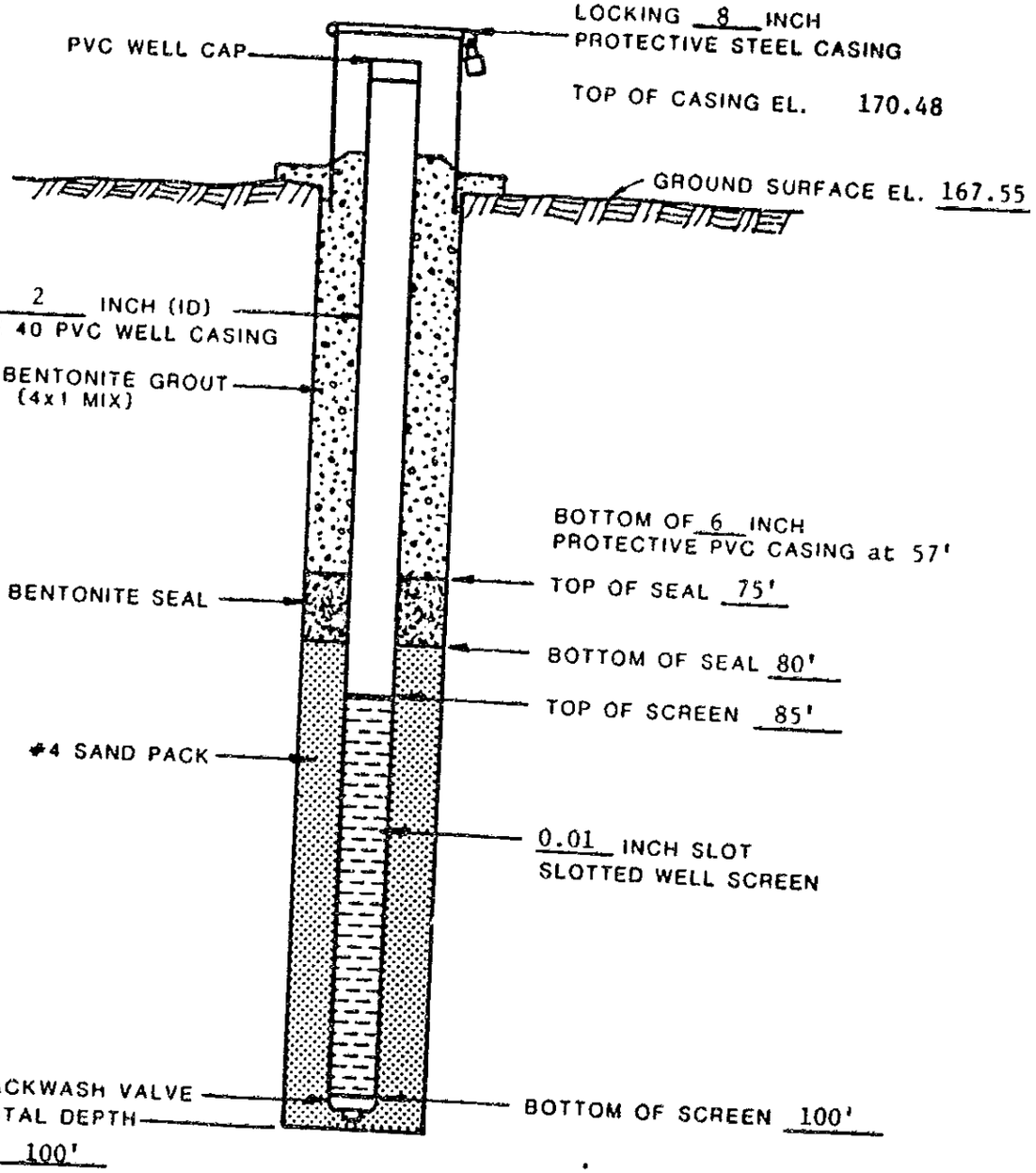
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-22

DATE INSTALLED: 11/21/85



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HOUSTON, TEXAS

DETAILS OF
MONITOR WELL CONSTRUCTION
MW-22

DRAWN BY: | DATE | PROJECT NO.

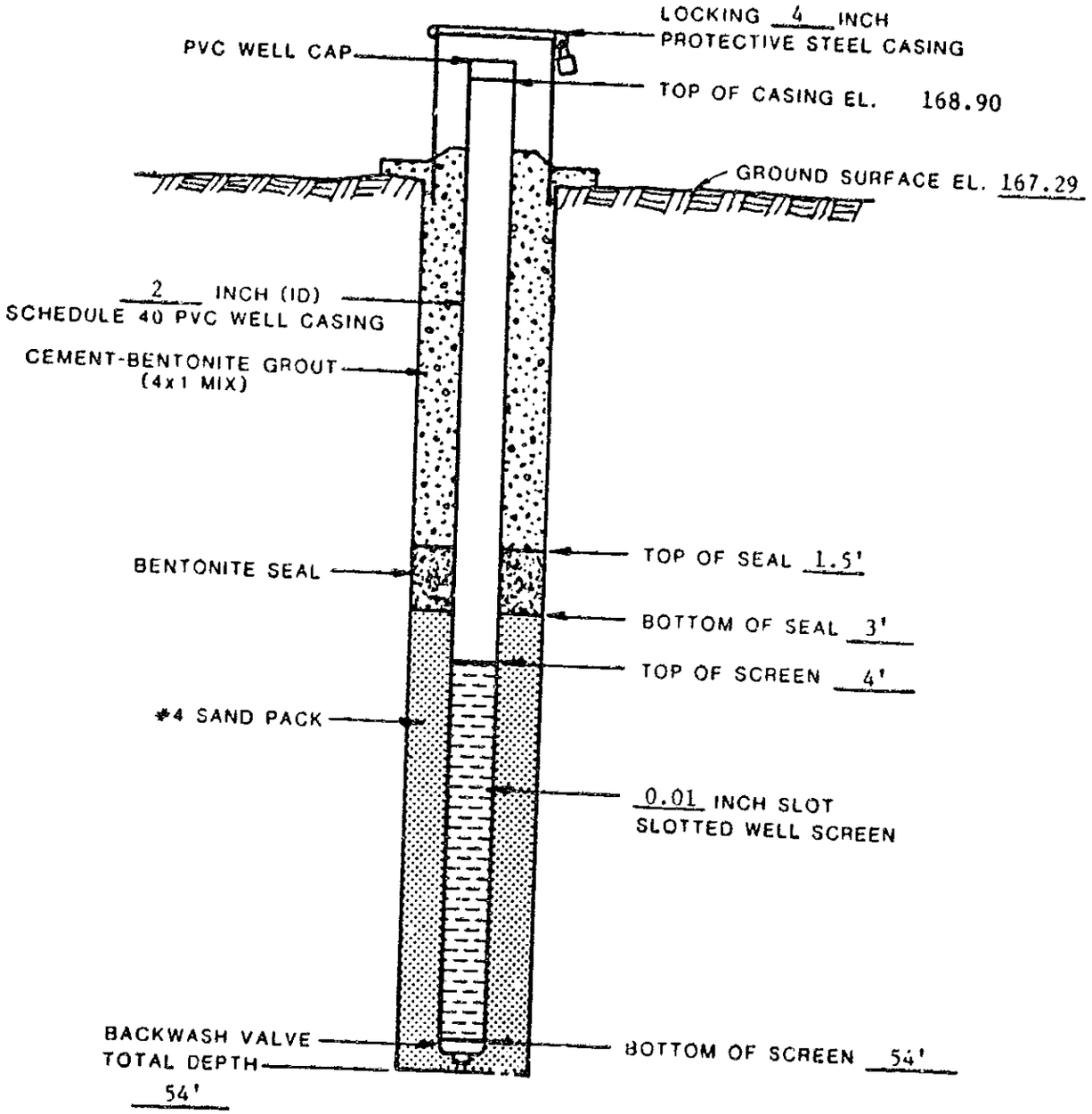
002420

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-23

DATE INSTALLED: 11/19-20/85



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DETAILS OF MONITOR WELL CONSTRUCTION MW-23

DRAWN BY:	DATE:	PROJECT NO.

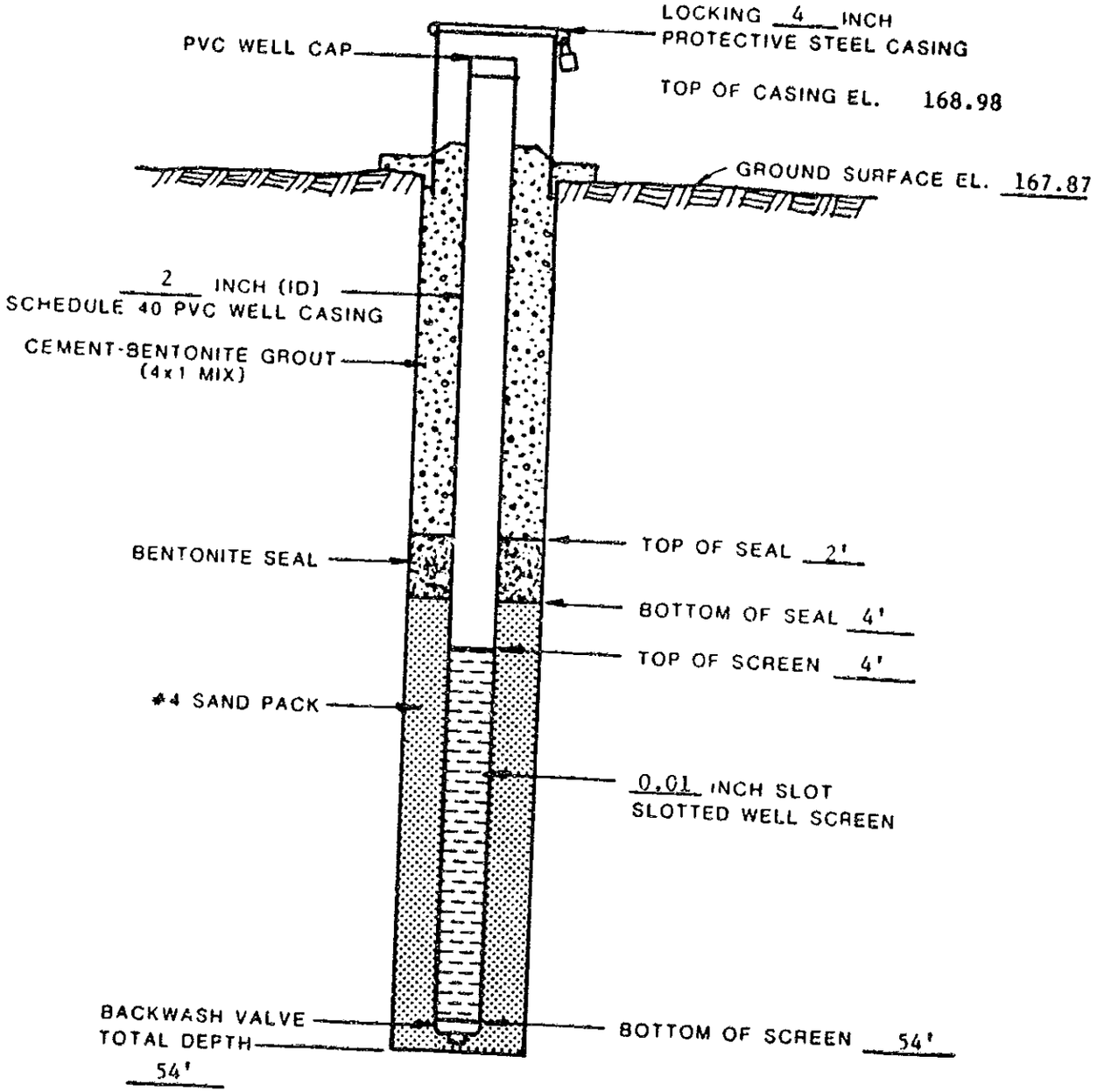
002440

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-24

DATE INSTALLED: 11/20/85



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HOUSTON TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-24

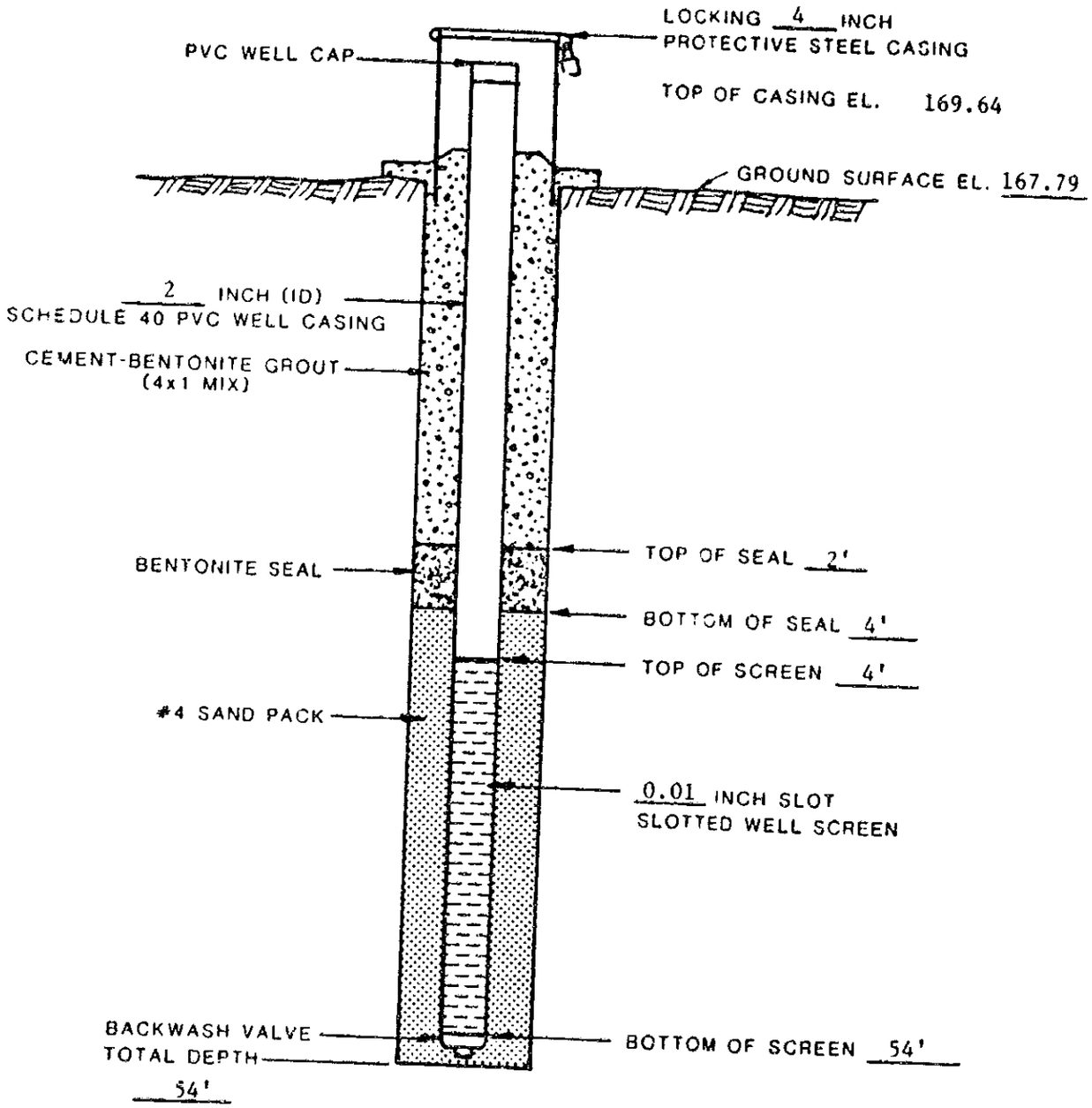
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-25

DATE INSTALLED: 11/20/85



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DETAILS OF MONITOR WELL CONSTRUCTION MW-25

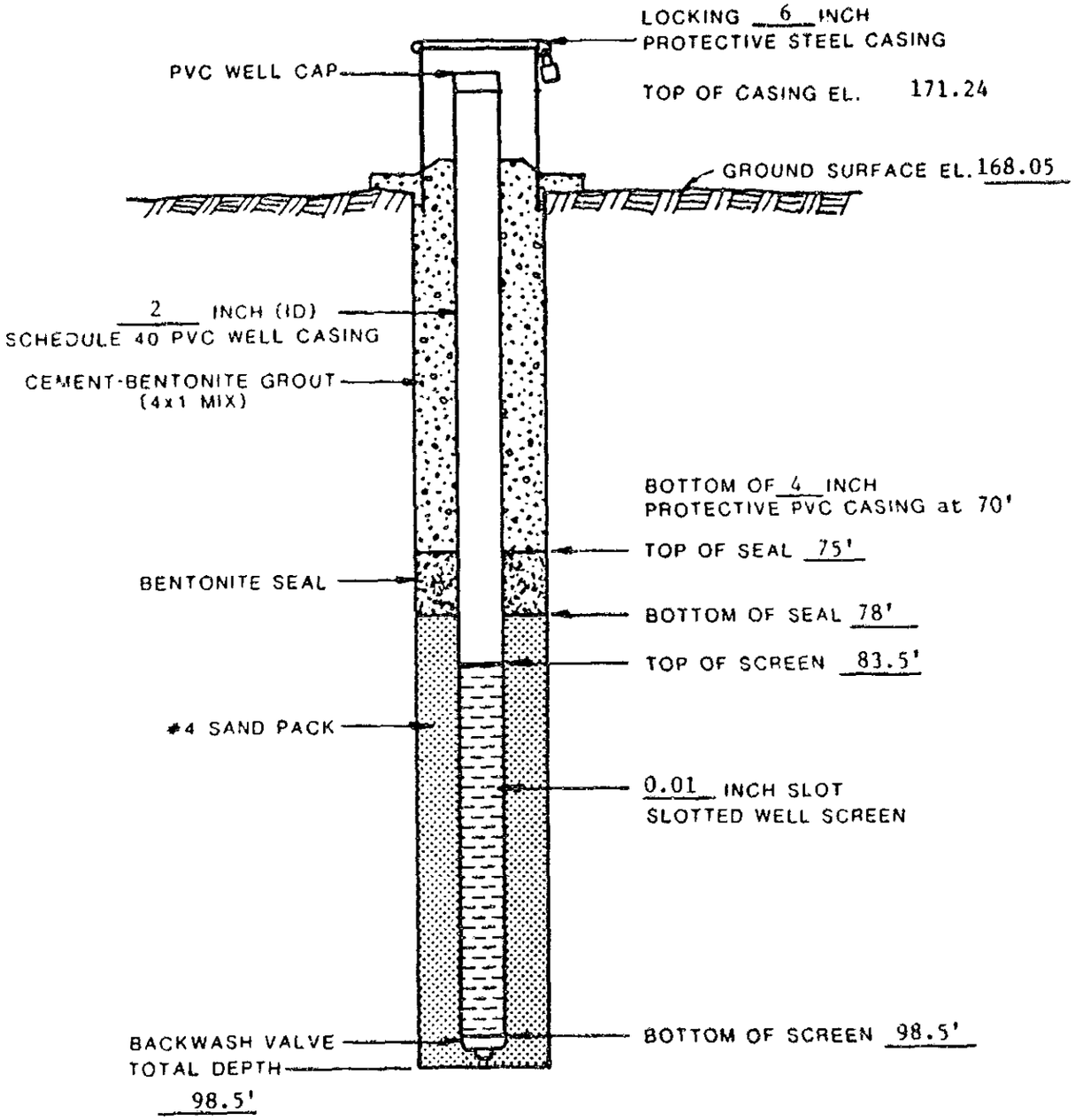
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

BORING NUMBER: MW-26

PROJECT NUMBER: 288-04

DATE INSTALLED: 12/2/85



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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-26

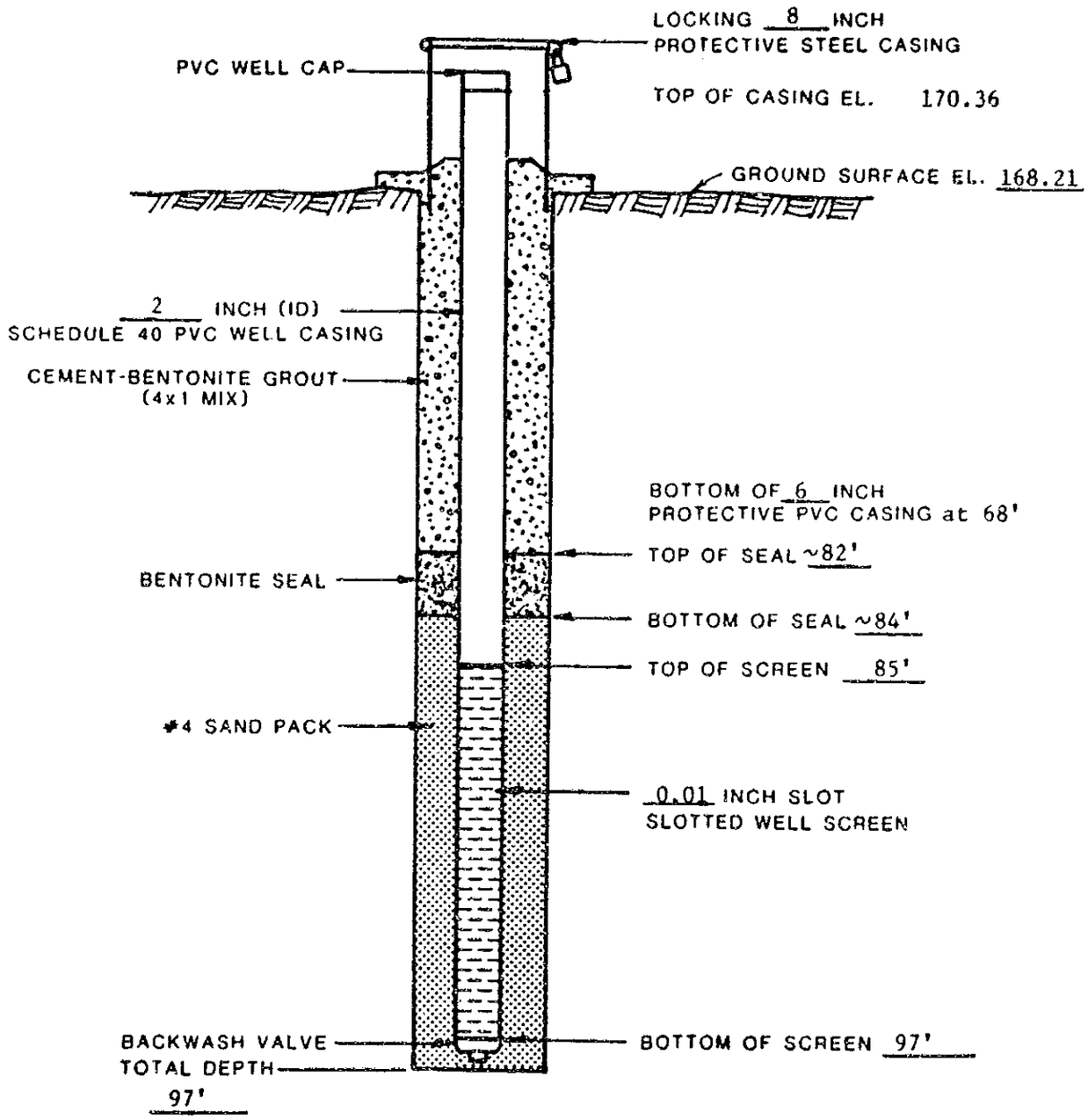
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-27

DATE INSTALLED: 11/26/85



002444

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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-27

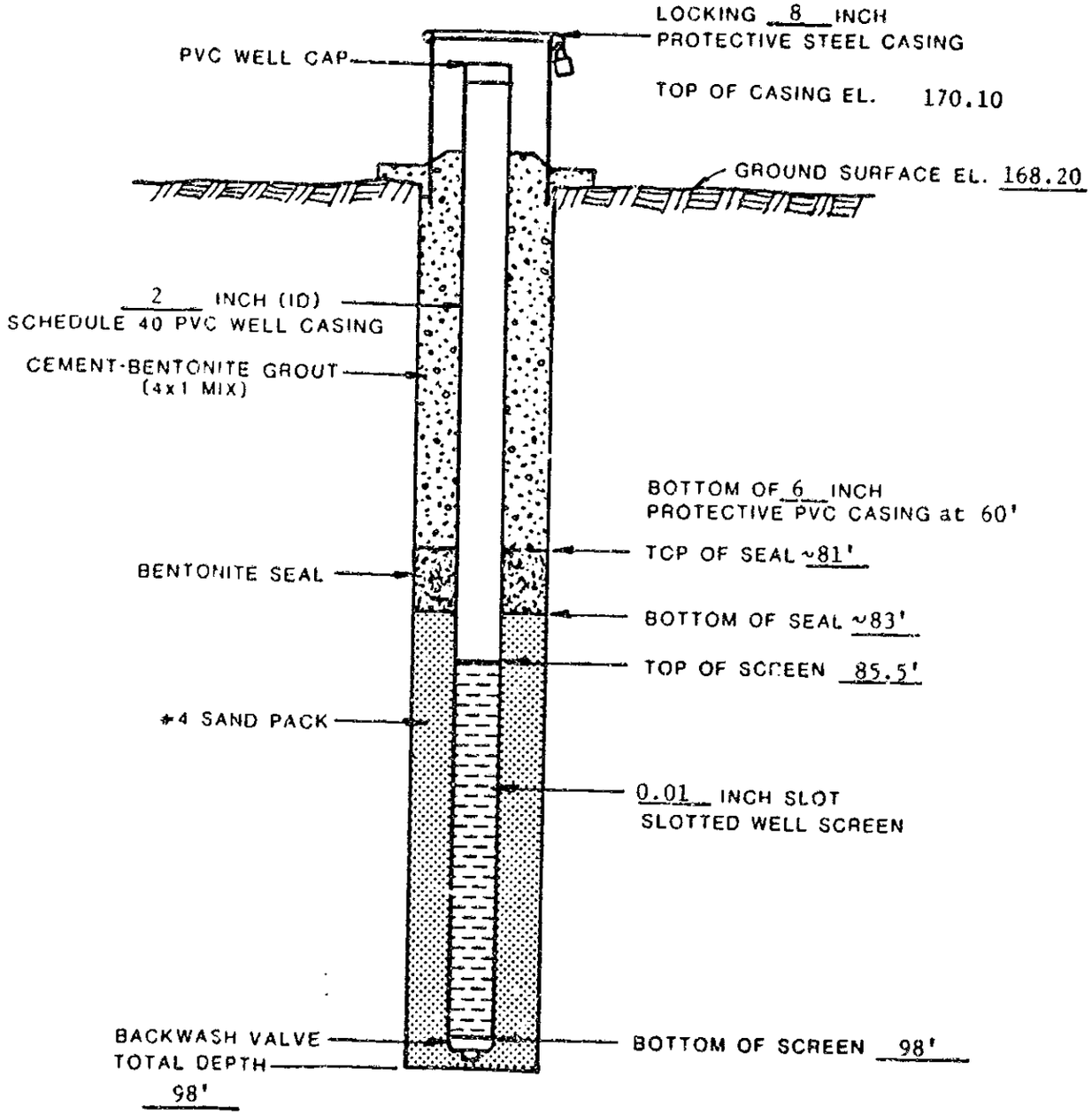
DRAWN BY:	DATE	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-28

DATE INSTALLED: 11/27/85



002445

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DETAILS OF MONITOR WELL CONSTRUCTION MW-28

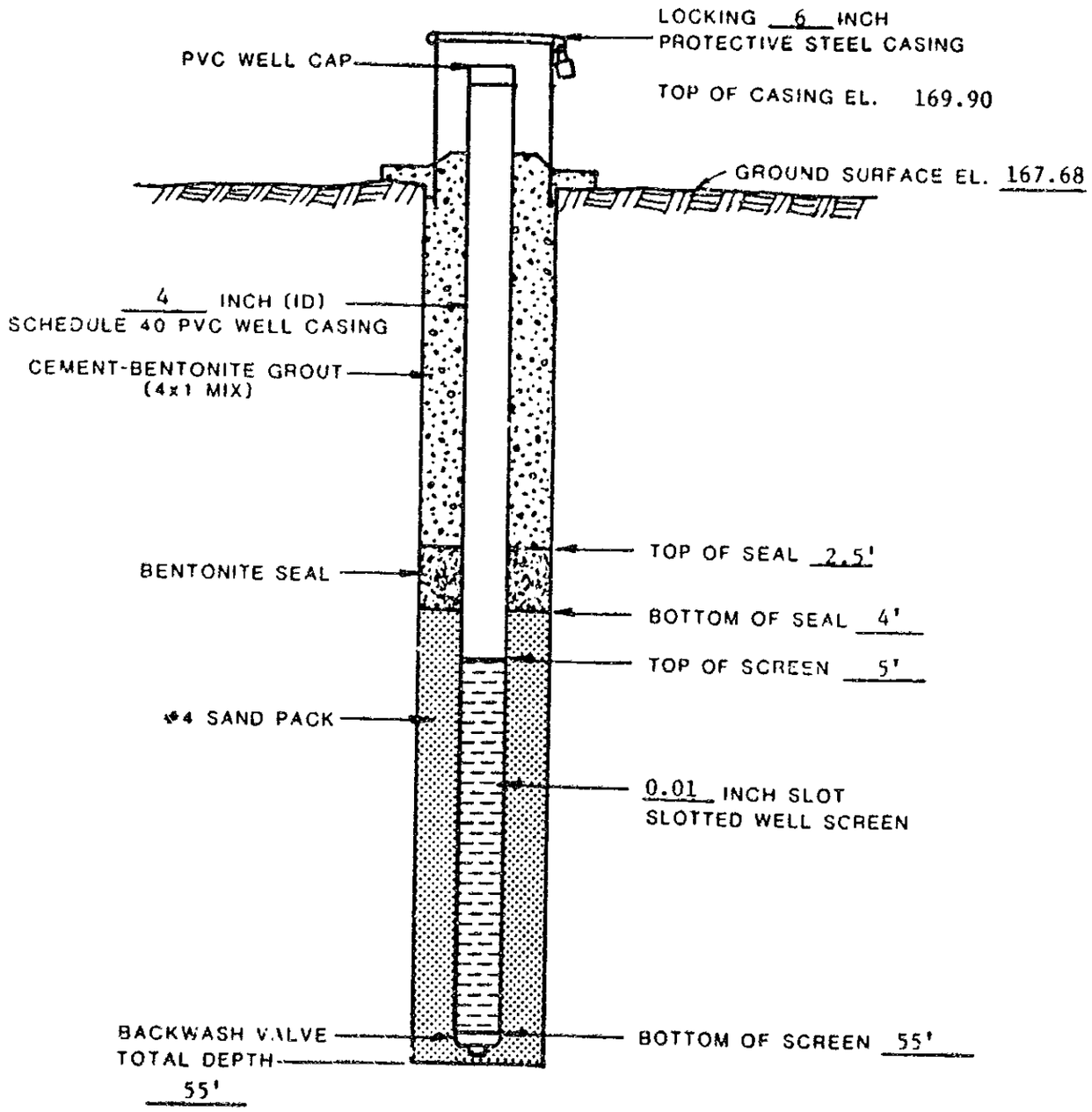
DRAWN BY:	DATE:	PROJECT NO.

PROJECT NAME: Sheridan

PROJECT NUMBER: 288-04

BORING NUMBER: MW-29

DATE INSTALLED: 12/3/85



002446

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HOUSTON, TEXAS

DETAILS OF MONITOR WELL CONSTRUCTION MW-29

CHECKED BY:	DATED:	PROJECT NO.

APPENDIX 4C

WELL DEVELOPMENT

002447

WELL DEVELOPMENT OF MW #1-19

Well #1

This 4" diameter well was drilled in January of 1972 to a total depth of 115 feet. This well is equipped with an electric powered jet pump and is currently being used as a livestock supply well. No information is available as to the initial well development procedure followed. In April of 1984, REI personnel ran the well pump for 45 minutes to purge the well. The water from the well had a measured pH of 7.22 and a conductivity 673 micromhos.

Well #2

This 2" diameter well was drilled in 1983 by the EPA. No information is available regarding the initial well development procedure followed. In March of 1984 the well was inspected by REI personnel for possible use as a piezometer. The well at that time was not suitable for that purpose as the well had silted up above the water table and water level measurements could not be obtained. In April of 1984, an attempt was made to remove the sediments by the air lift method. This method requires a 125 CFM air compressor with a coalescing filter to prevent oil discharge into the well casing. Seven feet of well casing was cleared of sediment using the air lift method making water obtained from this well by REI personnel had a measured pH of 7.85 and a conductivity of 885 micromhos.

002448

Well #4

This 4" diameter well was drilled in 1963 and had been equipped with a windmill pump for livestock supply purposes until 1971 when the well was abandoned. No information is available an the initial well development procedure followed. In April of 1984, REI personnel removed six well casing volumes using the air lift method. The water from the well had a measured pH of 8.02 and a conductivity of 1070 micromhos.

Well #5

This 4" well was drilled on 1-7-72. The well is currently inactive and no information is available on the well development procedure that was used. On April 19, 1984 six well volumes were removed using an air compressor with a coalescing filter. Water obtained from the well by REI personnel had a measured pH of 7.88 and a conductance of 1328 micromhos.

Well #6

This 2" well was drilled to a total depth of 59.2 feet prior to 1984. No information was available as to how the well was initially developed. The well was redeveloped using an air compressor with a coalescing filter to prevent oil discharge down the well casting. At least six well casing volumes of water were removed to redevelop the well. Water obtained from

002449

the well by REI personnel had a measured pH of 7.2 and a conductance of 883 micromhos.

Well #7

This well was drilled by REI to a depth of 96 feet on 3-31-84. The well was developed using the air lift method of well development. An air compressor with coalescing filter was used to remove 10 to 50 well casing volumes until turbidity in the water was no longer visually noticeable. On April 16, 1984 water obtained from the well had a measured pH of 7.5 and a conductance of 653 micromhos.

Well #8

This 4" well was drilled an 1-7-72 to a depth of 66 feet by H&N Drilling Co. (see attached log). The well was equipped with 1/2 hp electric submersible pump set at a depth of 59 feet well development and installation was supervised by Jim Bain of the Texas Water Quality Board. In April of 1984, REI personnel removed six well casing volumes using the air lift method. Water from the well had a measured pH of 7.6 and a conductivity of 794 micromhos.

002450

Well #9

This 4" well is located on the east side of the Sheridan disposal facility and has an approximately depth of 164 feet. No information is available regarding the initial well development procedure followed. In April of 1984 at least six well casing volumes of water were removed using the air lift method. Water obtained from the well be REI personnel had a measured pH of 7.2 and a conductivity of 896 micromhos.

Well #10

This 2" diameter well as installed by REI and developed using the air lift method until the water was no longer turbid. In April of 1984, water obtained from the well by REI personnel had a measured pH of 7.3 and a conductivity of 1280 micromhos.

Well #11

This 4" well was installed to a depth of 135 feet and been used as a domestic and livestock supply well. No information is available regarding the well development procedure followed. In April of 1984, the well pump was turned on and allowed to run for 45 minutes. Water obtained form this well by REI personnel had a measured pH of 7.16 and a conductivity of 765 micromhos.

002451

Well #12

This 2" well was installed by REI and developed using the air lift method until the water was no longer turbid. In April of 1984, water obtained by REI personnel had a measured pH of 7.50 and a conductivity of 1765 micromhos.

In June of 1984, monitor wells 13, 14, 15, 16, and 17 were installed by REI. These wells were developed by the air lift method. At least six well casing volumes of water were removed until the water was longer visually turbid.

In August of 1984, monitor Well #18 was installed by REI. This well was developed using the air lift method until the water was no longer visually turbid. At least six well casings volumes of water were removed. In March of 1985, monitor well #19 was installed by REI. This well was developed using the air lift method until the water was no longer visually turbid. At least six well casing volumes of water were removed from the well.

002452

The pump test wells and piezometers were developed until pH and specific conductivity (EC) stabilized after a minimum of three volumes of water were removed. Listed below are the methods used to develope the monitor wells. Field measurements for pH, EC, color and water level are recorded on the following pages:

MW-20:	Developed with 4 inch submersible pump
MW-21:	Hand bailed and surge blocked
MW-22:	(see note)
MW-23:	Hand bailed and surge blocked
MW-24:	Hand bailed and surge blocked
MW-25:	Hand bailed and surge blocked
MW-26:	Hand bailed, 2 volumes of water was removed in 5 minutes, there was no change in water level
MW-27:	(see note)
MW-28:	(see note)
MW-29:	Developed with 4-inch submersible pump and surge block

Note: Piezometers MW-22, MW-27, and MW-28 were air lifted for 20-30 minutes on 12/3/85. The wells produced 10-15 gpm, it was clear of fines.

002453

MONITOR WELL DEVELOPEMENT RECORD

Client: Sheridan
Job # : 288-04
Location: ~~MW-20~~
Date : 12/6
Well # : MW-20
Depth to water : 33'10"
Well Diameter : 4"
Total Depth : 98 ft
gallons/feet : 0.653
Well Volume : 41 gal

Volume # gal	PH	Cond.	~~Temp.~~ tim	Color	Remarks
Vol. #1 20	9.07	1600	1029	clear	SWL 32' 10"
			1032:30	clear	53' 7"
40	7.89	940	1035:10	milky	59' 6"
Vol. #2 80	7.61	820	1040:10	color of confining clay abit clearer milky	62' 8"
Vol. #3 120	7.45	790	1045:20	milky ~~clear~~ or abox	63' 5"
Vol. #4 160	7.37	780	1050:40	milky	63' 10.5
Vol. #5 200	7.36	790	1056:00	cloudy clearing up	64' 2"
Vol. #6 245	7.37	790	1101:05	cloudy clearing up	64' 2.5"
280 gal intake at 5 gals in 38 secs	85	5 gals in 40 secs			pump off 1107:20
pumping rate 5 gals in 40 sec		5 " " 39 secs			
" 30 secs					
" " 38 secs					

002454

REI

MONITOR WELL DEVELOPEMENT RECORD

Client: SOS
Job # : [illegible]
Location:
Date : 12/5/85
Well # : MW-21
Depth to water : 33.43
Well Diameter : 3"
Total Depth : [illegible]
gallons/feet : 1.63
Well Volume : [illegible]

Volume #	PH	Cond.	Temp.	Color	Remarks
Vol. #1	7.10	600			
Vol. #2	7.25	620			
Vol. #3	7.06	730			
Vol. #4	7.45	760			
Vol. #5	7.53	800			
Vol. #6	7.45	830			
W L - 33.43' TOC - 2.52'	35.11' after 1st [illegible]	46.1 after 3rd at 10 55	49.2 after 4th @ 11:12 [illegible]	36.75' @ 11:20	33.59' @ 11:55

REI

002455

MONITOR WELL DEVELOPEMENT RECORD

surged and hand bailed

Client: [illegible]
Location:
Well # : MW-23
Well Diameter : 2"
gallons/feet : 163

Job # : 28[illegible]-34
Date : 12/6
Depth to water : 32.34'
Total Depth : [illegible]
Well Volume : [illegible]

Volume #	PH	Cond.	Temp.	Color	Remarks
Vol. #1	7.42	1040			alot of [illegible] in bottom measuring
Vol. #2	6.92	1080			alot of sand
Vol. #3	7.05	1100			alot of sand
Vol. #4	7.92	1125			"
Vol. #5	7.15	1070			"
Vol. #6	7.14	1150			"
#7	7.19	1130			"
W.L 32.34 at 11:15 (stab.)	32.64' after 2 vol @ 11:40	32.52' after 6 vol @ 12:10			

002456

REI

MONITOR WELL DEVELOPEMENT RECORD

Client: SDS
Job # : 288-4
Location:
Date : 12/5
Well # : MW-24
Depth to water : 32.38'
Well Diameter : 2"
Total Depth : 54'
gallons/feet : .163
Well Volume : 5 gals

Volume #	PH	Cond.	Temp.	Color	Remarks
Vol. #1	7.57	1040			no sand very turbid
Vol. #2	7.48	1120			
Vol. #3	7.37	1150			
Vol. #4	7.28	1180			
Vol. #5	7.27	1160			
Vol. #6	7.28	1160			
static WL 32.38' @ 1324	W.L. 32.42' @ 1400 after bail				

REI

002455

MONITOR WELL DEVELOPEMENT RECORD

Client: SDS
Job # : [illegible]
Location:
Date : 12/5
Well # : MW-25
Depth to water : 32.96
Well Diameter : 2"
Total Depth : [illegible]
gallons/feet : 16.3
Well Volume : [illegible]

Volume #	PH	Cond.	Temp.	Color	Remarks
Vol. #1	7.58	1140			turbid, no sand
Vol. #2	7.42	1120			"
Vol. #3	7.25	950			
Vol. #4	7.35	1070			
Vol. #5	7.26	1000			
Vol. #6	7.22	1030			
static w.l. 32.96 @ 12:45	33.09' after 3 hrs at [illegible]	33.05' after 6 hrs at 12:54			

REI

342.35
42.35
4[illegible]
4[illegible]
43[illegible]

MONITOR WELL DEVELOPEMENT RECORD

Client: SDS
Job # : 288-[illegible]
Location:
Date : 12/10/85
Well # : MW-29
Depth to water :
Well Diameter : 4"
Total Depth : [illegible]
gallons/feet : 653
Well Volume : 15.5 gals

Volume # (gal)	PH	Cond.	WL ~~Temp.~~	Color	time ~~Remarks~~
Vol. #1 7.5 gal	6.95	830	3350@850 39'		0104 pump on rate (gal) 0.2 0.5
[illegible]	6.9[illegible]	850	39'		[illegible]
Vol. #2	6.87	860	4[illegible]'	[illegible]	1002 [illegible]
Vol. #3 45	7.03	870	43'	clear	1020 [illegible]
Vol. #4 [illegible]	7.10	870	43'	clear	10[illegible] measuring 0.5
Vol. #5	7.12	860	43'	[illegible]	1100 [illegible]
Vol. #6	7.19	870	[illegible]	[illegible]	1116 [illegible]
MW-24-32.60 MW-21-33.19	at 0853 [illegible]	32[illegible]66 1040 33200 1100	3280@10[illegible]	3[illegible]	32[illegible] pump off 11:20

WL 3352 @ 1136

REI

002455

MONITOR WELL DEVELOPEMENT RECORD

Client: SDS
Location: 11
Well # : MW-29
Well Diameter : 4"
gallons/feet : 653

Job # : 288-04
Date : 12/9/85
Depth to water : 33.14'
Total Depth : 55'
Well Volume : 15.5 gal

Volume #	PH	Cond.	W.L ~~Temp~~	Color	time Remarks
Vol. #1 7 1/2 gal 15	7.46 ~~7.46~~ 7.37	11 A bead [illegible]	48.5'	[illegible]	on 1135 1143 1148 DRY
Vol. #2			36'	[illegible] [illegible]	1255 1302 DRY
Vol. #3					
Vol. #4 2					
Vol. #5 3					
Vol. #6 4					
MW-24 32.85 @ 1100 32.50 1151 32.74 @ 1306		WL	1303 - 48.80' 1309 47.24'		

302460

REI

MONITOR WELL DEVELOPEMENT RECORD

Client: Sheridan
Job # : [illegible]-04
Location: [illegible] Tx
Date : 12/6/85
Well # : MW-29
Depth to water : Between 33'2 [illegible] 33'7 ?
Well Diameter : 4" PVC
Total Depth : 54'
gallons/feet : 653
Well Volume : 15.5 gal

Volume # gals	PH	Cond. (umhos)	W.L. ~~Temp.~~	Color	Remarks	TIME
0	6.70	770		[illegible]		0920
Vol. #1 9.5 gal 12 gal	7.35 off	910			water below intake	0921 off ORY
Vol. #2 5 ~~30~~			33'8.5"			1300
Vol. #3 11						
Vol. #4						
Vol. #5						
Vol. #6						

Dump intake at 49.2' / 51

REI

Piezometer Development

Piezometers MW-22, MW-27 and MW-28 were air lifted for 20 - 30 minutes on 12/3/85. The wells produced large volumes of water 10 - 15 gpm. The water was clean and free of fines. MW-26 was hand bailed on 12/16/85. 20 gallons (2 well volumes) were removed in 5 minutes, there was no change in water level.

002462

APPENDIX 4D

WATER TABLE AQUIFER

PUMP TEST DATA

002463

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 3

PROJECT: SDS

JOB NO.: 228-24

SUBJECT: Description of the wells

COMPUTED BY: LS DATE:

CHECKED BY: DATE:

MW-21

r = 12 feet
s = 0.13 feet

MW-23

r = 25 feet
s = 0.12 feet

MW-24

r = 50 feet
s = 0.09 feet

MW-25

r = 7.5 feet
s = 0.14

MW-29

r = 0.17 feet
s = 12.7 feet

Constants:

Q = 1.54 gpm
M = 23.41

002464

REI

Theis Equation

$$T = \frac{114.6\ Q\ W(u)}{s}$$

Where

s = drawdown (ft)
Q = pumping rate (gpm)
T = coefficient of transmissivity of the aquifer (gpd/ft)
W(u) = Well function of u

002465

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS Site

SUBJECT: J Gris Pump Matching

SHEET 1 OF 1

JOB NO.: [illegible]

COMPUTED BY: [illegible] DATE:

CHECKED BY: DATE:

$$T = \frac{114.6\ Q\ W(u)}{s}$$

MW-25

$$T = \frac{114.6(1.5)(1)}{2.048}$$

$T = 3581$ gpd/ft

MW-21

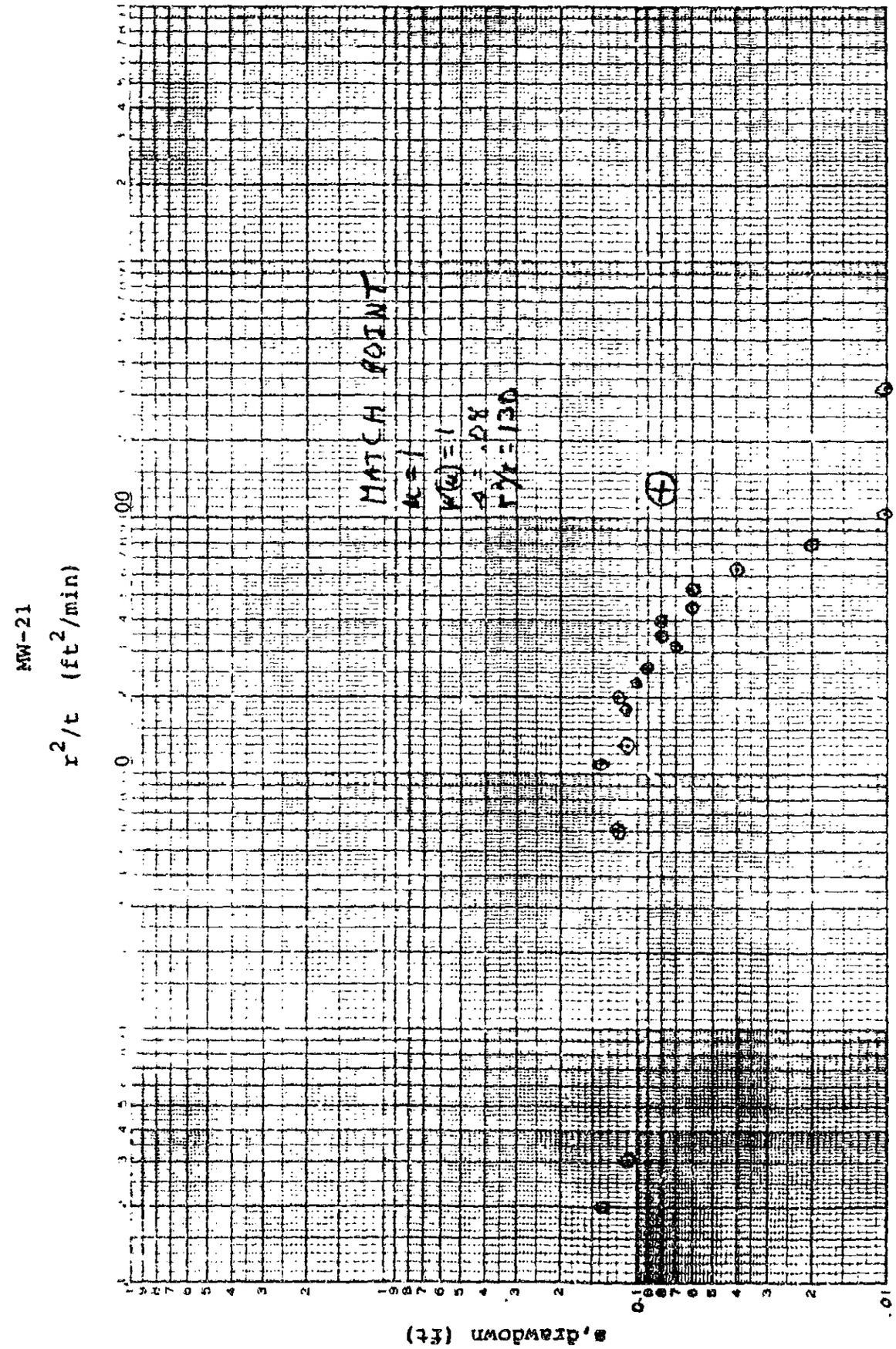
$$T = \frac{114.6\ 1.5\ (1)}{.08}$$

$T = 2149$ gpd/ft

002466

ERT

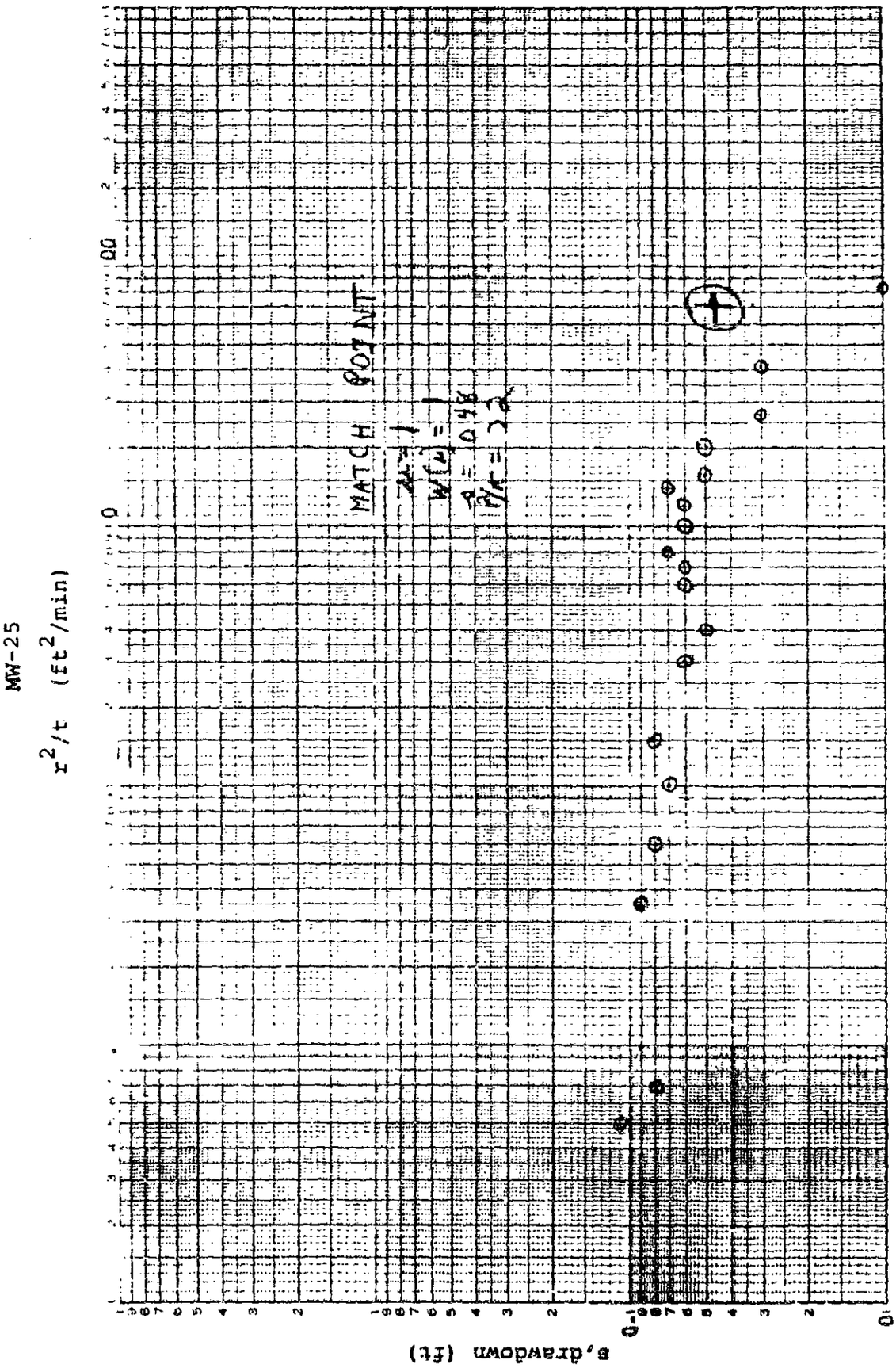
Theis Curve Matching



002467

Full Logarithmic, 3 × 3

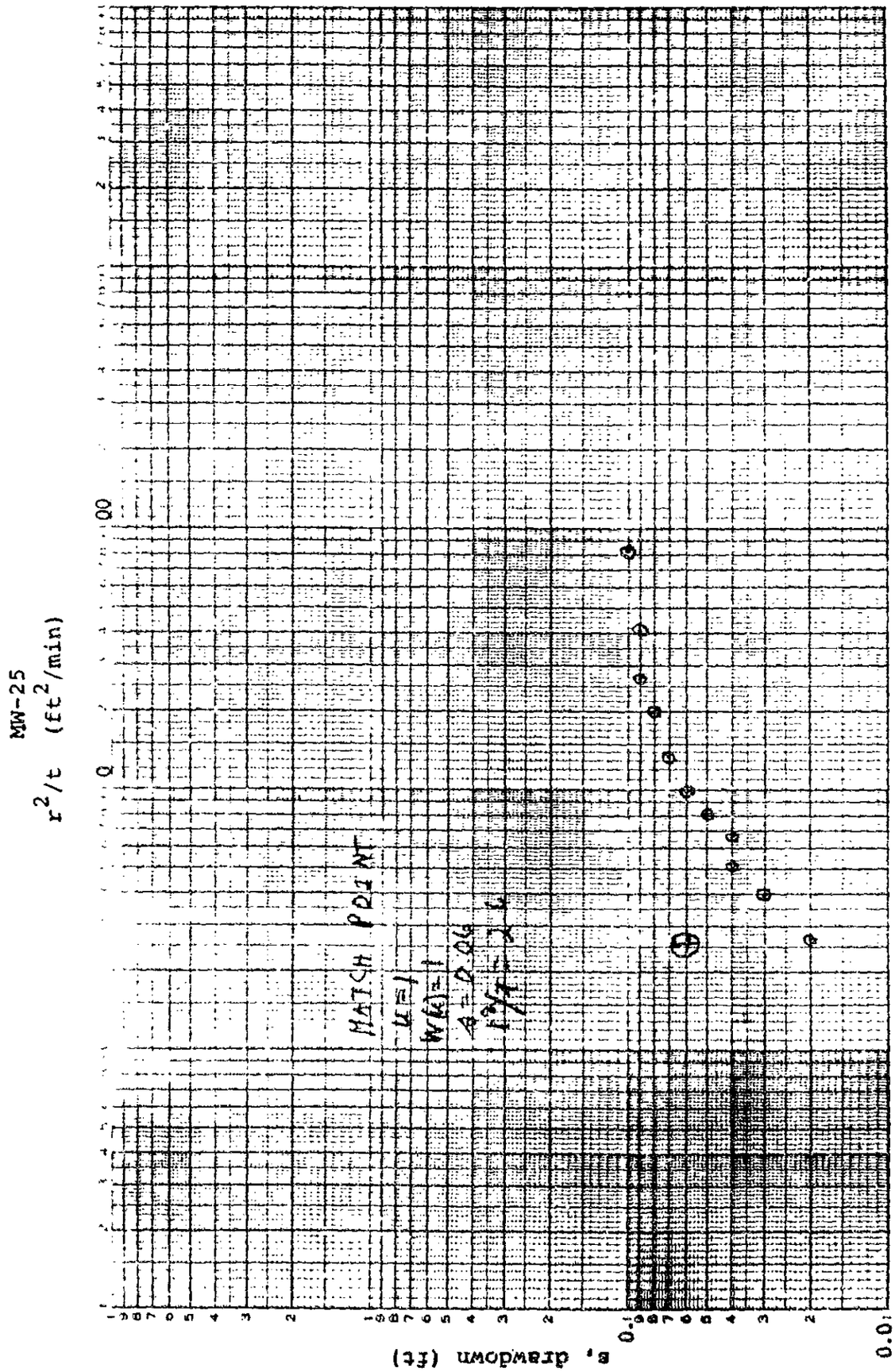
Theis Curve Matching



002468

Full Logarithmic, 3 × 5

Recovery MW-25 (Theis Curve Match)



002469

Full Logarithmic, 3 × 5

Modified Nonequilibrium Equation

$$T = \frac{264\ Q}{\Delta s}$$

Where

T = Coefficient of transmissivity (gpd/ft)
Q = Pumping rate (gpm)
Δs = Slope of the time - drawdown graph expressed as the change in drawdown between any two times on the log scale whose ratio is 10

002470

CALCULATIONS AND COMPUTATIONS

PROJECT: SOS

SHEET ___ OF ___

JOB NO.: ___

SUBJECT: Modified Nonequilibrium Equation

COMPUTED BY: ___ DATE: ___

CHECKED BY: ___ DATE: ___

$$T = \frac{264\,Q}{\Delta s}$$

MW-21

$$T = \frac{264\,(1.34)}{.13}$$

$T = 3330$ gpd/ft

MW-23

$$T = \frac{264\,(1.64)}{.10}$$

$T = 4330$ gpd/ft

MW-24

$$T = \frac{264\,(1.64)}{.07}$$

$T = 6185$ gpd/ft

MW-25

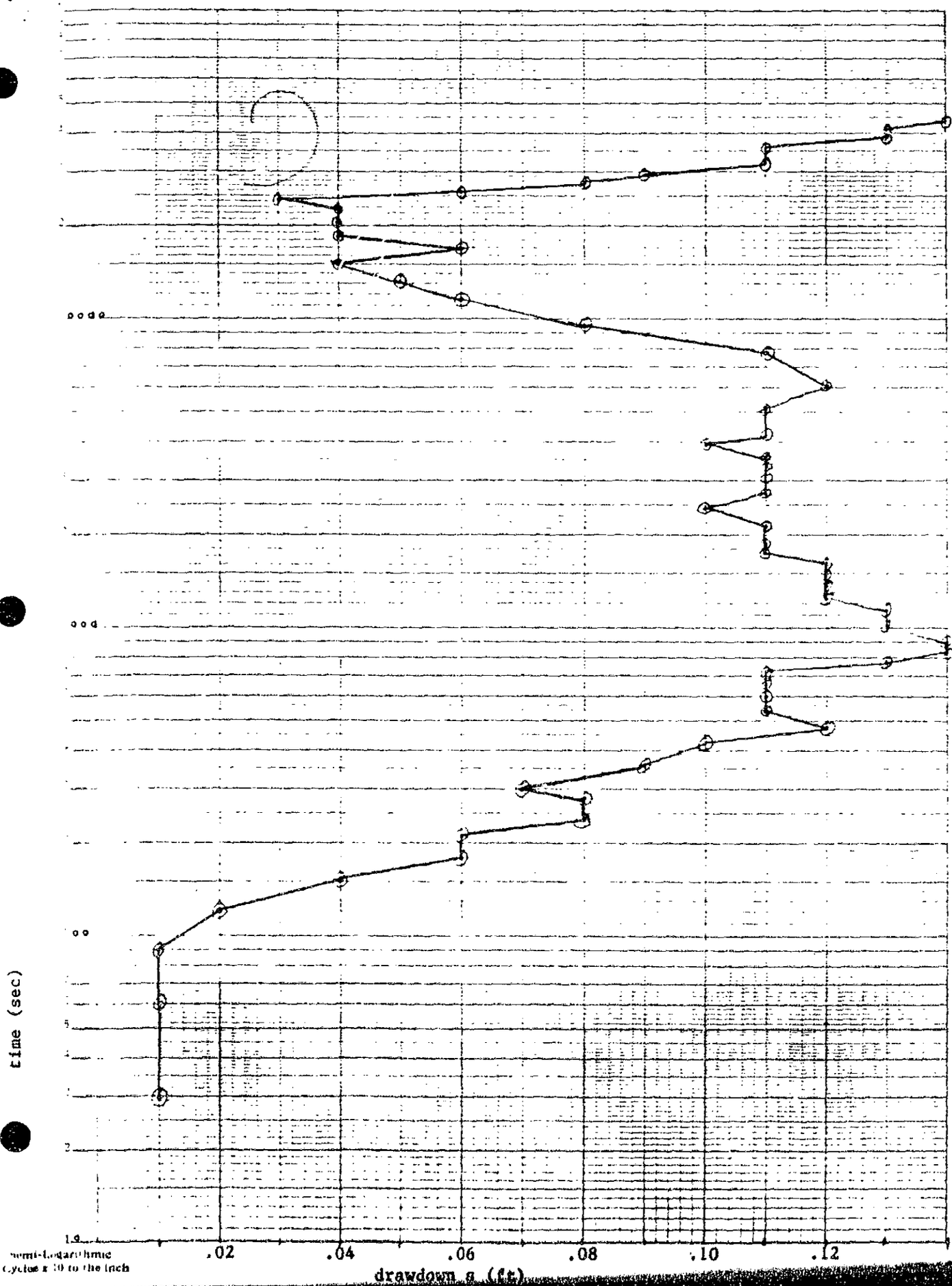
$$T = \frac{264\,(1.54)}{.08}$$

$T = 5412$ gpd/ft

002471

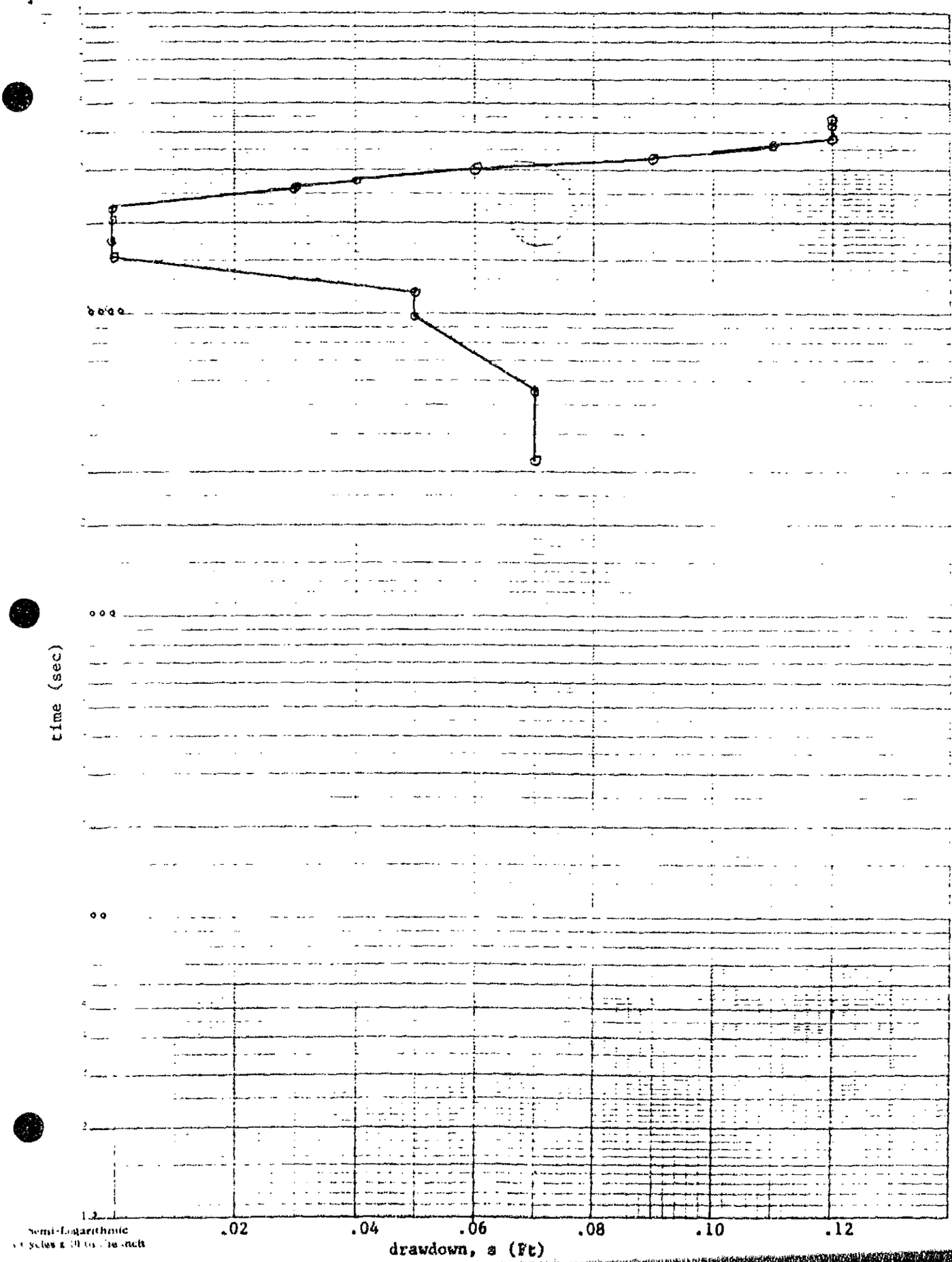
ERT

Time-drawdown, MW-21



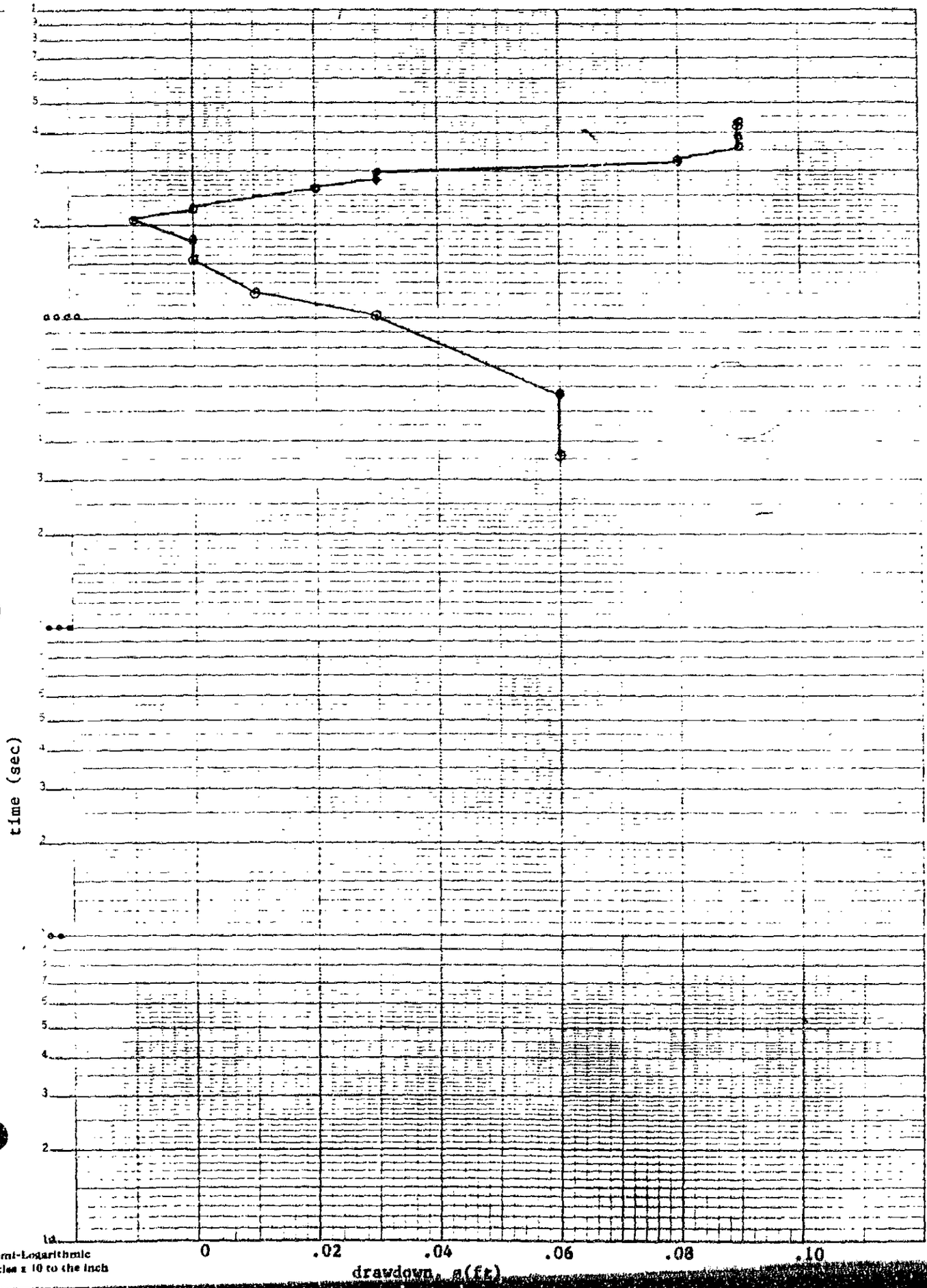
002472

Time-drawdown, MW-23



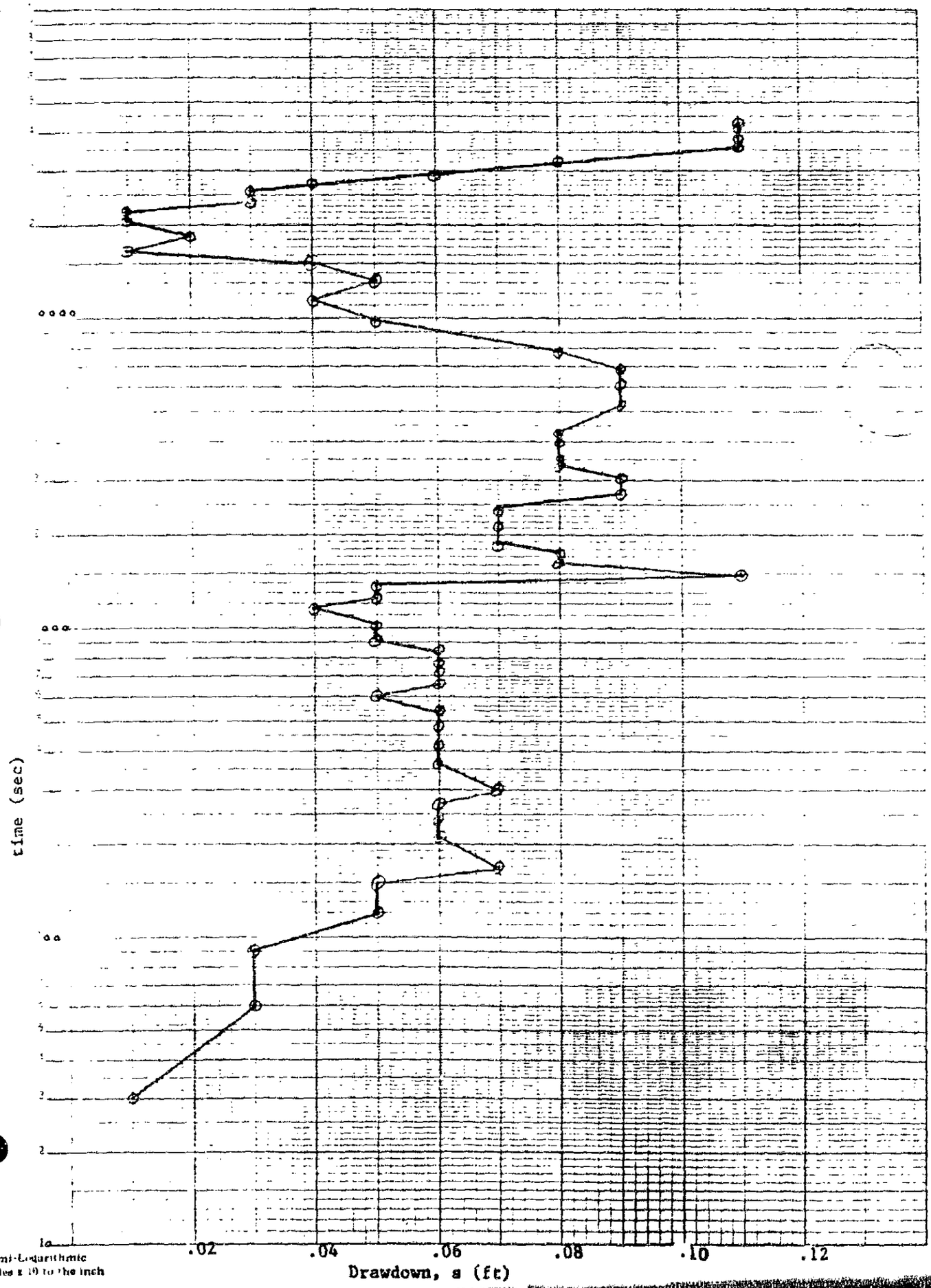
002473

Time-drawdown, MW-24



002474

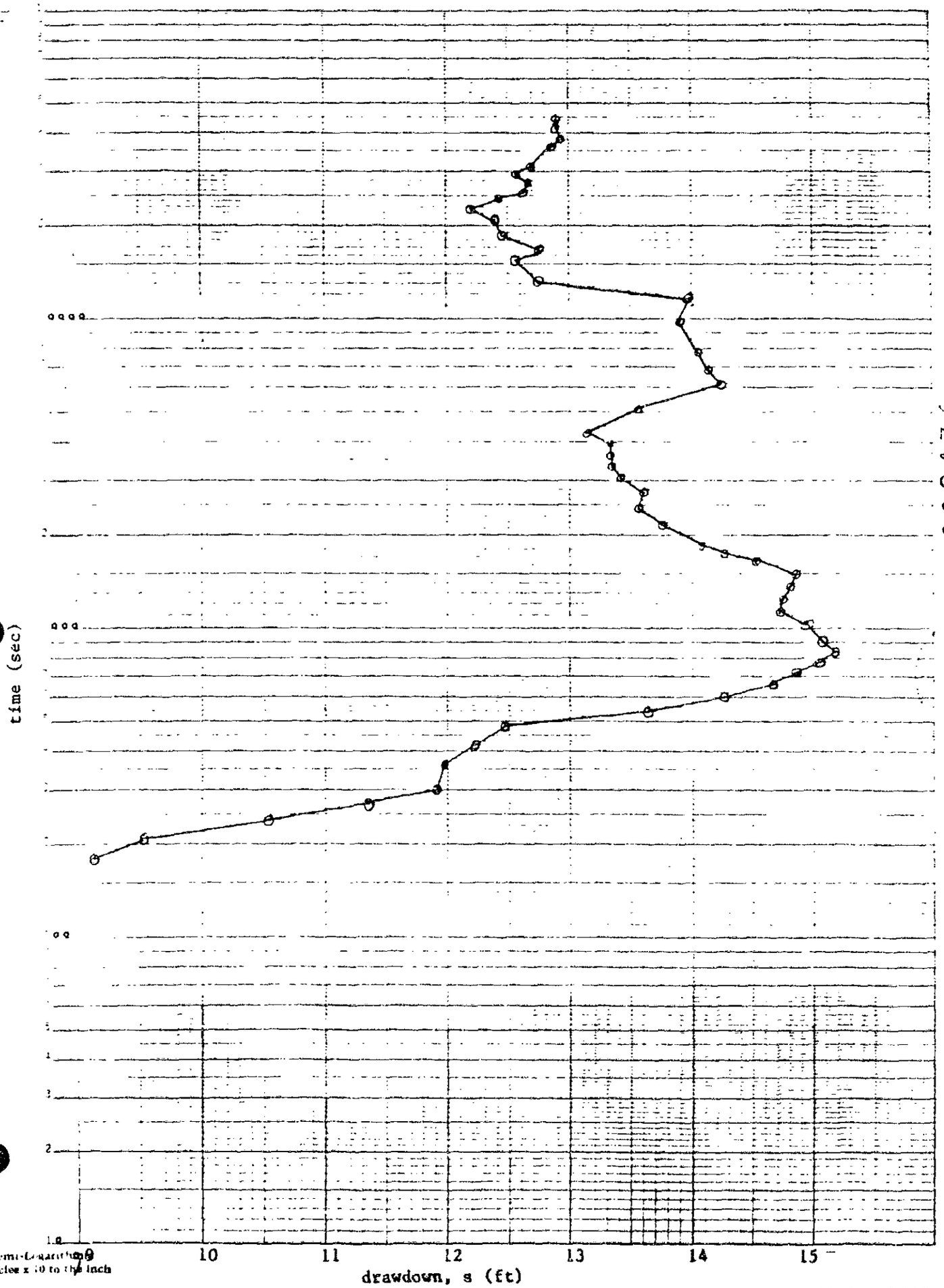
Time-drawdown, MW-25



Semi-Logarithmic
1 Cycles x 10 to the inch

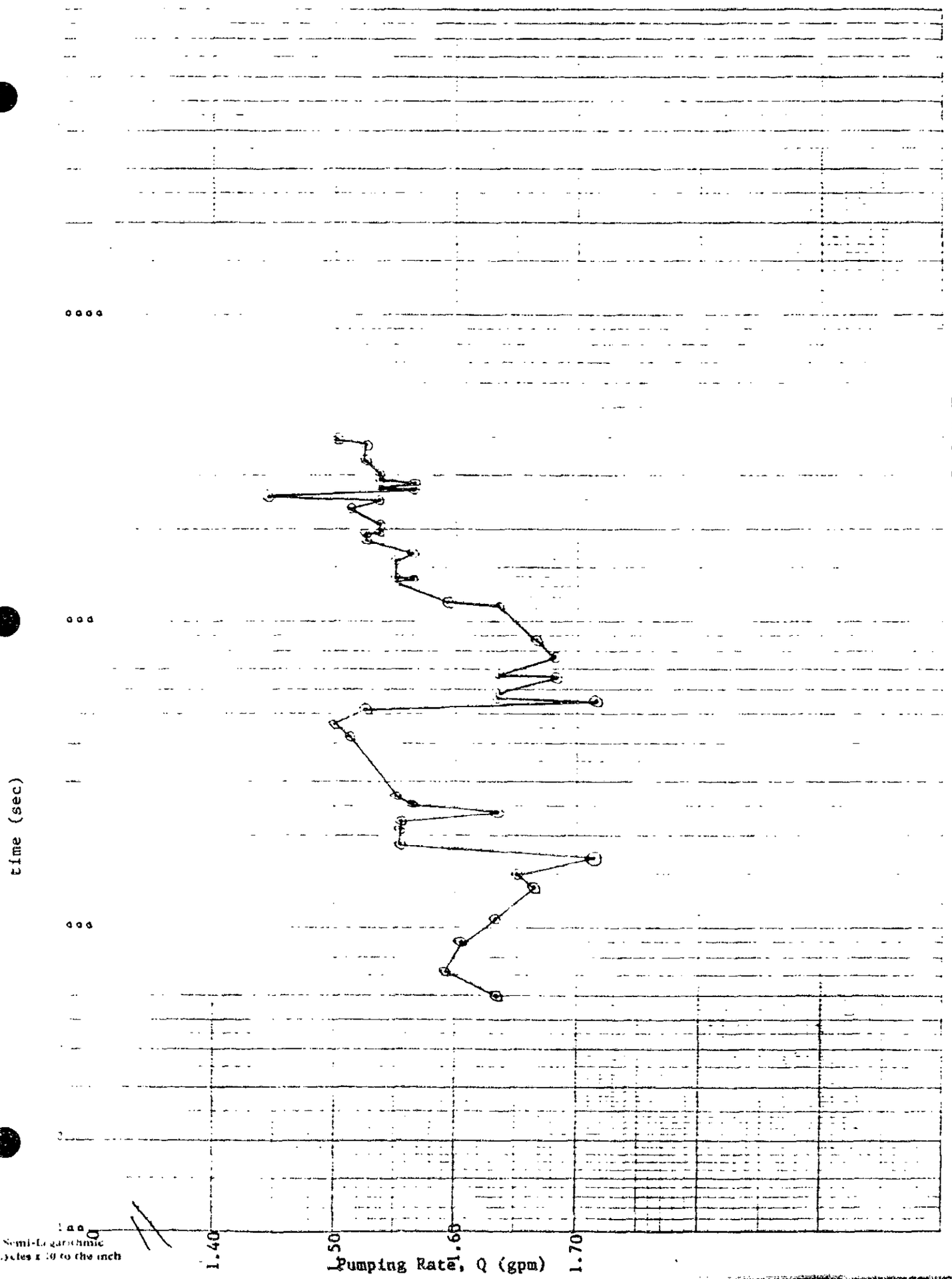
002475

Time-drawdown, MW-29



002476

Pumping Rate versus Time



002477

PUMP TEST DATA SHEET
DAWSONS

PROJECT NAME: SDS
PROJECT NUMBER: 28[illegible]-04
DATE: 12/18/85
OBSERVER: C. [illegible]

WELL # 14W-21
STATIC WATER LEVEL 33.03

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
		33.14*		1140	33.27
0930:00	30	33.15		1260	33.26
	60	33.15		1380	33.26
	90	33.15	(25)	1500	33.26
	120	33.16		1[illegible]	33.26
	150	33.18		1740	33.25
	180	33.20		1860	33.25
	210	33.20		2160	33.25
	240	33.22		2460	33.24
	270	33.22		2760	33.25
	300 (5)	33.21		3060	33.25
	360	33.23	1026	3360	33.25
0937:00	420	33.24	1031(61)	3660	33.25
	480	33.26	1036	3960	33.24
	540	33.25	1041	4260	33.25
940	600 (10)	33.25	1056	5160	33.25
	660	33.25	1111(101)	6060	33.26
	720	33.25			33.24
	780	33.27	1141	7860	33.25
	840	33.28	1211(161)	9660	33.22
	900	33.28	1241	11460	33.20
	1020	33.27	13:11(221)	13260	33.19
			~~1:41~~		~~33.18~~
			~~2:11~~		
				over	

*different sounder

002478

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SDS
PROJECT NUMBER: 298-04
DATE: 12/14
OBSERVER: Green

WELL # MW-21
STATIC WATER LEVEL 33.14

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
1341:00	15,060	33.18			
1411:60 (381)	16,860	33.20			
1441:00	18,660	33.18			
1511:00 (341)	20,460	33.18			
1541:00	22,260	33.18			
1611:00	24,060	33.17			
1641:00	25,860	33.20			
1711:00 (411)	27,660	33.22			
1741:00	29,460	33.23			
1827:00	32,220	33.25			
31:00 (551)	36,060	33.25			
2021:00	39,060	33.27			
2101:00	41,460	33.27			
2142	43,920	33.28			
pump off 2209					
2250		33.19			

002479

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: [illegible]
PROJECT NUMBER: [illegible]
DATE: [illegible]
OBSERVER: [illegible] CYROCK

WELL # 23

STATIC WATER LEVEL 31.91

Clock Time (Start)	Elapsed Time sec	Depth To Water	Clock Time Δs	Elapsed Time	DEPTH TO WATER
0930		31.91			
1025	3300	31.98	.07		
1103	5580	31.98	.07		
1215	9900	31.96	.05		
1249	11,940	31.96	.05		
1:48 1348	15,480	31.91	.00		
2:27 1427	17,820	31.91	.00		
3:16 1516	20,760	31.91	.00		
3:47 1547	22,620	31.91	.00		
4:46 1646	26,160	31.94	.03		
5:15 1715	27,900	31.95	.04		
5:50 1750	30,000	31.97	.06		
6:40 1840	33,000	32.00	.09		
19:10:00	36,600	32.03	.11		
20:15:00	38,700	32.03	.12		
21:08:00	41,880	32.03	.12		
21:39:00	43,740	32.03	.12		
[illegible]					
22:42		31.97			

002480

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SDS
PROJECT NUMBER: 288-08
DATE: 12/18/85
OBSERVER: [illegible]

WELL # 24
STATIC WATER LEVEL = 32.08

Clock Time (Start)	Elapsed Time (sec)	Depth To Water	Clock Time ΔS	Elapsed Time	DEPTH TO WATER
0930		32.08			
1030	3600	32.14	.06		
1105	5700	32.14	.06		
1219	10,140	32.11	.03		
1250	12,000	32.09	.01		
150 1350	15,600	32.08	0		
230 1430	18,000	32.08	0		
315 1515	20,700	32.07	+.01		
351 1551	22,860	32.08	.0		
48 1648	26,280	32.10	.02		
5:18 1718	28,080	32.11	.03		
5:49 1749	29,940	32.11	.03		
6:36 1836	32,760	32.16	.08		
1932:00	36,420	32.17	.09		
2013:00	38,580	32.17	.09		
2105	41,700	32.17	.09		
2138	43,680	32.17	.09		
pump off 2209					
2240		32.12			

002481

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SDS
PROJECT NUMBER: 288-04
DATE: 12/18/85
OBSERVER: [illegible]

WELL # 25
STATIC WATER LEVEL 32.64

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
0930:00	0	32.67		1140	32.71
	30	32.68		1260	32.72
	60	32.70		1380	32.72 *
	90	32.70	0955:00	1500	32.74
	120	32.72		1620	32.75
	150	32.72		1740	32.75
	180	32.74		1860	32.74
	210	32.73	[illegible]	1980	32.74
	240	32.73	[illegible]	2100	32.74
	270	32.73	[illegible]	2260	32.76
	300	32.74	[illegible]	3060	32.76
	360	32.73	[illegible]	[illegible]	32.75
0937:00	420	32.73	[illegible]	[illegible]	32.75
	480	32.73	[illegible]	3960	32.75
	540	32.73	[illegible]	4260	32.75
	600	32.72	1056	5100	32.76
	660	32.73	11:11:00	6060	32.76
	720	32.73	11:26:00	6960	32.76
	780	32.73	11:40:00	7860	32.75
	840	32.73	12:11:00	7660 *	32.72 *
	900	32.72	12:41:00	11,460	32.71
0947:00	1020	32.72	1:11:00	12,260	32.72
			1:41:00		32.71

* READJUSTED TAPE

002482

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SOS
PROJECT NUMBER: 248-04
DATE: 12/19/85
OBSERVER: [illegible]

WELL # 14W-25
STATIC WATER LEVEL

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
1341:00	15,060	32.71			
1411:00	16,860	32.68			
1441:00	18,660	32.69			
1511:00	20,460	32.68			
1541:00	22,260	32.68			
1611:00	24,060	32.70			
1641:00	25,860	32.70			
17[illegible]:00	27,660	32.7[illegible]			
1741:00	29,460	32.73			
1834:00	32,640	32.75			
1935:00	36,300	32.78			
2011:00	38,460	32.78			
2104:	41,640	32.78			
2136	43,560	32.78			
Pump off 2209					

002483

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SDS
PROJECT NUMBER: 288-24
DATE: 12/14/85
OBSERVER:

WELL # 29
STATIC WATER LEVEL 32.89
intake at 53.5'

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
[illegible]	[illegible]	33.28	[illegible]	1140	48.00
9:30:00	[illegible]	36.1		1260	[illegible]
	60	—		1200	45.09
	[illegible]	39.13	9:55:00	[illegible]	[illegible]
	[illegible]	39.23		[illegible]	47.[illegible]
	[illegible]	40.91		1740	47.[illegible]
	90	42.41	[illegible]	[illegible]	[illegible].37
	[illegible]	42.91	10:06:00	[illegible]	[illegible]
	[illegible]	43.7[illegible]	10:11:00	[illegible]	[illegible]
	270	[illegible]	10:16:00	[illegible]	46.9[illegible]
	300	[illegible]	[illegible]	[illegible]	46.69
	360	45.27	10:26	[illegible]	46.62
9:37:00	420	45.51	10:31:00	[illegible]	46.61
	480	45.75	10:36:00	3960	46.61
	540	4690	10:41:00	4260	46.[illegible]3
	600	47.54	10:56	5160	41.94
	660	47.91	11:11:00	6060	47.49
	720	48.13	11:26:00	6960	47.42
	780	48.22	11:41:00	7860	47.35
	840	48.47	12:11:00	9660	47.18
	900	48.36	12:31:00	11460	47.27
9:47:00	1020	48.20	13:11:00	13260	46.05

002484

PUMP TEST DATA SHEET
DRAWDOWN

PROJECT NAME: SDS
PROJECT NUMBER: 2[illegible]-04
DATE: 12/15/[illegible]
OBSERVER: [illegible]

WELL # 14W-29
STATIC WATER LEVEL _____

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
1341:00	15060	45.85			
1411:00	16860	46.05			
1441:00	19660	45.72			
1511:00	20,460	45.68			
1541:00	22,260	45.45			
1611:00	24,060	45.72			
1641:00	25,860	45.92			
1711:00	27,660	45.95			
1741:00	29,460	45.85			
1830:00	32,400	45.90			
1930:00	36,120	46.16			
2017:00	38,820	46.[illegible]			
2102	41,520	46.19			
2141	43,860	46.17			
pump off 2209					

002485

APPENDIX 4E
MONITOR WELL WATER LEVEL MEASUREMENTS
OVER TIME 4/5/84 - 1/2/87

002486

Monitoring Well - 1

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/5/84	167.84	Dry	-	
4/6/84		35.5	132.3	
4/9/84		Dry	-	
4/16/84		36.4	136.0	
4/17/84		36.6	135.8	

Well became plugged and rejuvenated to a total depth of 40.5 feet.

11/22/85		34.85	132.99	
12/6/85		29.3	138.5	
12/13/85		27.53	140.31	
12/19/85		28.44	139.40	
1/3/86		31.74	136.10	
1/14/86		32.78	135.06	stage - low
2/7/86		28.86	138.98	stage - very high
3/21/86		NA	-	tape weight too large to go down; stage - normal
4/24/86		35.55	132.29	very low
5/9/86		32.50	135.34	stage - low
6/11/86		26.03	141.81	stage - high
7/15/86		31.70	136.14	stage - medium
8/18/86		34.01	133.83	stage - low
9/18/86		32.52	135.32	stage - medium
10/27/86		29.23	138.61	stage - high
11/28/86		30.47	137.37	stage - high
1/2/87		26.01	141.83	stage - high

002487

Monitoring Well - 2

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/17/84	172.09	38.37	133.32	
7/5/84		38.60	133.09	
4/20/84		38.77	132.92	

No access, well covered with stock water tank.

002488

Monitoring Well - 3

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/5/84	167.92	38.42	129.50	
4/6/84		35.5	136.9	
4/9/84		35.2	137.2	
4/16/84		36.2	136.2	
4/17/84		35.7	136.7	
10/30/84		34.2	138.2	
10/30/85		34.25	138.11	
11/13/85		34.81	137.55	
11/22/85		34.52	133.40	
12/6/85		31.28	136.64	
12/13/85		30.5	137.4	
12/19/85		30.21	137.71	
1/3/86		31.61	136.31	
1/14/86		32.38	135.54	
2/7/86		30.25	137.67	
3/21/86		32.87	135.05	
4/24/86		34.32	133.60	
5/9/86		32.72	135.20	
6/11/86		29.35	138.57	stage - high
7/15/86		31.06	136.86	stage - medium
8/18/86		32.98	134.94	stage - low
9/18/86		32.37	135.55	stage - average
10/27/86		30.35	137.57	stage - high
11/28/86		30.87	137.05	stage - high
1/2/87		27.81	140.11	stage - high

002489

Monitoring Well - 4

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/6/84	169.73	36.85	132.88	
4/9/84		36.6	133.1	
4/16/84		36.8	132.9	
4/17/84		36.67	133.06	
3/6/85		34.27	135.46	
3/12/85		33.62	136.11	

002420

Monitoring Well - 5

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
3/26/84	172.36	38.67	133.69	
3/27/84		38.67	133.69	
4/5/84		38.42	133.94	
4/6/84		38.45	133.91	
4/9/84		38.1	134.3	
4/16/84		38.3	134.1	
4/17/84		38.15	134.21	
3/6/85		35.71	136.65	
3/12/85		35.63	136.73	
11/22/85		38.16	134.20	
12/6/85		32.51	139.85	
12/13/85		37.14	135.22	
12/19/85		36.76	135.60	
1/3/86		35.92	136.44	
1/14/86		36.08	136.28	
2/7/86		36.55	135.81	
3/21/86		35.97	136.39	
4/24/86		36.90	135.46	
5/9/86		NA	-	
6/11/86		35.67	136.69	
7/15/86		34.85	137.51	
8/18/86		NA	-	
9/18/86		NA	-	
10/27/86		35.77	136.59	
11/28/86		35.57	136.79	
1/2/87		34.49	137.87	stage - high

002491

Monitoring Well - 6

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
3/26/84	168.16	32.67	135.49	
3/27/84		32.67	135.49	
4/5/84		32.75	135.41	
4/6/84		32.75	135.41	
4/9/84		32.50	135.66	
4/16/84		32.90	135.26	
4/17/84		32.84	135.32	
3/6/85		29.45	138.71	
3/12/85		30.58	137.58	
11/6/85		32.35	135.81	
11/13/85		32.54	135.62	
11/22/85		32.42	135.74	
12/6/85		31.01	137.15	
12/13/85		30.82	137.34	
12/19/85		30.28	137.88	
1/3/86		30.3	137.9	
1/14/86		30.68	137.48	
2/7/86		30.54	137.62	
3/21/86		30.83	137.33	
4/24/86		31.67	136.49	
5/9/86		30.88	137.28	
6/11/86		29.59	138.57	
7/15/86		29.61	138.55	
8/18/86		30.76	137.40	
9/18/86		30.62	137.54	
10/27/86		29.90	138.26	
11/28/86		29.99	138.17	
1/2/87		28.53	139.63	

002492

Monitoring Well - 7

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/5/84	169.43	38.00	131.43	
4/6/84		38.00	131.43	
4/9/84		33.70	135.73	
4/16/84		34.40	135.03	
4/17/84		33.52	135.91	
3/6/85		31.42	138.01	
3/12/85		31.66	137.77	
11/6/85		33.95	135.48	
11/13/85		33.83	135.60	
11/22/85		33.72	135.71	
12/6/85		32.45	136.98	
12/13/85		31.75	137.68	
12/19/85		31.75	137.68	
1/3/86		31.75	137.68	
1/14/86		31.96	137.47	
2/7/85		31.41	138.02	
3/21/86		31.89	137.54	
4/24/86		32.55	136.88	
5/9/86		32.00	137.43	
6/11/86		30.65	138.78	
7/15/86		30.75	138.68	
8/18/86		31.80	137.63	
9/18/86		31.78	137.65	
10/27/86		31.27	138.16	
11/28/86		31.24	138.19	
1/2/87		29.77	139.66	

002493

Monitoring Well - 8

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/6/84	169.25	33.75	135.50	
4/9/84		33.5	135.8	
4/16/84		33.45	135.80	
4/17/84		33.50	135.75	
3/12/85		31.83	137.42	
10/30/85		33.50	135.75	
11/13/85		33.38	135.87	
11/22/85		33.24	136.01	
12/6/85		32.55	136.70	
12/13/85		32.43	138.82	
12/19/85		31.94	137.31	
1/3/86		31.52	137.73	
1/14/86		31.82	137.43	
2/7/86		32.00	137.25	
3/21/86		32.17	137.08	
4/24/86		32.36	136.89	
5/9/86		32.02	137.23	
6/11/86		31.18	138.07	
7/15/86		30.75	138.50	
8/18/86		31.62	137.63	
9/18/86		31.68	137.57	
10/27/86		31.23	138.02	
11/28/86		31.27	137.98	
1/2/87		30.26	138.99	

002494

Monitoring Well - 9

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/9/84	178.75	39.9	138.8	
4/16/84		39.95	138.80	
4/17/84		39.97	138.78	

Access limited by water tank

002495

Monitoring Well - 10

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/5/84	168.34	32.00	136.34	
4/6/84		32.1	136.2	
4/9/84		31.6	136.7	
10/30/85		31.83	136.51	
11/13/85		32.03	136.31	
11/22/85		32.02	136.32	
12/6/85		31.70	136.64	
12/13/85		31.59	136.75	
12/19/85		31.38	136.96	
1/3/86		30.96	137.38	
1/14/86		30.91	137.43	
2/7/86		31.11	137.23	
3/21/86		30.40	137.94	
4/24/86		30.73	137.61	
5/9/86		30.78	137.56	
6/11/86		30.39	137.95	
7/15/86		30.04	138.30	
8/18/86		30.24	138.10	
9/18/86		30.39	137.95	
10/27/86		30.35	137.99	
11/28/86		30.21	138.13	
1/2/87		29.93	138.41	

002496

Monitoring Well - 12

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
4/5/84	169.61	28.00	141.61	
4/6/84		28.08	141.53	
4/6/84		28.1	141.5	
4/19/84		27.75	141.86	
11/22/85		28.50	141.11	
12/6/85		27.68	141.93	
12/13/85		27.61	142.00	
12/19/85		28.02	141.59	
1/3/86		27.73	142.48	
1/14/867		NA	-	
2/7/86		28.03	141.58	
3/21/86		27.79	141.82	
4/24/86		27.99	141.62	
5/9/86		27.82	141.79	
6/11/86		27.01	142.60	
7/15/86		27.02	142.59	
8/18/86		27.71	141.90	
9/18/86		27.71	141.90	
10/27/86		27.57	142.04	
11/28/86		27.52	142.09	
1/2/87		26.60	143.01	

002497

Monitoring Well - 13

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
6/12/84	173.63	36.9	136.7	
6/13/84		36.87	136.76	
3/6/85		34.43	139.20	
8/27/85		36.9	136.7	
10/30/85		38.5	135.1	
11/6/85		38.12	135.51	
11/13/85		39.03	134.60	
11/22/85		38.01	135.62	
12/6/85		31.47	142.16*	
12/13/85		35.44	138.19	
12/19/85		35.53	138.10	
1/3/86		35.58	138.05	
1/14/86		35.81	137.82	
2/7/86		35.24	138.39	
3/21/86		35.73	137.90	
4/24/86		36.93	136.70	
5/9/86		36.05	137.58	
6/11/86		34.40	139.23	
7/15/86		34.62	139.01	
8/18/86		35.85	137.78	
9/18/86		35.93	137.70	
10/27/86		35.32	138.31	
11/28/86		35.17	138.46	
1/2/87		33.31	140.32	

* incorrect, due to apparent measuring error

002498

Monitoring Well - 14

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
10/30/85		39.58	135.72	
11/6/85		39.97	135.33	
11/13/85		38.88	135.42	
11/22/85	175.30	39.82	135.48	
12/6/85		38.30	137.00	
12/13/85		37.12	138.18	
12/19/85		37.36	137.94	
1/3/86		37.43	137.87	
1/14/86		32.65	142.65*	
2/7/86		37.06	138.24	
3/21/86		37.63	137.67	
4/24/86		38.47	136.83	
5/9/86		37.94	137.36	
6/11/86		36.23	139.07	
7/15/86		36.39	138.91	
8/18/86		37.69	137.61	
9/18/86		37.71	137.59	
10/27/86		37.06	138.24	
11/28/86		36.88	138.42	
1/2/87		35.01	140.29	

* incorrect due to apparent measuring error

002499

Monitoring Well - 15

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
6/12/84	174.16	38.84	135.32	
6/13/84		39.45	134.71	
3/6/85		33.34	140.82	
3/12/85		35.43	138.73	
10/30/85		38.8	135.36	
11/13/85		40.40	133.76	
11/22/85		38.84	135.32	
12/6/85		35.81	138.35	
12/13/85		34.43	139.73	
12/19/85		34.88	139.28	
1/3/86		37.60	136.56	
1/14/86		38.31	135.85	
2/7/86		34.25	139.91	
3/21/86		39.25	134.91	
4/24/86		40.40	133.76	
5/9/86		37.58	136.58	
6/11/86		33.65	140.51	
7/15/86		36.92	137.24	
8/18/86		39.57	134.59	
9/18/86		37.41	136.75	
10/27/86		35.02	139.14	
11/28/86		35.65	138.51	stage - high
1/2/87		33.21	140.95	

002500

Monitoring Well - 16

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
6/12/84	173.80	40.1	133.7	
6/13/84		40.62	133.18	
3/6/85		33.81	139.99	
3/12/85		35.65	138.15	
10/30/85		40.3	133.5	
11/13/85		41.25	132.55	
11/22/85		40.91	132.89	
12/6/85		36.18	137.62	
12/13/85		35.63	138.17	
12/19/85		35.31	138.49	
1/3/86		37.60	136.20	
1/14/86		38.68	135.12	
2/7/86		36.22	137.58	
3/21/86		39.54	134.26	
4/24/86		41.10	132.70	
5/9/86		38.82	134.98	
6/11/86		34.81	138.99	
7/15/86		37.29	136.51	
8/18/86		39.65	134.15	
9/18/86		NA	-	pond odor too strong to measure
10/27/86		35.96	137.84	
11/28/86		36.96	136.84	
1/2/87		32.82	140.98	

002501

Monitoring Well - 17

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
6/13/84	171.83	35.21	136.62	
3/6/85		32.42	139.41	

ACCIDENTLY DESTROYED

002502

Monitoring Well - 18

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
10/30/85	173.92	40.5	133.4	
11/13		42.31	131.61	
11/22		40.94	132.98	
12/6/85		36.13	137.79	
12/13/85		35.62	138.30	
12/19/85		35.22	138.70	
1/3/86		37.61	136.31	
1/14/86		38.76	135.16	
2/7/86		36.44	137.48	
3/21/86		39.65	134.27	
4/24/86		41.21	132.71	
5/9/86		38.83	135.09	
6/11/86		34.80	139.12	
7/15/86		37.35	136.57	
8/18/86		39.84	134.08	
9/18/86		NA	-	pond odor to strong to measure
10/27/86		35.95	137.97	
11/28/86		37.04	136.88	
1/2/87		32.75	141.17	

002503

Monitoring Well - 19

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
10/30/85	170.38	31.8	138.6	
11/22/85		31.98	138.40	
12/6/85		30.49	139.89	
12/13/85		30.54	139.84	
12/19/85		29.98	140.40	
1/3/86		29.93	140.45	
1/14/86		30.21	140.17	
2/7/86		30.36	140.02	
3/21/86		30.43	139.95	
4/24/86		31.06	139.32	
5/9/86		30.37	140.01	
6/11/86		29.10	141.28	
7/15/86		29.58	140.80	
8/18/86		30.53	139.85	
9/18/86		30.43	139.95	
10/27/86		29.86	140.52	
11/28/86		29.93	140.45	
1/2/87		28.35	142.03	

002504

Monitoring Well - 20

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/13/85	170.10	32.59	137.51	
12/19/85		32.43	137.67	
1/3/86		32.40	137.70	
1/14/86		32.56	137.54	
2/7/86		32.14	137.96	
3/21/86		32.35	137.75	
4/24/86		33.00	137.10	
5/9/86		32.57	137.53	
6/11/86		31.40	138.70	
7/15/86		31.47	138.63	
8/18/86		32.26	137.84	
9/18/86		30.43	139.67*	
10/27/86		31.77	138.33	
11/28/86		31.73	138.37	
1/2/87		30.51	139.59	

* incorrect due to apparent measuring error

002505

Monitoring Well - 21

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/13/85	170.05	33.55	136.50	
12/19/85		33.05	137.00	
1/3/86		32.64	137.41	
1/14/86		32.76	137.29	
2/7/86		32.95	137.10	
3/21/86		32.37	137.68	
4/24/86		32.88	137.17	
5/9/86		32.76	137.29	
6/11/86		32.22	137.83	
7/15/86		31.61	138.44	
8/18/86		31.97	138.08	
9/18/86		32.13	137.92	
10/27/86		32.00	138.05	
11/28/86		31.89	138.16	
1/2/87		31.47	138.58	

002506

Monitoring Well - 22

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/19/86	170.48	32.78	137.70	
1/3/86		32.74	137.74	
1/14/86		32.88	137.60	
2/7/86		32.45	138.03	
3/21/86		32.78	137.70	
4/24/86		33.41	137.07	
5/9/86		32.95	137.53	
6/11/86		31.74	138.74	
7/15/86		31.85	138.63	
8/18/86		32.74	137.74	
9/18/86		32.75	137.73	
10/27/86		32.27	138.21	
11/28/86		32.22	138.26	stage - high ground and pad heaved up, off by 2-3"
1/2/87		30.92	139.56	

002507

Monitoring Well - 23

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/19/86	168.90	31.95	136.95	
1/3/86		31.48	137.42	
1/14/86		31.63	137.27	
2/7/86		31.81	137.09	
3/21/86		NA	-	almost out of chalk
4/24/86		31.76	137.14	
5/9/86		31.64	137.26	
6/11/86		31.10	137.80	
7/15/86		30.48	138.42	
8/18/86		30.73	138.17	
9/18/86		30.95	137.95	
10/27/86		30.83	138.07	
11/28/86		30.73	138.17	
1/2/87		30.36	138.54	

002508

Monitoring Well - 24

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/19/85	168.98	-	-	
1/3/86		31.65	137.33	
1/14/86		31.75	137.23	
2/7/86		31.98	137.00	
3/31/86		31.37	137.61	
4/24/86		31.88	137.10	
5/9/86		31.83	137.15	
6/11/86		31.30	137.68	
7/15/86		30.81	138.17	
8/18/86		31.09	137.89	
9/18/86		31.30	137.68	
10/27/86		31.14	137.84	
11/28/86		30.93	138.05	
1/2/87		30.48	138.50	

002509

Monitoring Well - 25

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/13/85	169.64	33.10	136.54	
1/3/86		32.23	137.41	
1/14/86		32.35	137.29	
2/7/86		32.53	137.11	
3/21/86		NA	-	almost out of chalk
4/24/86		32.48	137.16	
5/9/86		32.38	137.26	
6/11/86		31.81	137.83	
7/15/86		31.25	138.39	
8/18/86		31.55	138.09	
9/18/86		31.77	137.87	
10/27/86		31.60	138.04	
11/28/86		31.49	138.15	
1/2/87		31.05	138.59	

002510

Monitoring Well - 26

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/19/85	171.24	33.57	137.67	
1/3/86		33.51	137.73	
1/14/86		33.66	137.58	
2/7/86		33.26	137.98	
3/21/86		NA	-	almost of out chalk
4/24/86		34.17	137.07	
5/9/86		33.74	137.50	
6/11/86		32.57	138.67	
7/15/86		32.64	138.60	
8/18/86		33.26	137.98	
9/18/86		33.28	137.96	
10/27/86		32.84	138.40	
11/28/86		32.85	138.39	
1/2/87		31.69	139.55	

002511

Monitoring Well - 27

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/19/85	170.36	-	-	
1/3/86		32.56	137.80	
1/14/86		32.68	137.68	
2/7/86		32.38	137.98	
3/21/86		32.37	137.99	
4/24/86		33.17	137.19	
5/9/86		32.76	137.60	
6/11/86		31.63	138.73	
7/15/86		31.65	138.71	
8/18/86		32.47	137.89	
9/18/86		32.46	137.90	
10/27/86		32.06	138.30	sulfer odor
11/28/86		31.99	138.37	
1/2/87		30.80	139.56	

002512

Monitoring Well - 28

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/13/85	170.10	32.53	137.57	
12/19/85		32.53	137.57	
1/3/86		32.44	137.66	
1/14/86		32.53	137.57	
2/7/86		32.20	137.90	
3/21/86		NA	-	almost out of chalk
4/24/86		33.06	137.04	
5/9/86		32.63	137.47	
6/11/96		31.45	138.65	
7/15/86		31.62	138.48	
8/18/86		32.34	137.76	
9/18/86		32.41	137.69	
10/27/86		31.98	138.12	
11/28/86		31.92	138.18	stage - high ground and pad heaved ups, 2-3"
1/2/87		30.66	139.44	

002513

Monitoring Well - 29

Date	Top of casing elevation	Depth to water (ft)	Water elevation (MSL)	Notes
12/13/86	169.90	33.33	136.57	
12/19/86		32.90	137.00	
1/3/86		32.47	137.43	
1/14/86		32.62	137.28	
2/7/86		32.78	134.12	
3/21/86		30.65	139.25*	
4/24/86		32.74	137.16	
5/9/86		32.66	137.24	
6/11/86		32.12	137.78	
7/15/86		31.65	138.25	
8/18/86		32.12	137.78	
9/18/86		32.20	137.70	
10/27/86		32.08	137.82	
11/28/86		31.93	137.97	stage - high ground and pad heaved up 2-3"
1/2/87		31.42	138.48	

* incorrect due to apparent measuring error

002514

APPENDIX 4F
CONFINED AQUIFER
PUMP TEST DATA ANALYSIS
AND LEAKING AQUIFER ANALYSIS

002515

A pump test was conducted on 1/4/86 using the pump test well and the four piezometers to determine the hydraulic characteristics of the confined aquifer. The aquifer was pumped at 5.5 gpm which produced 15 feet of drawdown in the pumped well. This pumping rate did not adequately stress the aquifer and the pump test was terminated.

002516

THEIS CURVES

$$T = \frac{Q}{4} \frac{W(u)}{s}$$

$$S = \frac{4Tu}{r^2/t}$$

Where:

T = Transmissivity (ft^2/min)

Q = Discharge (ft^3/min)

W(u) = Well function

S = Storage coefficient

$$u = \frac{r^2 S}{4Tt}$$

r = Radius (ft)

t = Time (min)

002517

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 2

PROJECT: SDS

JOB NO.:

SUBJECT: Theis Curve Calculations

COMPUTED BY: DATE:

CHECKED BY: DATE

MW-22

$$T = \frac{1.38}{4\pi 127}(21)$$

$$T = 2.18 \ ft^2/min$$

$$S = \frac{4(18)(.069)}{225.3}$$

$$S = 22 \times 10^{-4}$$

MW-26

$$T = \frac{1.38}{4\pi(78)} 19$$

$$T = 26 \ ft^2/min$$

$$S = \frac{4(26)(0.72)}{497}$$

$$S = 17 \times 10^{-4}$$

002518

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 2 OF 2

JOB NO.:

SUBJECT: Slug Test Calculations

COMPUTED BY: DATE:

CHECKED BY: DATE:

MW - 27

$$T = \frac{1.38}{4\pi(4.87)} 3$$

$$T = 0.068 \text{ ft}^2/\text{min}$$

$$S = \frac{4(.068)\ .03}{33}$$

$$S = 2.4 \times 10^{-4}$$

MW - 27

$$T = \frac{1.38}{4\pi\ 6.8} 1.9$$

$$T = 0.031 \text{ ft}^2/\text{min}$$

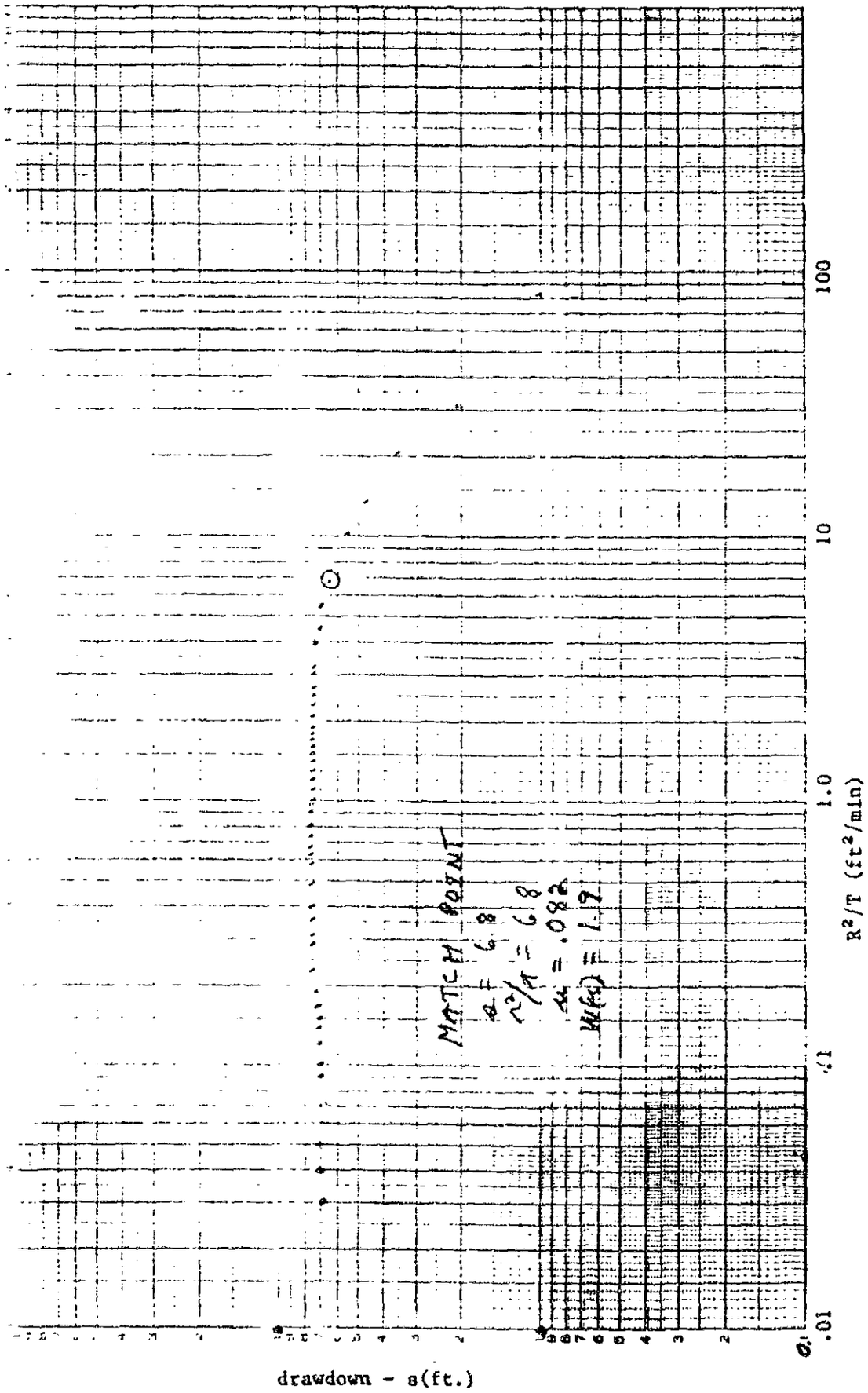
$$S = \frac{4(.031)(.082)}{6.8}$$

$$S = 1.4 \times 10^{-3}$$

00257'9

REI

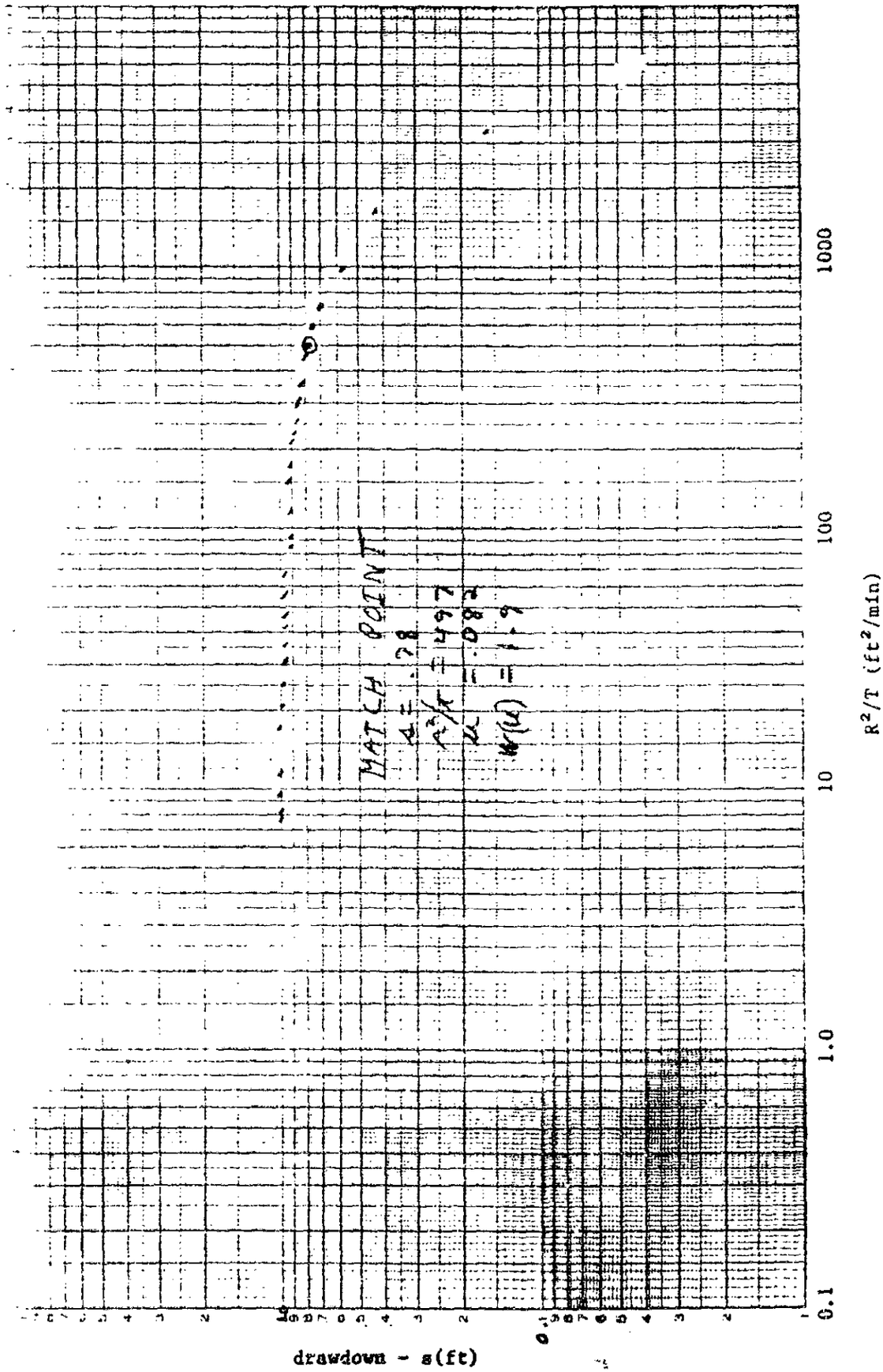
Theis Curve MW-28



302520

Full Logarithmic, 3 × 5

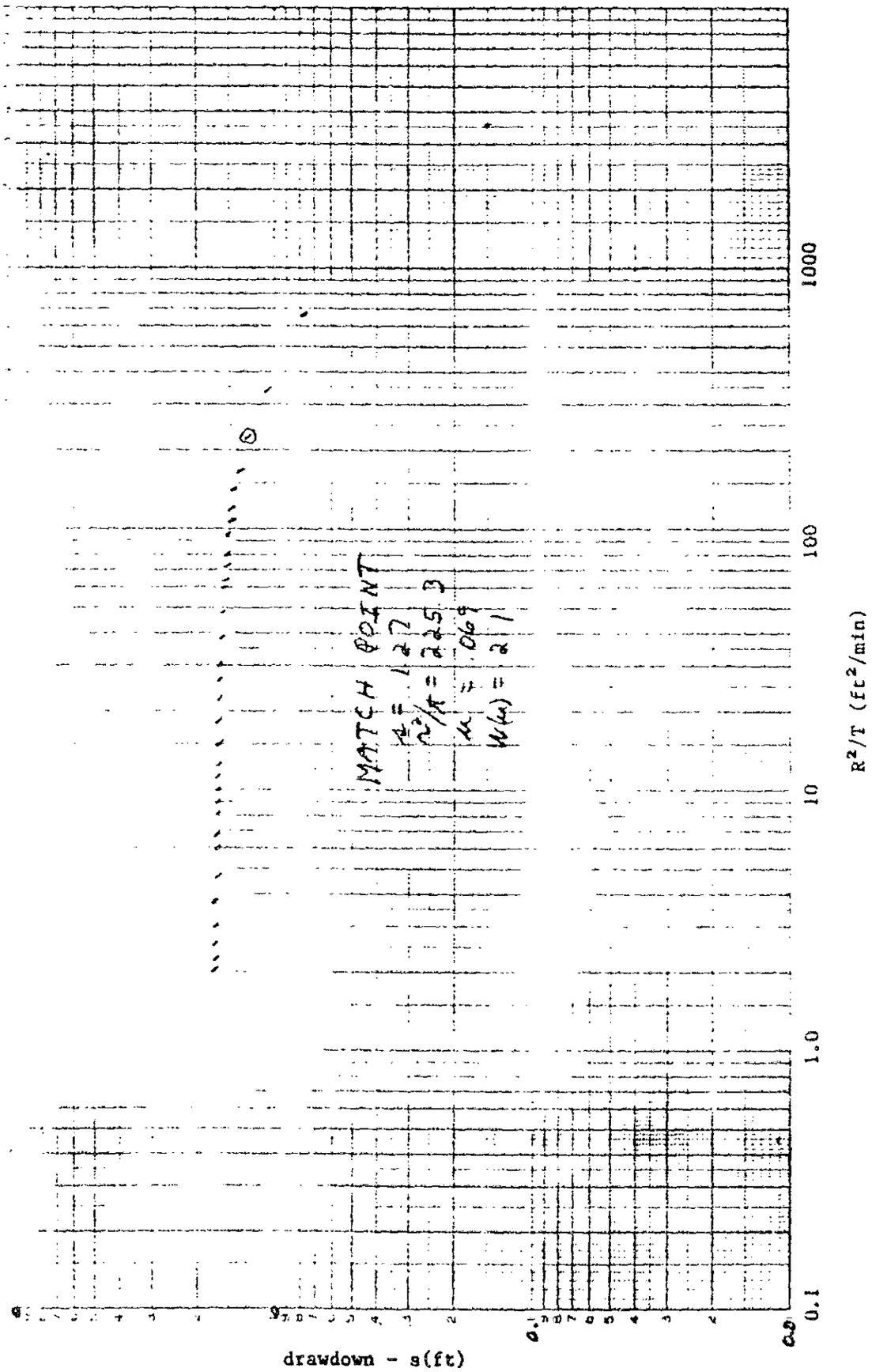
Theis Curve MW-26



002521

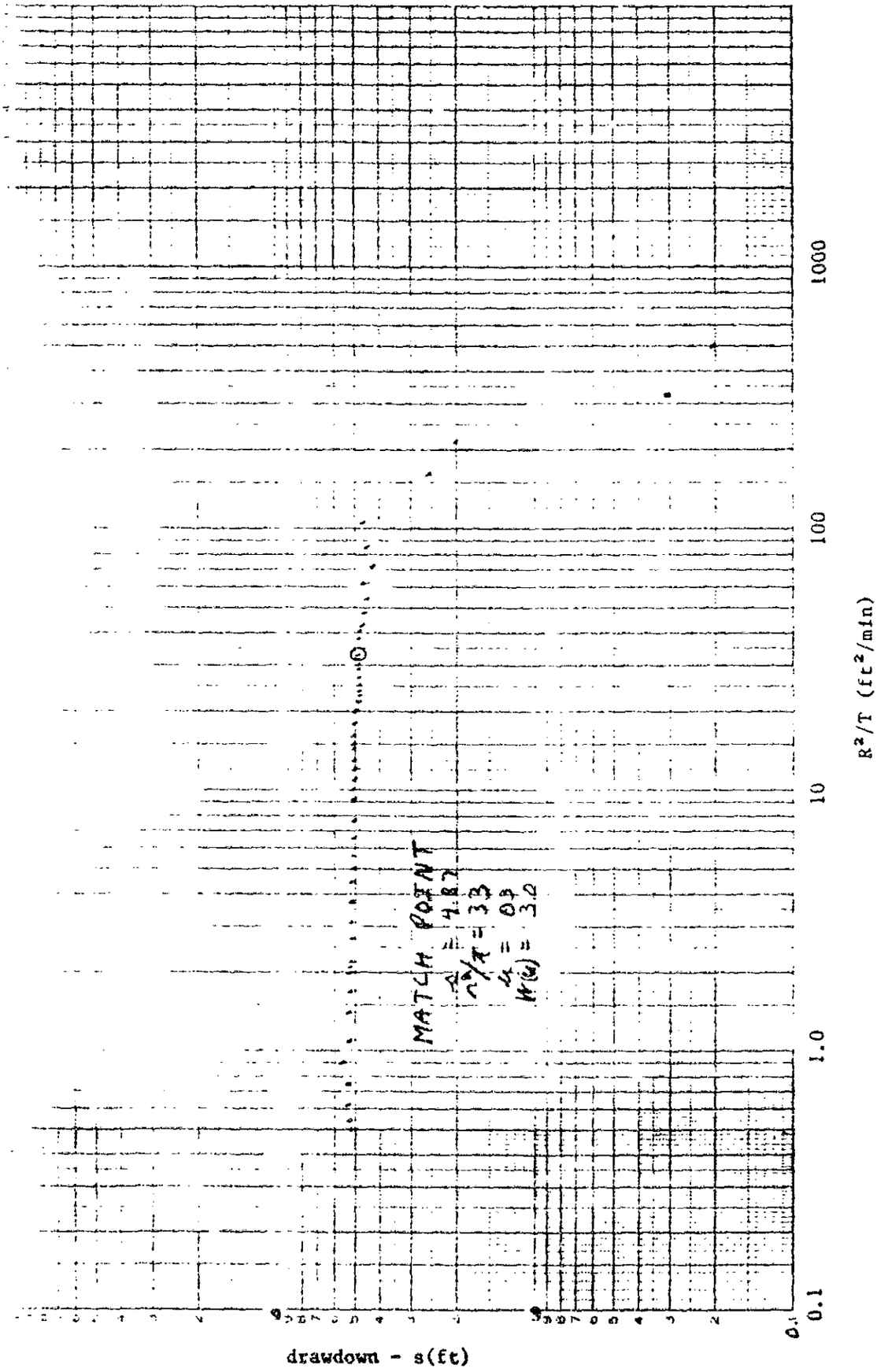
Full Logarithmic, 3 × 5

Theis Curve MW-22



002522

Theis Curve MW-27



002523

Full Logarithmic 3 x 5

Time-drawdown Calculations

$$T = \frac{264\ Q}{\Delta s}$$

$$S = \frac{0.3\ T\ t_o}{r^2}$$

where

T = transmissivity (gpd/ft)

Q = pumping rate (gpm)

Δs = change in drawdown between any two log cycles, straight line

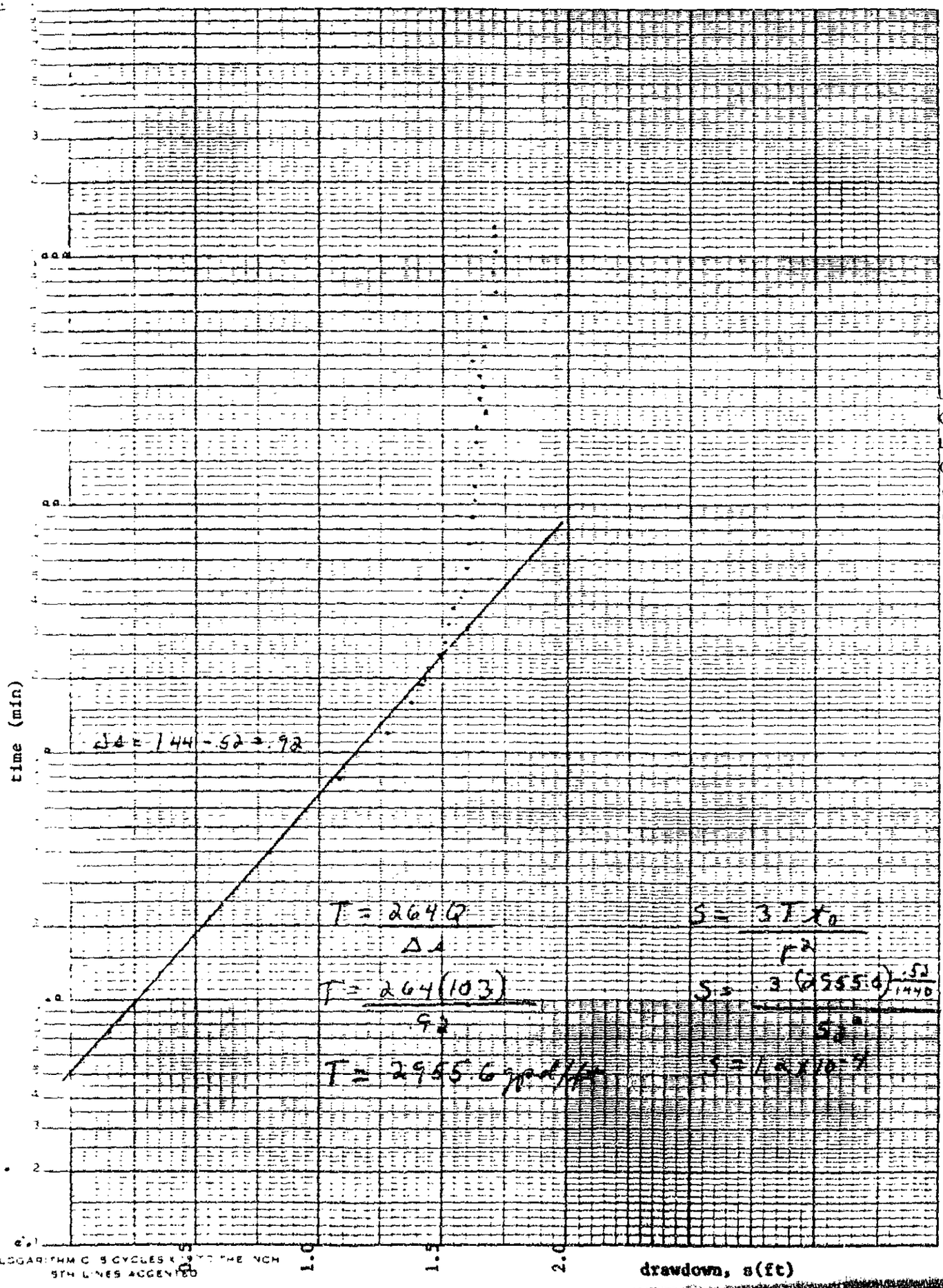
S = storage coefficient

t_o = intercept at zero drawdown (days)

r = radius of observation well (ft)

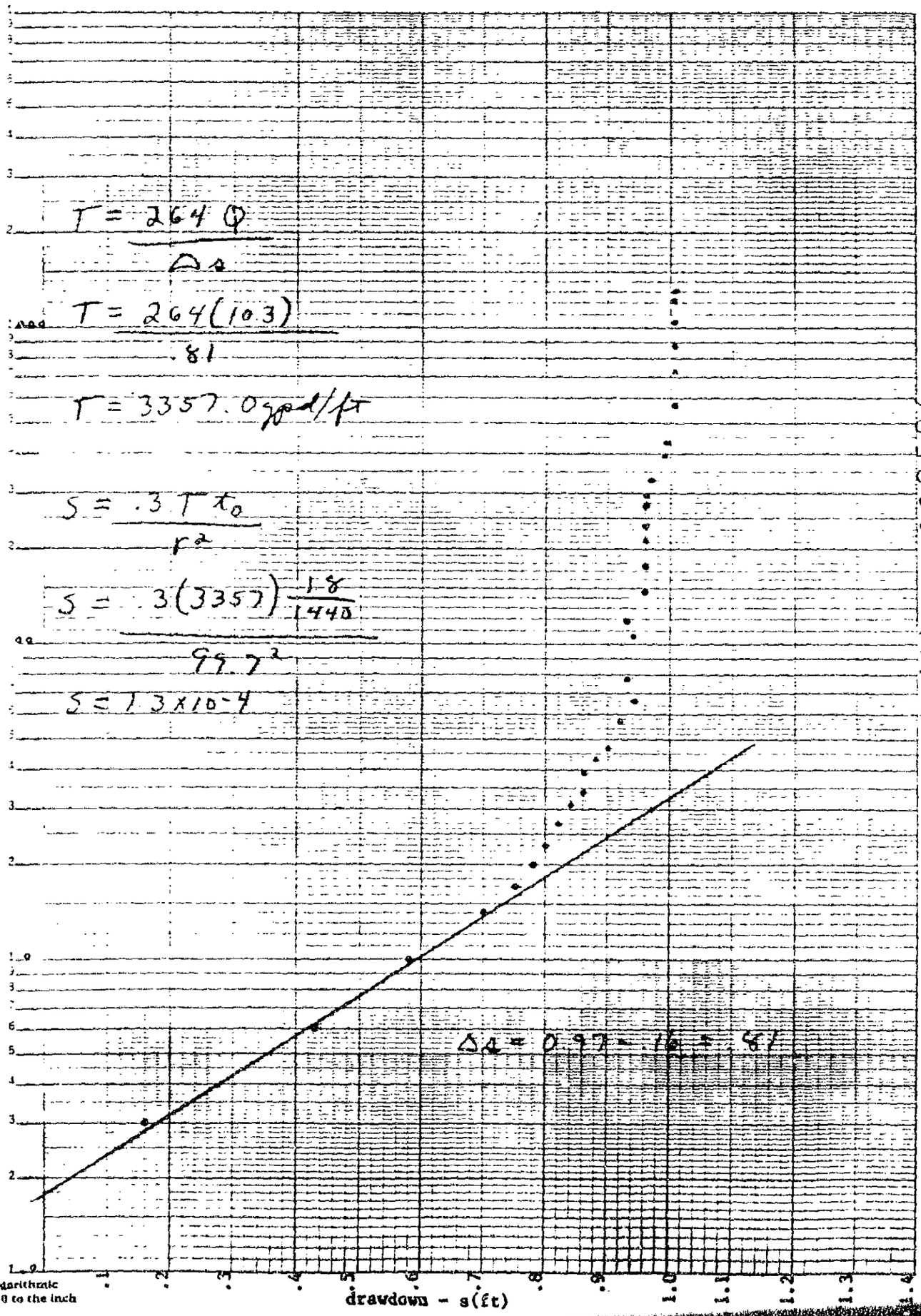
002524

Time-drawdown, MW-22



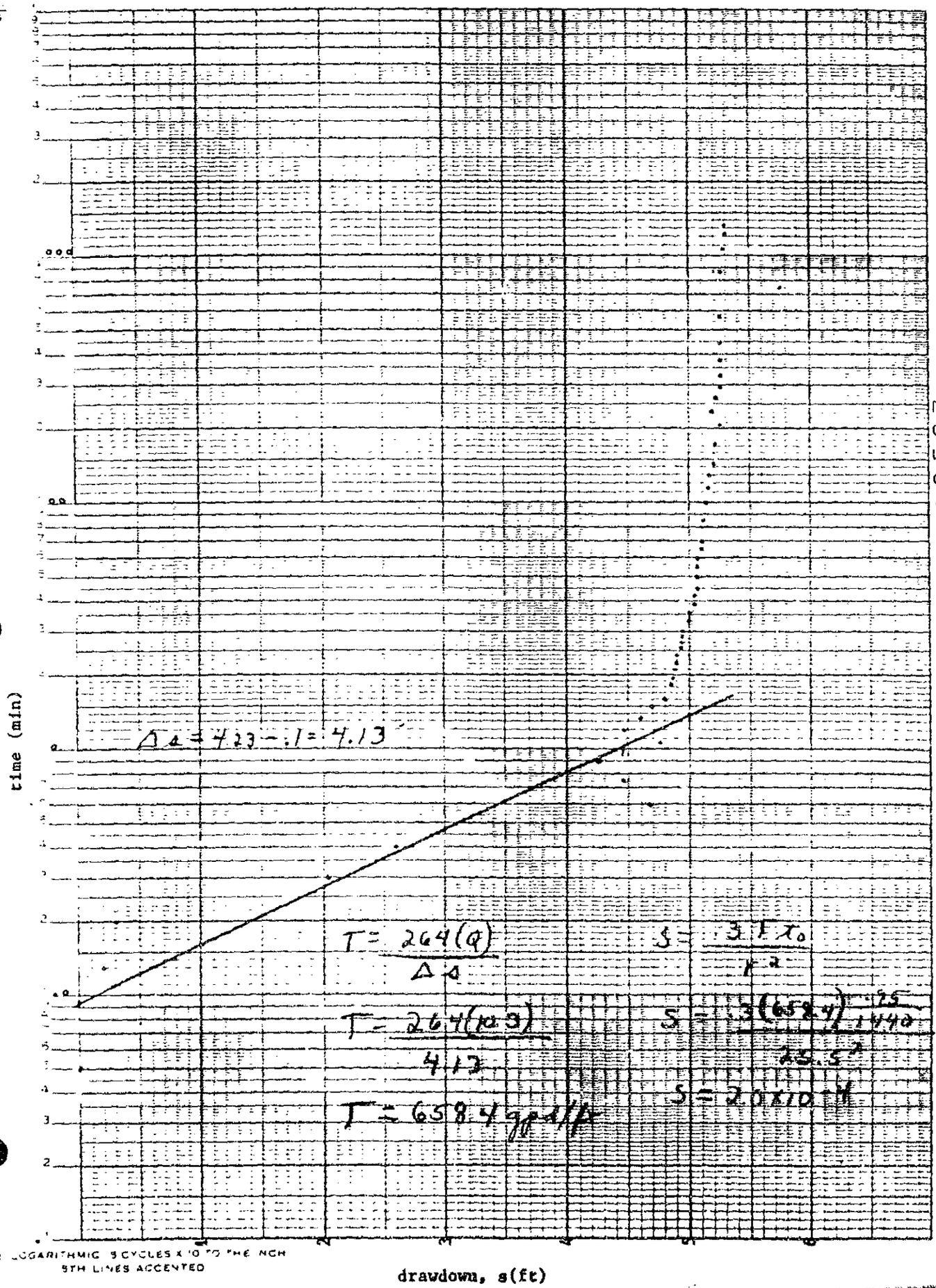
002525

Time-drawdown, MW-26



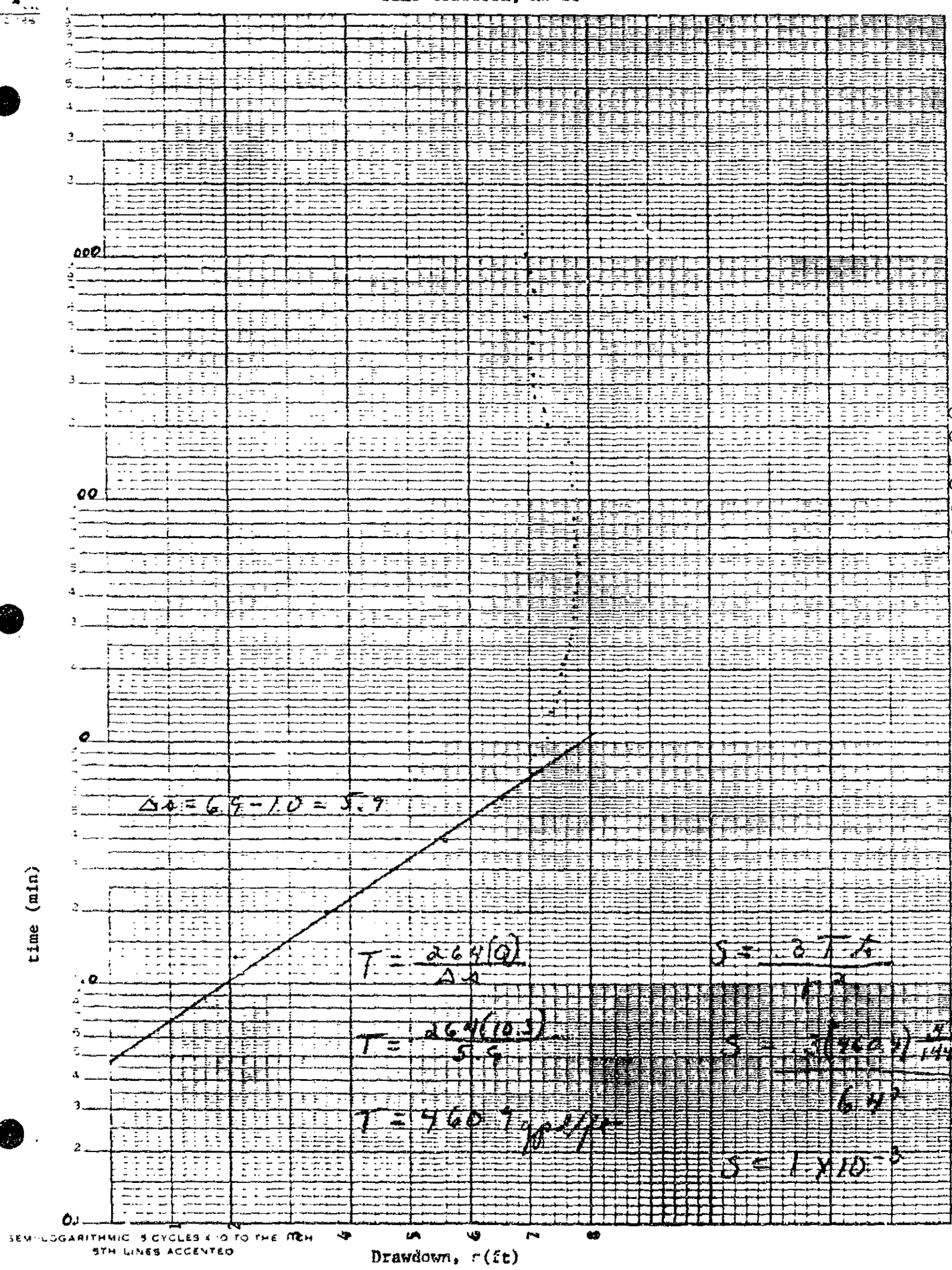
002526

Time-drawdown, MW-27



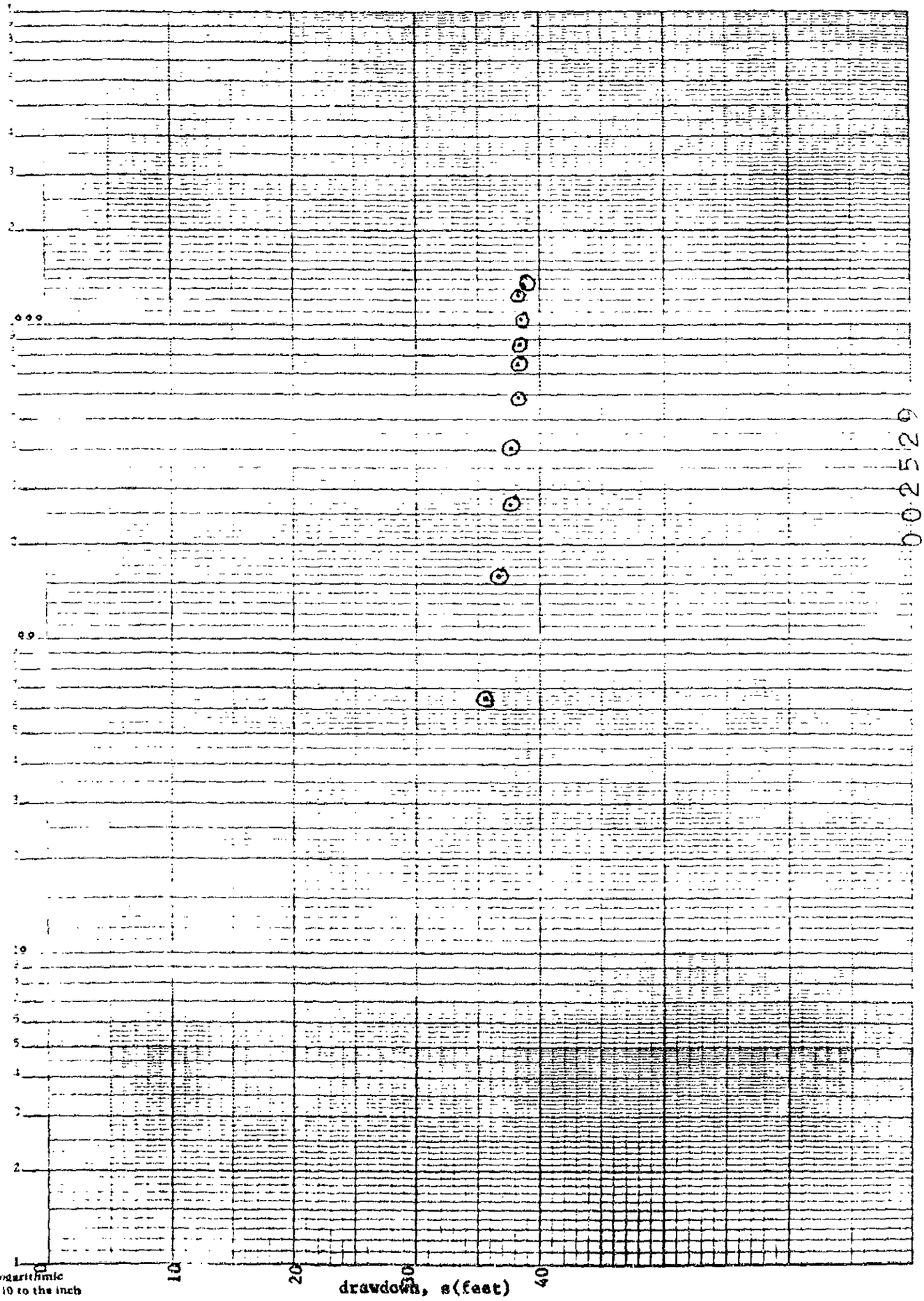
002527

Time-drawdown, MW-28



002522

Time-drawdown, MW-20



002529

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 1

PROJECT:

JOB NO.:

SUBJECT: Recovery #22 Static W.L.

COMPUTED BY: DD DATE: 2/13/85

CHECKED BY: DATE:

time	t (min) (pump on = 0813:00)	t' (min) (pump off = 0832:00)	t/t'	W.L.	S' (W.L. - static W.L.)
0832:00	1339.0	0.0	∞	33.93	1.72
0832:30	1339.5	0.5	2679	33.98	1.77
0833:00	1340.0	1.0	1340	33.92	1.71
0833:30	1340.5	1.5	894	33.75	1.54
0834:00	1341.0	2.0	671	33.63	1.42
0834:30	1341.5	2.5	537	33.55	1.34
0835:00	1342.0	3.0	447	33.47	1.26
0835:30	1342.5	3.5	384	33.37	1.16
0836:00	1343.0	4.0	336	33.31	1.15
0836:30	1343.5	4.5	299	33.22	1.01
0837:00	1344.0	5.0	269	33.15	0.94
0838:00	1345	6.0	224	33.03	0.82
0839:00	1346	7.0	192	32.94	0.73
0840:00	1347	8.0	168	32.85	0.64
0841:00	1348	9.0	150	32.79	0.58
0842:00	1349	10.0	135	32.79	0.53
0844:00	1351	12.0	113	32.66	0.45
0845:00	1352	13.0	104	32.63	0.42
0848:00	1355	16.0	85	32.57	0.36
0851:00	1358	19.0	71	32.55	0.34
0854:00	1361	22.0	62	32.49	0.28
0858:00	1365	26.0	52	32.47	0.26
0903:00	1370	31.0	44	32.45	0.24

002530

REI

CALCULATIONS AND COMPUTATIONS

SHEET ___ OF ___

PROJECT: _____ JOB NO.: _____

SUBJECT: Recovery #27 static w.l. = 32.17
Pump on => 1013:00

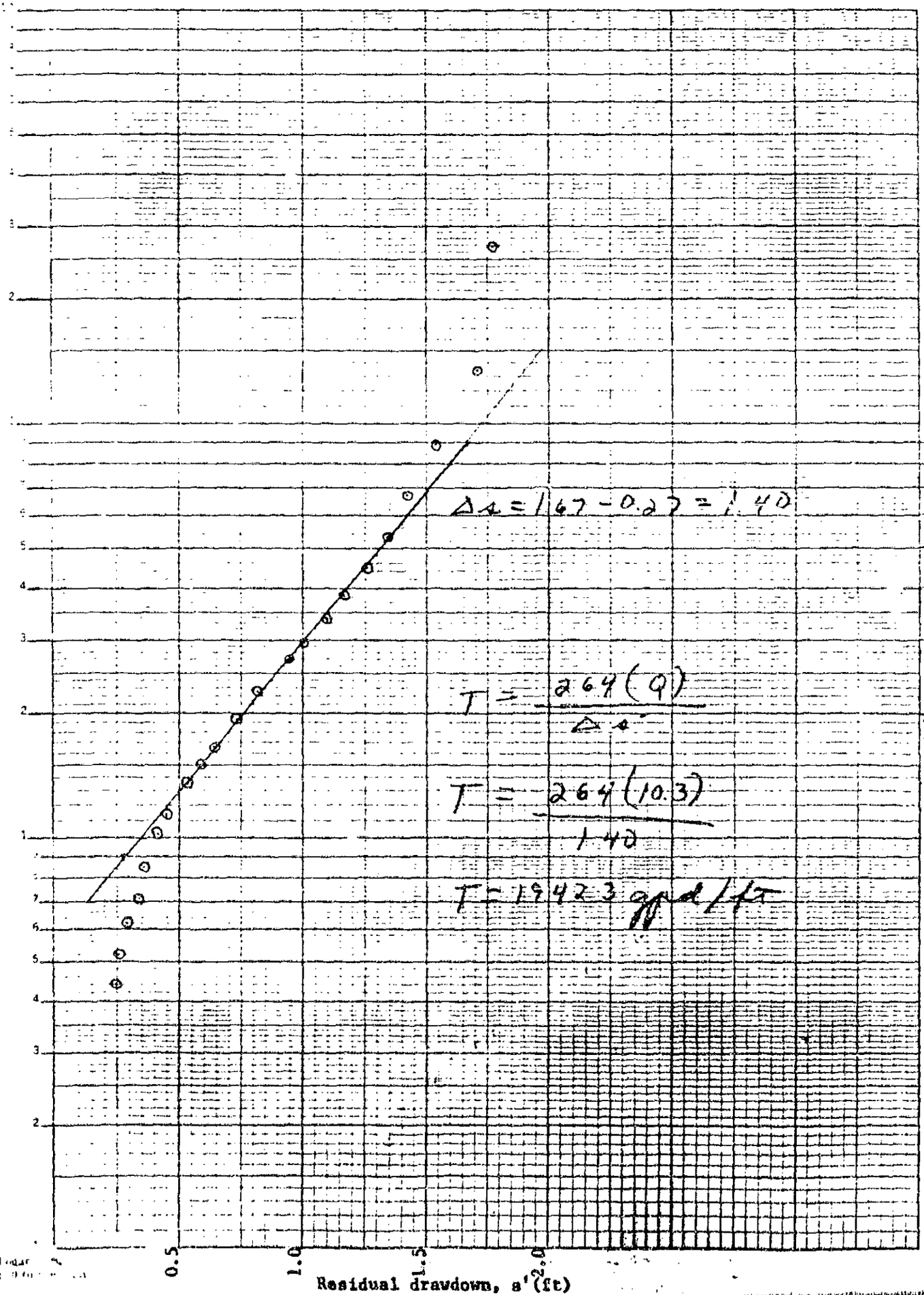
COMPUTED BY: ___ DATE: ___

CHECKED BY: ___ DATE: ___

time	t(min)	t'(min)	t/t'	w.l.	s' (w.l. - static w.l.)
0832:00	1339.0	0	∞	37.20	5.03
0832:30	1339.5	0.5	2679	37.12	4.95
0833:00	1340.0	1.0	1340	36.82	4.65
0833:30	1340.5	1.5	894	36.47	4.30
0834:00	1341.0	2.0	671	36.04	3.97
0834:30	1341.5	2.5	537	35.60	3.43
0835:00	1342.0	3.0	447	35.17	3.00
0835:30	1342.5	3.5	384	34.86	2.69
0836:00	1343.0	4.0	336	34.44	2.27
0836:30	1343.5	4.5	299	—	
0837:00	1344.0	5.0	269	33.70	1.73
0838:00	1345	6.0	224	33.55	1.38
0839:00	1346	7.0	192	33.32	1.15
0840:00	1347	8.0	168	33.05	0.88
0841:00	1348	9.0	150	32.89	0.72
0842:00	1349	10.0	135	32.73	0.56
0843:00	1350	11.0	123	32.59	0.42
0844:00	1351	12.0	112	32.56	0.39
0845:00	1352	13.0	104	32.48	0.31
0846:00	1353	14.0	97	32.42	0.25
0847:00	1354	15.0	90	32.39	0.22
0849:00	1356	17.0	80	32.32	0.15
0851:00	1358	19.0	71	32.26	0.09
0853:00	1360	21.0	65	32.23	0.06
0855:00	1362	23.0	59	32.23	0.06
0857:00	1364	25.0	54	32.21	0.04
0907:00	1374	35.0	39	32.15	−0.02

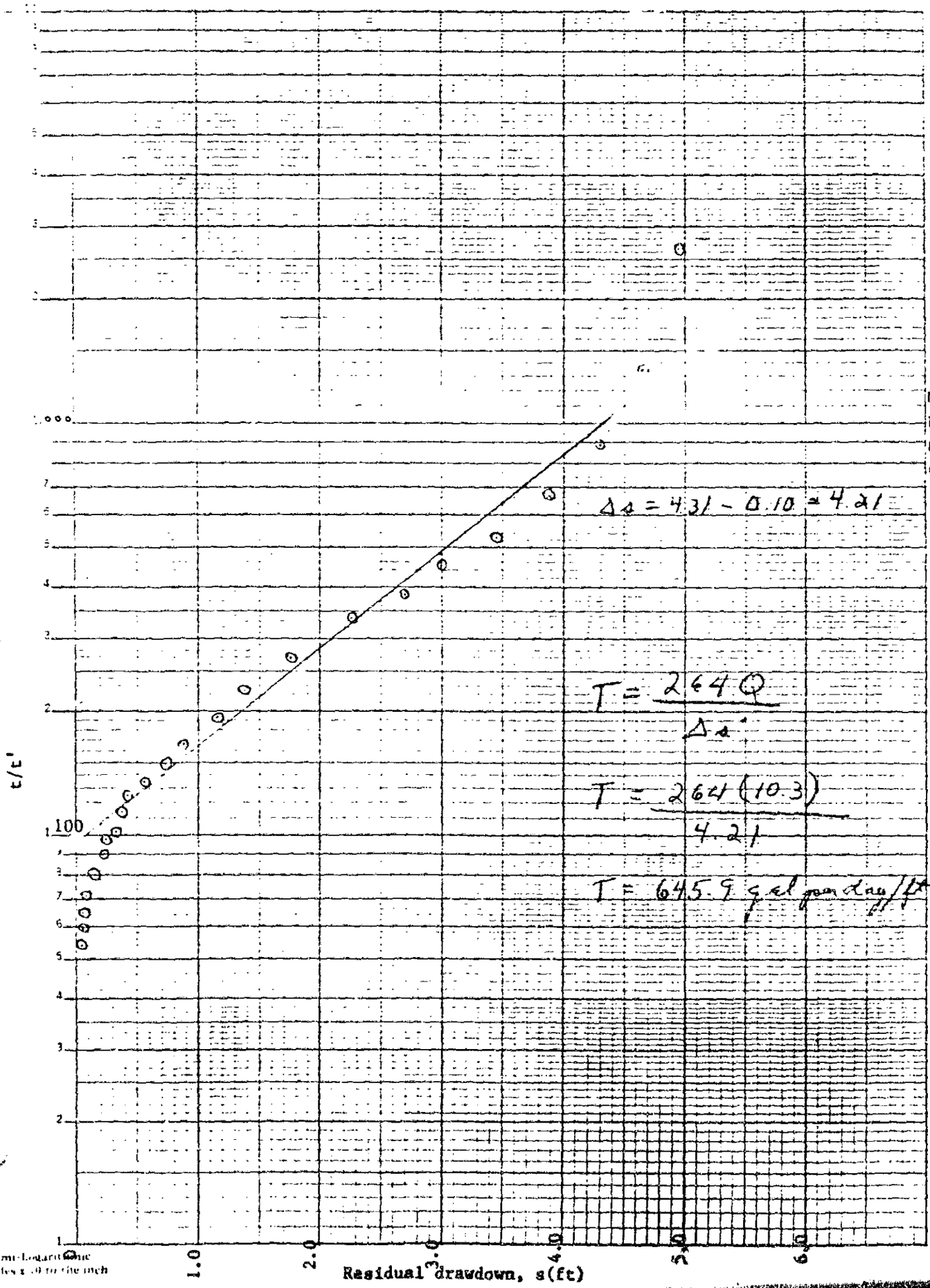
REI

Recovery Curve, MW-22



002532

Recovery Curve, MW-27



$\Delta s = 4.31 - 0.10 = 4.21$

$$T = \frac{264Q}{\Delta s}$$

$$T = \frac{264(10.3)}{4.21}$$

$T = 645.9$ gal per day/ft

0025533

Distance Drawdown Curve

$$T = \frac{528\,Q}{\Delta s}$$

$$T = \frac{528(10.3)}{5.0}$$

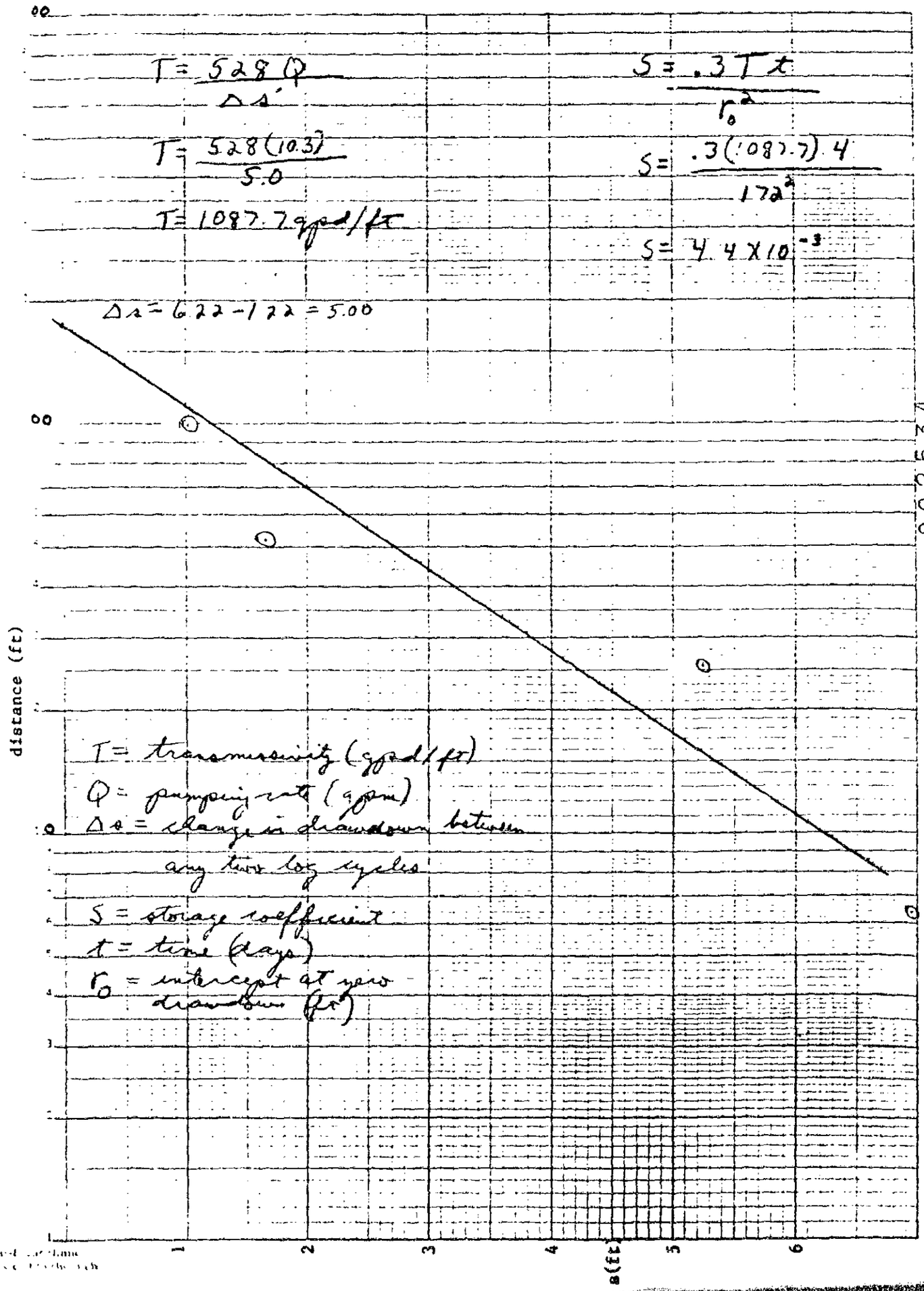
$$T = 1087.7 \text{ gpd/ft}$$

$$S = \frac{.3\,T\,t}{r_0^2}$$

$$S = \frac{.3(1087.7)\,.4}{172^2}$$

$$S = 4.4 \times 10^{-3}$$

$\Delta s = 6.22 - 1.22 = 5.00$



T = transmissivity (gpd/ft)
Q = pumping rate (gpm)
Δs = change in drawdown between any two log cycles
S = storage coefficient
t = time (days)
r_0 = intercept at zero drawdown (ft)

002534

Hantush-Jacob, Leaky Aquifer

$$T = \frac{Q(1440)\ L(u,v)}{4\pi s\ 7.48}$$

$$S = 4T\ \frac{t/r^2}{1/u}$$

$$\frac{K'}{b'} = 4T\ \frac{v^2}{r^2}$$

where

T = transmissivity (ft^2/day)

Q = discharge (gpm)

$L(u,v)$ = leakance function

s = drawdown (ft)

S = storage coefficient

t = time (days)

r = radius from pump well (ft)

$u = \frac{r^2 S}{4Tt}$

K' = vertical hydraulic conductivity of the confining bed

b' = thicknes of confining bed

$v = \frac{r}{2}\sqrt{\frac{K'}{b'T}}$

002535

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 4

PROJECT: SDC

JOB NO

SUBJECT: H-5

COMPUTED BY: DATE:

CHECKED BY: DATE:

MW-22

$$T = \frac{10.3\,(1440)(2.3)}{4\pi(1.60)\,7.48}$$

$$T = 226.8\ (ft^2/day)$$

$$S = 4(226.8)\,\frac{1.8\times10^{-5}}{100}$$

$$S = 16\times10^{-4}$$

$$\frac{K'}{b'} = 4(226.8)\,\frac{2.2}{50^2}$$

$$\frac{K'}{b'} = 0.013/day$$

$$K' = 0.013(25)$$

$$K' = 0.33\ ft/day$$

002536

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SUBJECT: H-J

SHEET 7 OF 4

JOB NO.

COMPUTED BY [illegible] DATE

CHECKED BY DATE

MW-26

$$T = \frac{10.3(1440)(1)}{4\pi(97)7.48}$$

$$T = 1627 \ (ft^2/day)$$

$$S = 4(1627)\frac{2.3\times10^{-5}}{100}$$

$$S = 1.5\times10^{-4}$$

$$\frac{K'}{b'} = 4(1627)\frac{45^2}{997^2}$$

$$\frac{K'}{b'} = 0.013/day$$

$$K' = 0.013(25)$$

$$K' = 0.33 \ ft/day$$

002537

REI

CALCULATIONS AND COMPUTATIONS

SHEET 3 OF 4

PROJECT: SOS

JOB NO.:

SUBJECT: H - J

COMPUTED BY: DATE:

CHECKED BY: DATE:

MW-27

$$T = \frac{10.3(1440)16}{4\pi(5.16)7.48}$$

$T = 48.9\ ft^2/day$

$$S = 4(48.9)\frac{1.2\times10^{-4}}{100}$$

$S = 2.3\times10^{-4}$

$$\frac{K'}{b'} = 4(48.9)\frac{3^2}{25.5^2}$$

$\frac{K'}{b'} = 0.027/day$

$K' = 0.027(25)$

$K' = 67\ ft/day$

002538

REI

CALCULATIONS AND COMPUTATIONS

SHEET 4 OF 4

PROJECT: [illegible]

JOB NO.:

SUBJECT: H - J

COMPUTED BY: [illegible] DATE:

CHECKED BY: DATE

MW-28

$$T = \frac{103(1440)\,2.8}{4\pi(0.77)(0.48)}$$

$$T = 56.8 \text{ ft}^2/\text{day}$$

$$S = 4(56.8)\frac{6.1\times10^{-4}}{100}$$

$$S = 1.4\times10^{-3}$$

$$\frac{K'}{b'} = 4(56.8)\frac{.17^2}{6.4}$$

$$\frac{K'}{b'} = 0.16 \text{ /day}$$

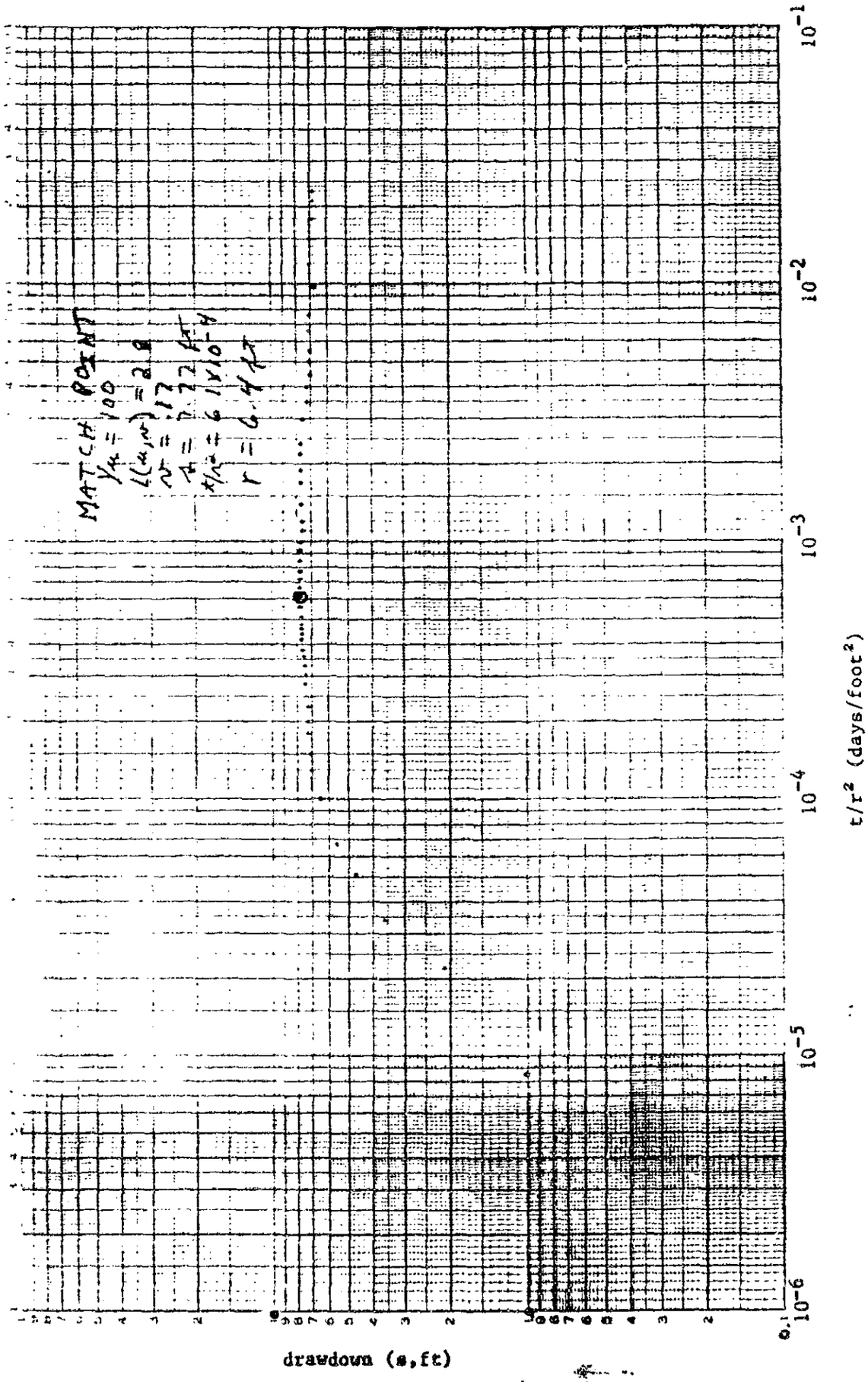
$$K = 0.16(.05)$$

$$K' \quad 40 \text{ ft/day}$$

002539

REI

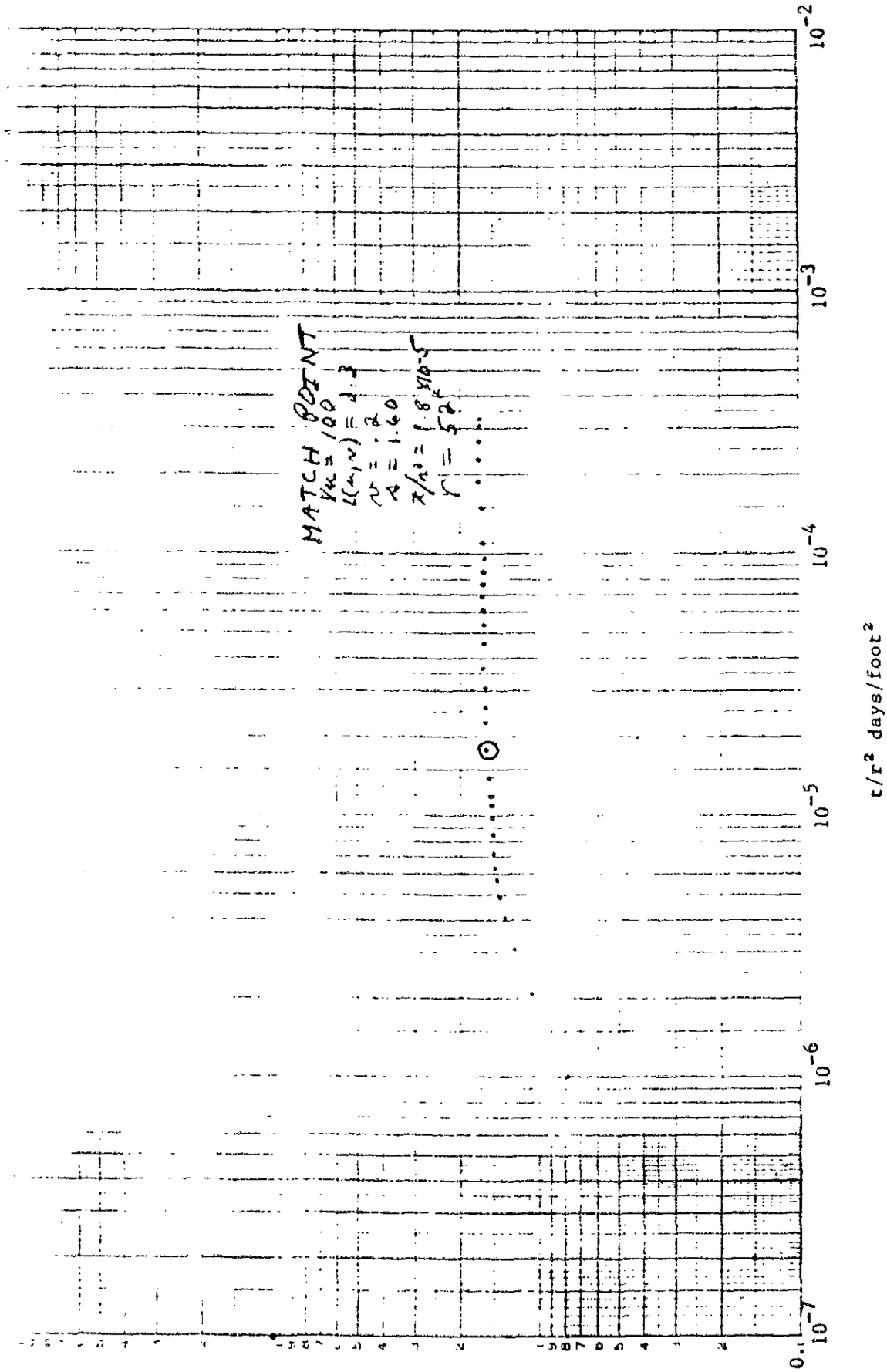
Hantush-Jacob Leaky Aquifer Solution, MW-28



002540

Full Logarithmic, 5 × 5

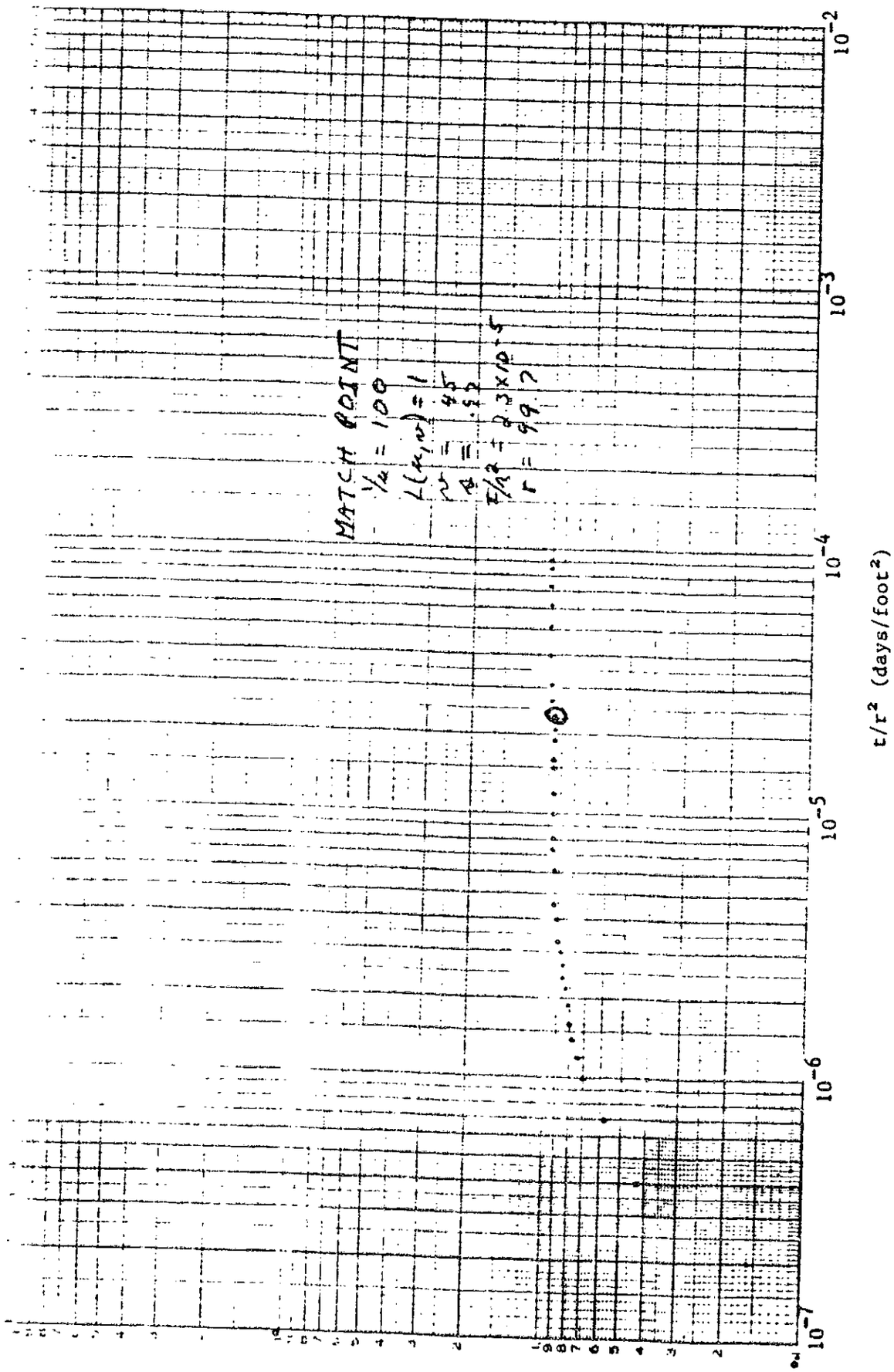
Hantush-Jacob Leaky Aquifer Solution, MW-22



002541

Full Logarithmic 3 x 5

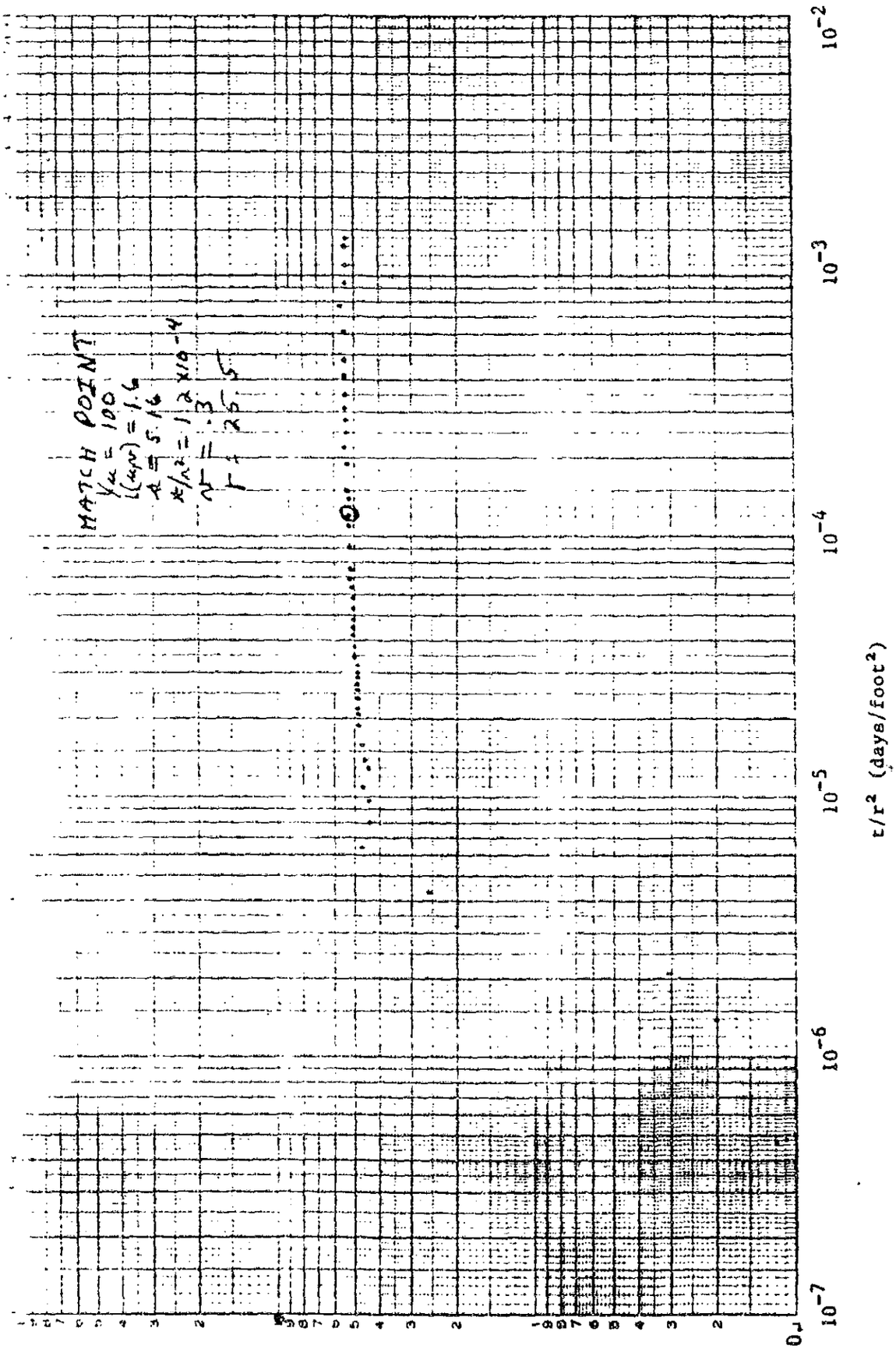
Hantush-Jacob Leaky Aquifer Solution, MW-26



002542

Full Logarithmic, 3 x 5

Jantush-Jacob Leaky Aquifer Solution, MW-27



002543

Full Logarithmic, 5 x 5

Leaky Aquifer Solution,
Bureau of Reclamation

$$T = \frac{Q\mu}{2\pi s}$$

$$S = \frac{t\ K'}{M'}$$

$$\frac{K'}{M'} = \frac{T\ x1^2}{r1^2}$$

$$\mu = \frac{s2\pi KM}{Q}$$

Where:

T = Coefficient of transmissivity (ft^2/min)
Q = Pumping rate (ft^3/min)
s = Drawdown (ft)
S = Storativity (dimensionless)
t = Time (min)
K' = Vertical permeability of upper confining clay (ft/min)
M' = Thickness of upper confining clay (ft)
x = X value for type curve which fits the plotted s-t relation for the observation well
r = Radius from pumping well (ft)

002544

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 1 OF 4

SUBJECT: Leaky Aquifer, Bureau of Reclamation

JOB NO.:

COMPUTED BY ____ DATE ____

CHECKED BY ____ DATE ____

MW-22

Matched Point

$x = 0.2$
$y = 1.0$
$u = 10$
$s = 0.9$
$t = 40$
$r = 50.0$
$Q = 1.38$

$$T = \frac{Qu}{4\pi s}$$

$$T = \frac{1.38(10)}{4\pi \cdot 9}$$

$$T = .24 \text{ ft}^2/\text{min}$$

$$\frac{K'}{M'} = \frac{T x_1^2}{r^2}$$

$$\frac{K'}{M'} = \frac{.24(.2^2)}{50^2}$$

$$\frac{K'}{M'} = 3.6 \times 10^{-6}/\text{min}$$

$$S = \frac{t K'}{M'}$$

$$S = 40(3.6 \times 10^{-6})$$

$$S = 0.0001$$

$$K' = \frac{M' S}{t}$$

$$K' = \frac{11(0.0001)}{40}$$

$$K' = 2.75 \times 10^{-5} \text{ ft/min}$$

ERT

0025475

CALCULATIONS AND COMPUTATIONS SHEET 2 OF 4

PROJECT: SOS JOB NO.:

SUBJECT: LA, BR COMPUTED BY: DATE:

CHECKED BY: DATE:

MW-26

Mated Point

$x = 1.0$ $t = 14$

$\eta = 1.0$ $r = 99.7$

$u = 1.0$ $Q = 1.38$

$s = 2.2$

$$T = \frac{Qu}{2\pi s}$$

$$T = \frac{1.38}{2\pi \cdot 2.2}$$

$T = 0.10$ ft/min

$$\frac{K'}{M'} = \frac{T x_1^2}{r^2}$$

$$\frac{K'}{M'} = \frac{.10(1)^2}{99.7^2}$$

$$\frac{K'}{M'} = 1.0 \times 10^{-5}/\text{mi}$$

$$S = \frac{t K'}{M'}$$

$$S = 14(1.0 \times 10^{-5})$$

$S = 0.0001$

$$K' = \frac{M' S}{t}$$

$$K' = \frac{(11)(.0001)}{14}$$

$K' = 7.86 \times 10^{-5}$ ft/min

002546

ERT

CALCULATIONS AND COMPUTATIONS

SHEET 3 OF 4

PROJECT: [illegible]

JOB NO.:

SUBJECT: LA, [illegible]

COMPUTED BY: DATE:

CHECKED BY: DATE:

MW-27

Match Point

$x = .8$
$\eta = 1.0$
$u = 1.0$
$s = 9.2$

$t = 8$
$r = 25.5'$
$Q = 1.32$

$$T = \frac{Qu}{2\pi s}$$

$$T = \frac{1.32(1)}{2\pi 9.2}$$

$T = 0.0239$ ft²/min

$$\frac{K'}{M'} = \frac{Tx^2}{r^2}$$

$$\frac{K'}{M'} = \frac{0.0239(.8)^2}{25.5^2}$$

$\frac{K'}{M'} = .0000735$/min

$$S = \frac{tK'}{M'}$$

$S = 8(.0000735)$

$S = .0002$

$$K' = \frac{M'S}{t}$$

$$K' = \frac{(11).0002}{8}$$

$K' = 2.75 \times 10^{-4}$ ft/min

002547

ERT

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 4 OF 4

JOB NO.:

SUBJECT: LA, BR

COMPUTED BY: DATE:

CHECKED BY: DATE:

MW-28

Matched Point

$x = .4$
$\eta = 1.0$
$u = 1.0$
$s = 7.0$

$t = 11$
$r = 6.4$
$Q = 1.38$

$$T = \frac{Q u}{4 \pi s}$$

$$T = \frac{1.38 \cdot 1}{4 \pi 7}$$

$$T = 0.0314 \text{ ft}^2/\text{min}$$

$$\frac{K'}{M'} = \frac{T x^2}{r^2}$$

$$\frac{K'}{M'} = \frac{0.0314 \cdot .4^2}{6.4^2}$$

$$\frac{K'}{M'} = 1.0 \times 10^{-4} / \text{min}$$

$$S = \frac{t K'}{M'}$$

$$S = (11)\, 1 \times 10^{-4}$$

$$S = 0.0013$$

$$K' = \frac{M' S}{t}$$

$$K' = \frac{(11)\, .0013}{11}$$

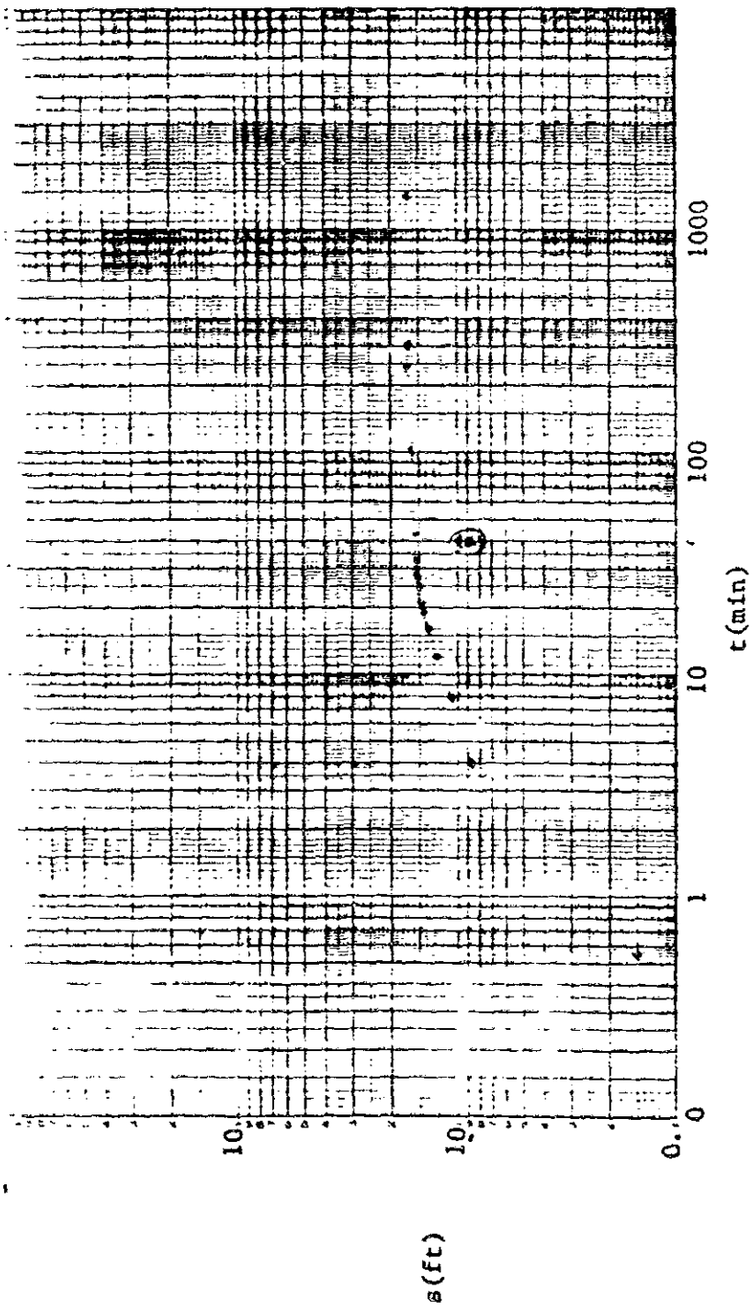
$$K' = 1.3 \times 10^{-3} \text{ ft/min}$$

002548

ERT

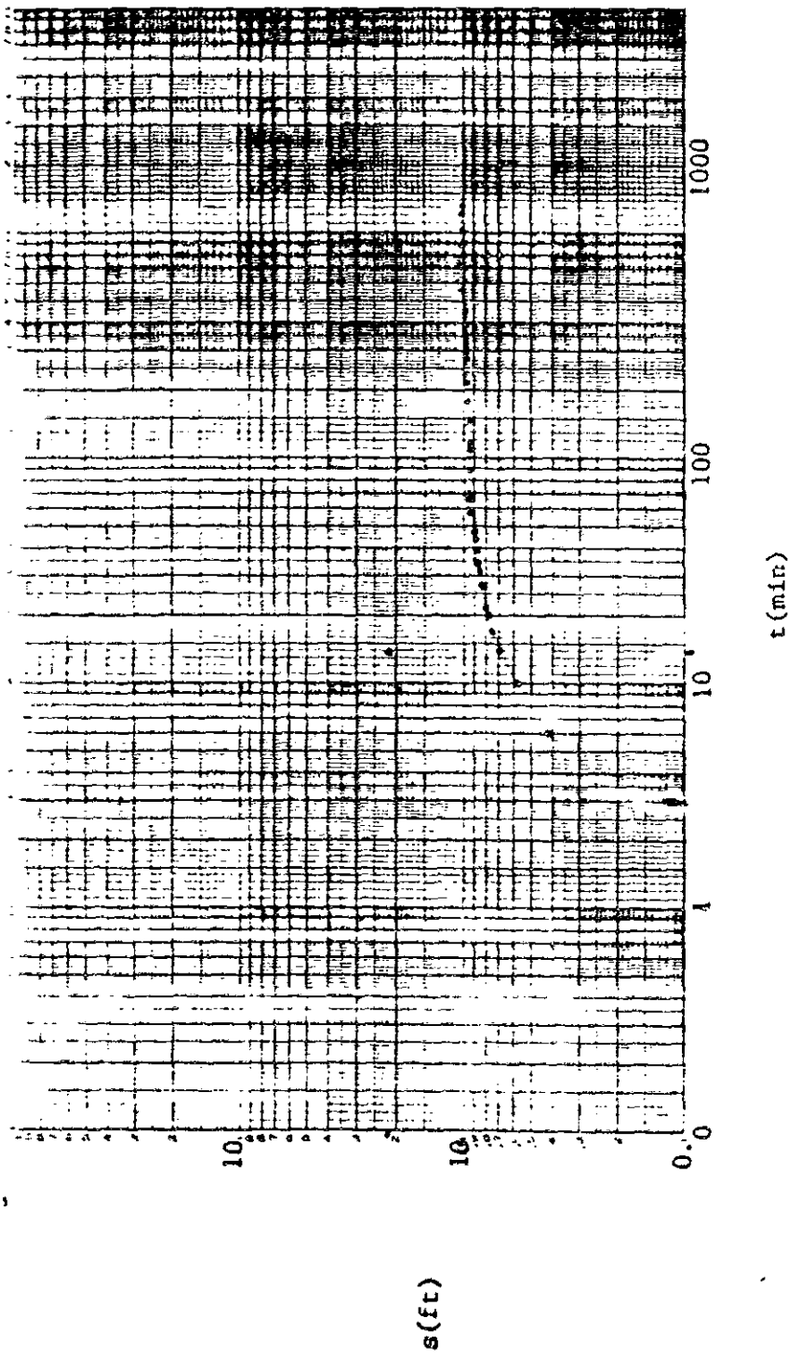
LEAKY AQUIFER SOLUTION
BUREAU OF RECLAMATION

MW-22



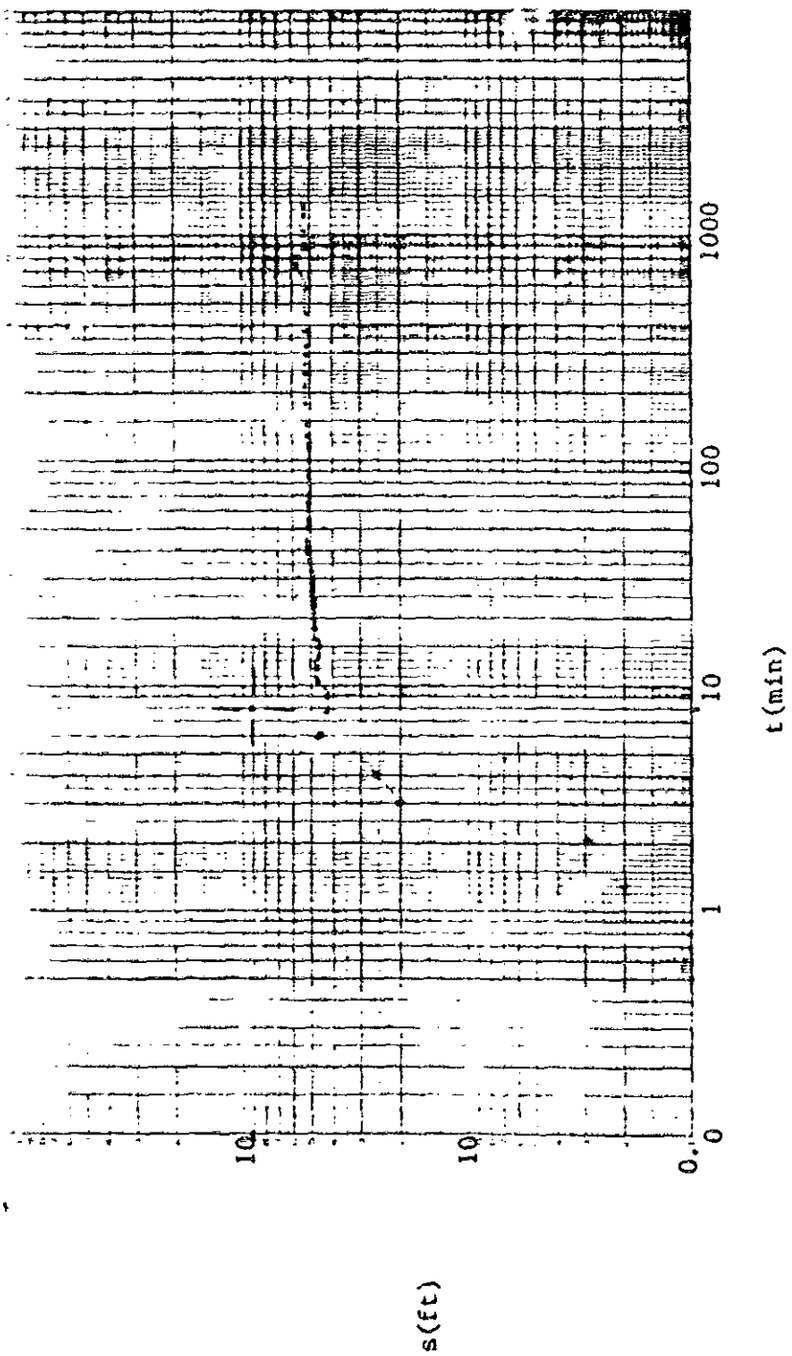
002549

LEAKY AQUIFER SOLUTION
BUREAU OF RECLAMATION



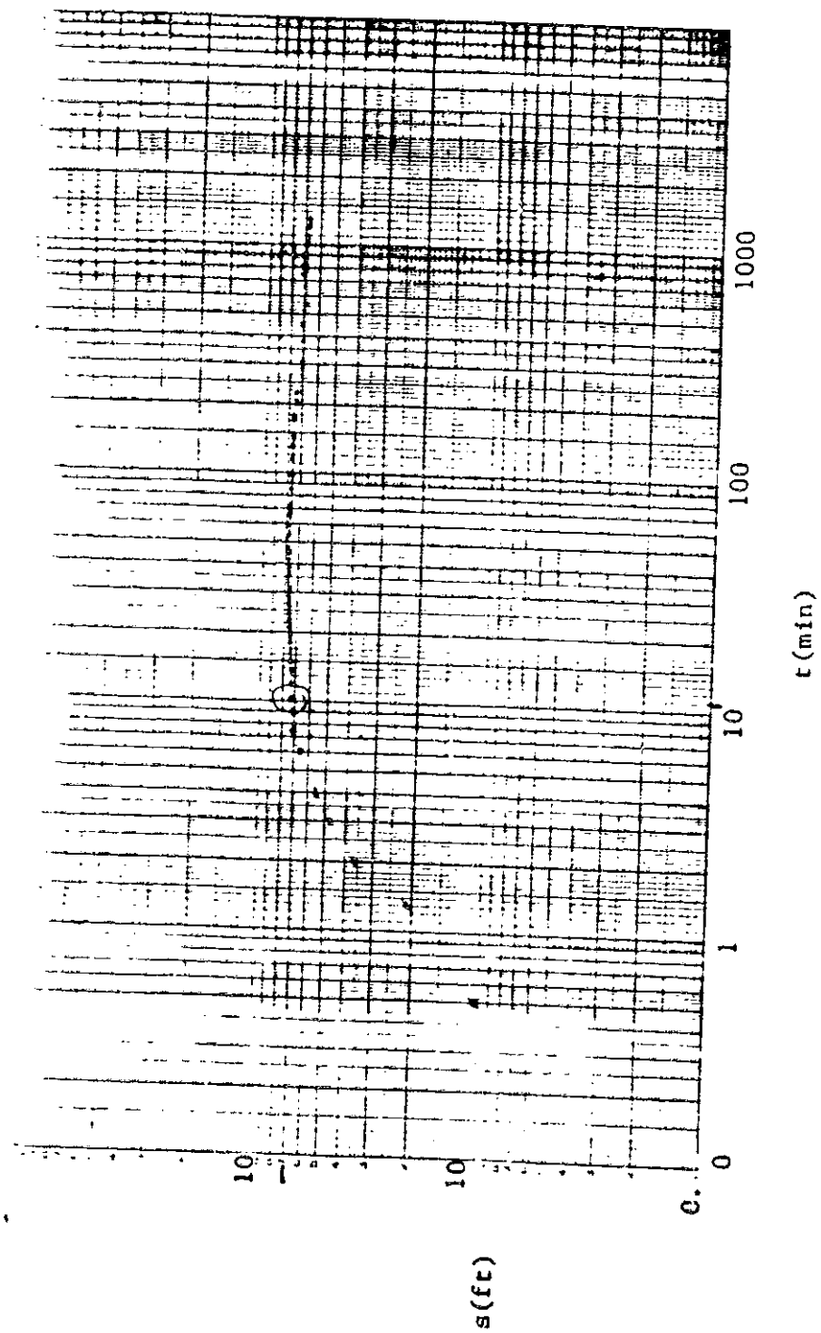
002550

LEAKY AQUIFER SOLUTION
BUREAU OF RECLAMATION



002551

LEAKY AQUIFER SOLUTION
BUREAU OF RECLAMATION



MW-28

002552

PROJECT NAME: SOS
PROJECT NUMBER: 222-04
DATE: 2/11/86
OBSERVER: [illegible]

WELL # MW-20
STATIC WATER LEVEL 33.18

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
pump on 1013					
1119	66	68.00			
1250	157	68.69			
1455	292	69.65			
1655	402	69.95			
2005	592	70.34			
2238	745	70.19			
0110	897	70.51			
0350	1057	70.70			
0639	1226	70.68			
0811	1318	70.77			

00255

PROJECT NAME: SDS
PROJECT NUMBER: 288-04
DATE: 2/11/86
OBSERVER: C Rodgers - [illegible]

WELL # MW-24
STATIC WATER LEVEL 3193

top of [illegible]

[illegible] #1

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
1013	[illegible]	31.93		16 1/2	39.41
				17	
	20	3716		18	39.46
	~~[illegible]~~ 80	3405		19 1/2	39.50
	90			20	
	120	35.56		21.1	39.57
	150			22.5	39.534
	180	3667		24	39.59
	210			25.5	39.62
	240	3751		27.[illegible]	39.620
	3			[illegible]	[illegible].63
	30			[illegible]	39.63
	6	38.43		33	39.70
	7 1/2	38.95		36	39.70
	8			39	39.71
	9	39.01		42	39.72
	10 1/2	39.22		45	39.74
	11			50	39.74
	12	39.23		55	39.76
	13 1/2	38.30		60	39.71
	14	3		65	39.69
	15	39.40		70	39.71

DRAWDOWN

PROJECT NAME: _____
PROJECT NUMBER: _____
DATE: _____
OBSERVER: _____

WELL # MW-25
STATIC WATER LEVEL 31.93

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
11:39	85	39.68			
	100	39.71			
	115	39.64			
	130	39.63			
	145 min	39.63			
	175	39.55			
	205	39.23			
	235	39.15			
	265	39.04			
	295	39.01			
	325	39.02			
1639	386	38.95			
1737	444	39.02			
1946	573	38.90			
2218	745	39.03			
2852	879	38.97			
334	1041	38.90			
604	1211	38.82			
256	1303	38.85			

21 hrs
46 min

0025355

PROJECT NAME: SOS
PROJECT NUMBER: 284-04
DATE: 2/11/86
OBSERVER: M. Fiesta / S. Greene

WELL # MK-37
TOP OF PVC
STATIC WATER LEVEL 32.1
Sounder #3

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
		31.91		16	-3.2
				17	
	30	31.91		18	-3.2
	~~60~~ 80	32.11		19 1/2	-3.2
	90			20	-3
	120	32.22		21	-3.2
	150			22.5	-3.19
	180	33.94		24	-3.18
	210			25.5	-3.15
	240	34.50		27.0	-3.15
	270			28.5	-3.15
	300			30	-3.14
	6	40'-3.41		33	-3.14
	7 1/2	40'-3.66		36	-3.08
	8			39	-3.05
	9	40'-3.83		42	-3.05
	10 1/2	40'-3.35		45	-3.03
	11			50	-3.02
	12	40'-3.62		55	-3.01
	13 1/2	-3.49		60	-3.01
	14			65	-2.99
	15	40'-3.40		70	-2.96

PROJECT NAME: _____
PROJECT NUMBER: _____
DATE: _____
OBSERVER: _____

WELL # MW-27 (cont)

STATIC WATER LEVEL 32.17

Samples # 3 (Top of PVC

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
11:35 AM	85	40 - 2.97			
11.50	100	40 - 2.96			
12:05	115	-2.93			
2:20	130	-2.92			
12:35	145	-2.89			
1:05 PM	175	-2.88			
1:35	205	-2.84			
2:05	235	-2.90			
2:35	265	-2.86			
3:05	295	40 - 2.84			
3:35	325	40' - 2.85			
1637	384	40 - 2.85			
1736	443	40' - 2.84			
1943	570	40 - 2.85			
2219	726	40 - 2.35			
1250	877	40 - 2.83			
0330	1037	40 - 2.80			
0572	1189	40 - 2.79			
0753	1300	40 - 2.79			

002557

PROJECT NAME: (r = '99.7) SDS
PROJECT NUMBER: 282-04
DATE: 2/11/86
OBSERVER: S Greene

WELL # MW-26
STATIC WATER LEVEL: 33[illegible]

sounder # 2

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH WATER
1013 on 1016	3	[illegible]	1441	273	[illegible]
1018	6	33.42	[illegible]	298	33.7
1022	10	33.5[illegible]	1539	325	[illegible]
[illegible]	14	33.7[illegible]	1643	390	[illegible]
1030	17	33.75	1743	450	32.9
[illegible]	20	[illegible]	1950	577	34.01
1036	23	33.8[illegible]	[illegible]	729	34.01
[illegible]	27	[illegible]	0059	886	34.05
1044	31	33.84	0239	1046	34.02
1047	34	33.8[illegible]	[illegible]	1215	34.[illegible]
1050	39	33.86	[illegible]	1307	34.01
1056	43	33.88			
1100	47	33.90			
1110	57	[illegible]			
1119	66	33.94			
114[illegible]	87	[illegible]			
1159	106	33.94			
1209	116	33.93			
1311	148	33.96			
1315	177	33.96			
1346	213	33.96			
1409	236	33.96			

r = 52.0 -

PROJECT NAME: SDS
PROJECT NUMBER: 288-04
DATE: 2/11/86
OBSERVER: D Greene

WELL # MW-2
STATIC WATER LEVEL 32.21
Sounder # 2

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time	DEPTH TO WATER
1013 pump on			1412	239	33.88
1014	.75	32.36	1442	269	33.85
1017	4	33.00	1513	300	33.87
1021	8	33.29	1543	330	33.85
1025	12	33.48	1641	388	33.83
1029	16	33.58	1739	446	33.88
1032	19	33.63	1949	576	33.88
1035	22	33.65	2220	727	33.92
1038	25	33.70	0055	882	33.91
1041	28	33.72	0237	1044	33.92
1041	33	33.73	0625	1212	33.92
1051	38	33.75	[illegible]	1304	33.92
1055	42	33.78			
1058	45	33.79			
1109	56	33.80			
[illegible]	70	33.81			
1143	90	33.82			
1155	102	33.84			
1212	119	33.84			
1229	146	33.86			
1313	180	33.84			
1343	210	33.84			

PUMP TEST DATA SHEET
~~DRAWDOWN~~ Recovery

PROJECT NAME: Pump 0813
PROJECT NUMBER:
DATE:
OBSERVER:

WELL # MW-27
STATIC WATER LEVEL 37.17

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time $s=h-h_0$	DEPTH TO WATER
pump off	0832	37.20			
	30	37.12			
	60	36.82			
	90	36.47			
	120	36.04			
	150	35.60			
	180 sec	35.17			
	210	34.86			
	240	34.44			
	270	—			
	300	33.90			
	6 mins	33.55			
	7	33.32			
	8	33.05			
	9	32.89			
	10	32.73			
	11	32.59			
	12	32.56			
	13	32.49			
	14	32.42			
	15	32.39			
0:49 —	17	32.32			
	19	32.26			
	21	32.23			
	23	32.23			
	25	32.21			
	35	32.15			

002360

pump on 1013

PUMP TEST DATA SHEET
DRAWDOWN Recovery

PROJECT NAME: _____
PROJECT NUMBER: _____
DATE: _____
OBSERVER: _____

WELL # MW-22

STATIC WATER LEVEL 32.21

Clock Time (Start)	Elapsed Time	Depth To Water	Clock Time	Elapsed Time S=h-ho	DEPTH TO WATER
pump off	0832:00	✓35-1.07	0858	[illegible]	-2.53
			0903	[illegible]	-2.55
	✓30	✓-1.02		1.77	
	✓60	✓1.08		1.71	
	✓90	✓1.[illegible]		1.54	
	✓120	✓1.37		1.42	
	✓150	✓-1.45		1.34	
	✓180	✓-1.53		1.26	
seconds	✓210	✓1.63		116	
	✓240	✓-1.69		1.10	
	✓270	✓-1.75		1.01	
	✓300	✓-1.85		0.94	
	✓6	✓-1.97		0.82	
	7	✓-2.06		0.73	
	8	✓-2.15		0.64	
	9	✓-2.21		0.58	
	10	✓-2.[illegible]		0.53	
	12	✓-2.34		0.45	
	13	✓2.37		0.42	
0848		✓-2.43		0.36	
0851		✓-2.45		0.34	
0854		✓-2.51		0.28	

002561

APPENDIX 4G
INSITU PERMEABILITIES

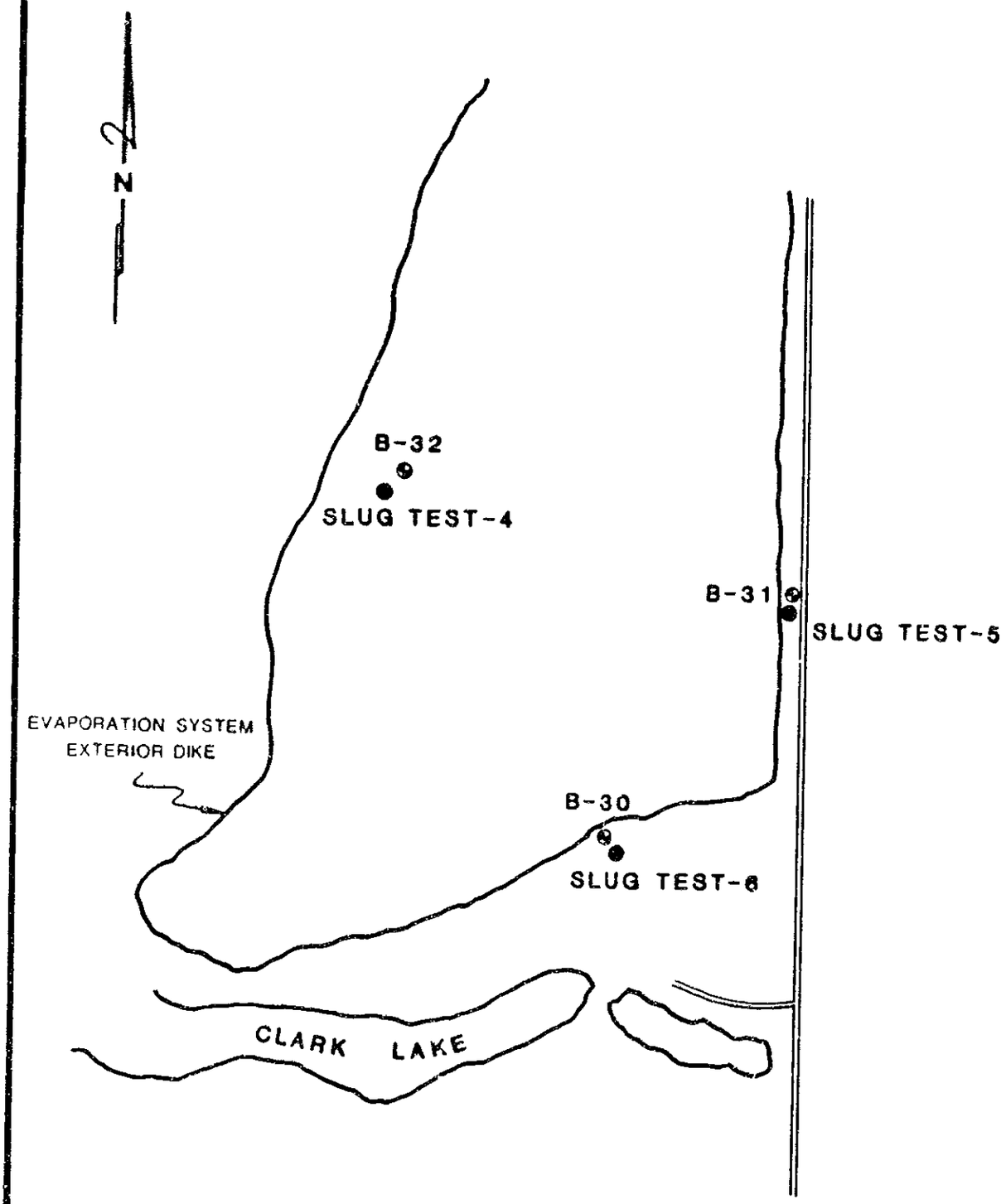
002562

Insitu Permeabilities - Holes were advanced and sampled in the immediate vicinity of three boreholes BH-30, 31 and 32, see Figure 4-A. The location of the boreholes were approved by the EPA in the Hydrogeologic Investigation Plan. Two inch diameter galvanized pipe was set in place, then pushed with the drilling rig approximately one foot into the upper clay layer. Total depth was approximately 23 feet. Three in situ permeabilities (slug test) measurements were made in these holes.

The slug test were allowed to equilibrate for two days, then water levels were monitored for two weeks. In situ permeabilities were calculated using a falling head equation. Details of the calculation and construction are on the following pages.

The results show the clay has a low permeability, 10^{-8} to 10^{-9} cm/sec. These permeabilities should be considered a worst case scenario because the clay was under 20 feet of hydraulic head pressure which is far in excess of normal conditions. Results are in close agreement with laboratory results.

002563



0 500
SCALE IN FEET

RESOURCE ENGINEERING INC.
ENVIRONMENTAL CONSULTANTS
HOUSTON, TEXAS

FIGURE 4-A
LOCATION OF SLUG TEST HOLES
SHERIDAN DISPOSAL SERVICE

DRAWN BY:	DATE	PROJECT NO.
L.C.S.	2/20/86	288-04

002564

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 4

PROJECT: [illegible]

JOB NO.: [illegible]

SUBJECT: In situ [illegible]

COMPUTED BY: [illegible] DATE: [illegible]

CHECKED BY: ____ DATE: ____

Falling Head [illegible] Test with Superimposed [illegible]

$$K = \frac{aL}{At} \ln h_2/h_1$$

where, $h_1 = L_p + H - \frac{L_p V_1}{V_p}$

V_p = volume of water at beginning of test (cm³)

H = atmospheric pressure = 1034.59

L_p = height of water at beginning (cm)

L = thickness of sample (cm)

A = area of sample (cm²)

$a = V_p/L_p$ (cm²)

t time (sec)

V_1 = height of water at beginning (cm)

V_2 = height of water at end (cm)

002565

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SUBJECT: [illegible]

SHEET 2 OF 4

JOB NO.: [illegible]

COMPUTED BY: [illegible] DATE: [illegible]

CHECKED BY: _____ DATE: _____

Slug test hole #4 – constructed with 25 foot 2 inch ID galvanized pipe pushed 1.05 feet in the clay

	date	time	top of casing (ft)	water level below casing (ft)
start	12/5	1424	0.92	3.32
	12/6	1454	0.96	3.37
	[illegible]	1530	0.97	3.44
	[illegible]/13	[illegible]	[illegible]	[illegible]
	[illegible]	1520	0.95	3.51
[illegible]	[illegible]/19	1405	[illegible]	[illegible]

elapsed time = 1,208,460 (sec) ave. = 0.95 ft) $\Delta = 0.22$ (ft)

$L_p = (25 - 3.32 - 1.05) \cdot 30.48 = 628.[illegible]$ cm/

$H = 1034.59$

$A = 20.27$ cm²

$V_p = 12,744.71$ (cm³)

$V_1 = 628.[illegible]$ cm

$V_2 = 622.09$ cm

$h_1 = 1632.362$

$h_2 = 1632.693$

$L = 32.004$ cm

$t = 1,208,460$ sec)

$$K = \frac{20.27(32.004)}{20.27(1,208,460)} \ln \frac{1633.693}{1632.362}$$

$K = 2.16 \times 10^{-8}$ cm/sec

002566

REI

CALCULATIONS AND COMPUTATIONS

SHEET 3 OF 4

PROJECT: SDS

JOB NO.: [illegible]-04

SUBJECT: In situ permeabilities

COMPUTED BY: [illegible] DATE: ____

CHECKED BY: ____ DATE: ____

Using test hole T/5 - constructed with 25 feet, 2 inch I.D. galvanized pipe pushed 1.05 feet into the clay.

	date	time	top of casing (ft)	water level below casing (ft)
start	12/5	1436	0.95	0.85
	12/6	1550	0.96	0.93
	12/10	1545	0.95	1.01
	12/13	1156	0.95	1.09
	12/16	1150	0.96	1.09
stop	12/19	1153	0.97	1.19

elapsed time 1,209,480 ave = 0.95 Δ = 0.34

$L_y = (25 - 1.05 - .85) \cdot 30.48 = 704.0$ cm

$H = 1034.59$

$A = 20.27$ cm²

$V_y = 14,270.71$ cm³

$V_1 = 704.09$ cm

$V_2 = 693.73$ cm

$h_1 = 1703.94$

$h_2 = 1704.45$

$L = 32.0004$

$t = 1,209,480$ sec

$$K = \frac{20.27(32.0004)}{20.27(1,209,480)} \ln \frac{1704.45}{1703.94}$$

$K = 7.92 \times 10^{-9}$ cm/sec

002567

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 4 OF 4

JOB NO.: [illegible]

SUBJECT: In situ permeabilities

COMPUTED BY: [illegible] DATE:

CHECKED BY: DATE:

Slug test #6 constructed with [illegible] inch ID galvanized pipe pushed 1.30 feet into the clay

	date	time	top of casing ft	water level from casing ft
start	12/5	1443	1.72	7.36
	12/6	1557	1.71	7.48
	12/10	1552	1.68	7.52
	12/13	1205	1.70	7.68
	12/16	1557	1.71	7.75
stop	12/19	1505	1.70	7.56 *

elapsed time = 954,960 [illegible] 1.75 $\Delta = 0.39$ *

* datum point may be in [illegible] because of new [illegible] datum point deleted from calculations

$L_p = (25 - 1.30 - 7.75) \cdot 30 = 486.1$ cm

$H = 1034.59$

$A = 20.27$ cm²

$V_p = 9853.63$ cm³

$V_1 = 486.16$ cm

$V_2 = 474.[illegible]$ cm

$h_1 = 1496.76$

$h_2 = 1497.36$

$L = 39.[illegible]$

$t = 954,960$

$$K = \frac{(20.27)\,3960}{(20.27)\,954,960} \ln \frac{1497.36}{1496.76}$$

$K = 166 \times 10^{[illegible]}$ cm [illegible]

002560

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 4 OF 4

JOB NO.: 298-24

SUBJECT: In situ permeabilities

COMPUTED BY: SS DATE:

CHECKED BY: DATE:

Slug test #6 - constructed with 25 foot, 2 inch I D galvanized pipe pushed 1.30 feet into the clay. water level below casing (ft)

	date	time	top of casing (ft)	water level below casing (ft)
start	12/5	1443	1.72	7.36
	12/6	1557	1.71	7.48
	12/10	1552	1.68	7.52
	12/13	1205	1.70	7.68
	12/16	1557	1.71	7.75
stop	12/19	1505	1.70	7.56 *

elapsed time = 954,960 ave = 1.70 $\Delta = 0.39$ *

* datum point may be in error because of new well sounder, this datum point deleted from calculations

$L_p = (25 - 1.30 - 7.75) \cdot 30.48 = 486.1$ cm

$H = 103.59$

$A = 20.27$ cm²

$V_p = 9853.63$ cm³

$V_1 = 486.16$ cm

$V_2 = 474.21$ cm

$h_1 = 149.76$

$h_2 = 149.36$

$L = 39.62$ cm

$t = 954,960$

$$K = \frac{(20.27)\,39.62}{(20.27)\,954,960} \ln \frac{149.36}{149.76}$$

$K = 1.66 \times 10^{-8}$ cm/sec

RCI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 3 OF 4

JOB NO.: 28[illegible]-04

SUBJECT: In situ permeabilities

COMPUTED BY: [illegible] DATE:

CHECKED BY: DATE:

Slug test hole "[illegible]" - constructed with 25 foot, 2 inch I.D. galvanized pipe pounded 1.05 feet into the clay.

	date	time	top of casing (ft)	water level below casing (ft)
start	12/5	[illegible]	0.95	0.85
	12/6	[illegible]	0.96	0.83
	12/10	[illegible]	0.95	1.01
	12/13	[illegible]	0.95	1.09
	12/16	[illegible]	0.96	1.09
stop	12/19	[illegible]	0.97	1.19

elapsed time = 1,209,48[illegible] ave = 0.95 $\Delta = 0.34$

$L_p = ([illegible] - [illegible] - .85) \cdot 30.48 = 704.09$ cm

$H = 10[illegible]$

$A = 20[illegible]$

$V_p = 14,[illegible]$ cm^3

$V_1 = 70[illegible]$ cm

$V_2 = 6[illegible]$ cm

$h_1 = 1[illegible]$

$h_2 = 1[illegible]$

$L = 32[illegible]$

$t = 1,2[illegible]$ sec

$$K = \frac{[illegible] - 32.00[illegible])}{[illegible]\ 1,209,48[illegible]} \ln \frac{1704.45}{1703.94}$$

$K = 7.[illegible] \times 10^{-9}$ cm/sec

002570

RFI

CALCULATIONS AND COMPUTATIONS

PROJECT: SDS

SHEET 2 OF 4

JOB NO.: 288-04

SUBJECT: In situ permeabilities

COMPUTED BY: [illegible] DATE: [illegible]

CHECKED BY: ____ DATE: ____

Slug test hole #4 - constructed with 25 foot, 2 inch ID galvanized pipe pushed 1.05 feet in the clay.

	date	time	top of casing (ft)	water level below casing (ft)
start	12/5	1424	0.92	3.32
	12/6	1454	0.96	3.37
	12/10	1530	0.97	3.44
	12/13	1143	0.94	3.47
	12/16	1520	0.95	3.51
stop	12/19	1405	0.94	3.54

elapsed time = 1,208,460 (sec) ave. = 0.95 (ft) $\Delta = 0.22$ (ft)

$L_p = (25 - 3.32 - 1.05) \cdot 30.48 = 628.80$ cm

$H = 103.459$

$A = 20.27$ cm^2

$V_p = 12,744.71$ (cm^3)

$V_1 = 628.80$ cm

$V_2 = 622.09$ cm

$h_1 = 1632.362$

$h_2 = 1632.693$

$L = 32.004$ cm

$t = 1,208,460$ (sec)

$$K = \frac{20.27(32.004)}{20.27(1,208,460)} \ln \frac{1633.693}{1632.362}$$

$K = 5.37 \times 10^{-9}$ cm/sec

002571

CALCULATIONS AND COMPUTATIONS

PROJECT: Sheridan Disposal Services

SUBJECT: In situ permeabilities

SHEET 1 OF 4

JOB NO.: 283-141

COMPUTED BY: BS DATE: 2/81

CHECKED BY: _____ DATE: _____

Falling Head Permeability Test with Superimposed Air Pressure

$$K = \frac{aL}{At} \ln \frac{h_2}{h_1}$$

where $h_1 = L_p + H - \frac{L_p V_i}{V_p}$

V_p = volume of water at beginning of test (cm^3)

H = atmospheric pressure = 1034.59

L_p = height of water at beginning (cm)

L = thickness of sample (cm)

A = area of sample (cm^2)

$a = V_p / L_p$ (cm^2)

t = time (sec)

V_1 = height of water at beginning (cm)

V_2 = height of water at end (cm)

00257 2

RCI

ETC TESTING and CERTIFICATION

Technical Report

for

RESOURCE ENGINEERING

ATTENTION: CHRIS ITIN

3000 RICHMOND AVENUE

HOUSTON, TX 77098

CLARK LAKE
SAMPLE # L1

002573

Chain of Custody Data Required for ETC Data Management Summary Reports						
KB176	RESOURCE ENGINEERING	RES28804	BL1	851219		
ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours

Denis C. K. Lin, Ph.D.
Vice President
Research and Operations

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002574

Introduction

This report contains the analytical results on your soil sample, BL1 85/12/19. It is designed to include comprehensive data from the entire analytical process in order to satisfy the needs of various levels of review.

The results obtained from your sample are presented in tabular format immediately following this introduction. Quality assurance data is tabulated along with the appropriate sample results for verification. Depending on the analyses ordered, the quality assurance data may include results from blank, spiked blank, spiked sample (i.e. matrix spike) and replicate sample as well as results from surrogate compound analyses. Quality assurance data for verification of proper instrument performance is also included where appropriate. The report appendices include the chain of custody record for your sample and, where appropriate, the gas chromatograms and mass spectra.

The procedures used in the analysis of the sample are described in this report's methodology section. All analytical procedures within our laboratory are performed within a strictly enforced Quality Assurance Protocol. A description of this Protocol is included in the report.

Results

Sample results, and associated quality assurance data, are always tabulated in one or more of this report's Quantitative Results Tables. The format of each table varies with the class of analysis.

Priority Pollutants

The priority pollutant compounds and elements are listed with their NPDES (National Pollution Discharge Elimination System) numbers, and the Method Detection Limit (MDL) published in the Federal Register. When a compound or element is present below its published MDL it is reported as BMDL (Below Method Detection Limit). When a compound or element is not present at any detectable concentrations it is reported as ND (Not Detected). MDL's for non-aqueous matrices are based on USEPA published MDL's but are adjusted as per sample weight. Matrix spike and replicate analyses, where included, were performed on samples randomly chosen within each quality assurance batch and are therefore not necessarily spikes and replicates of this report's sample. Surrogate compound recovery data and instrument calibration data are included in the Method Performance Data Tables.

002575

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 7, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28804	BLI	851219		

NPDES Number	Compound (Acrolein and Acrylonitrile values are screen only.)	Results: Sample Concen. ug/kg	Results: MDL ug/kg	QC Replicate: First ug/kg	QC Replicate: Second ug/kg	QC Blank and Spiked Blank: Blank Data ug/kg	QC Blank and Spiked Blank: Concen. Added ug/kg	QC Blank and Spiked Blank: % Recov	QC Matrix Spike: Unspiked Sample ug/kg	QC Matrix Spike: Concen. Added ug/kg	QC Matrix Spike: % Recov
1V	Acrolein	ND	500	ND	ND	ND	4000	90	ND	4000	126
2V	Acrylonitrile	ND	500	ND	ND	ND	400	99	ND	400	81
3V	Benzene	ND	22	ND	ND	ND	90.0	105	ND	90.0	92
4V	bis(Chloromethyl)ether	ND	50	ND	ND	ND	0	-	ND	0	-
5V	Bromoform	ND	24	ND	ND	ND	90.0	114	ND	90.0	91
6V	Carbon tetrachloride	ND	14	ND	ND	ND	90.0	103	ND	90.0	89
7V	Chlorobenzene	ND	30	ND	ND	ND	90.0	101	ND	90.0	93
8V	Chlorodibromomethane	ND	16	ND	ND	ND	90.0	107	ND	90.0	90
9V	Chloroethane	ND	50	ND	ND	ND	90.0	96	ND	90.0	91
10V	2-Chloroethylvinyl ether	ND	50	ND	ND	ND	90.0	180.	ND	90.0	196.
11V	Chloroform	ND	8.0	ND	ND	ND	90.0	100	ND	90.0	96
12V	Dichlorobromomethane	ND	11	ND	ND	ND	90.0	101	ND	90.0	91
13V	Dichlorodifluoromethane	ND	50	ND	ND	ND	90.0	104	ND	90.0	84
14V	1,1-Dichloroethane	ND	24	ND	ND	ND	90.0	100	ND	90.0	96
15V	1,2-Dichloroethane	ND	14	ND	ND	ND	90.0	100	ND	90.0	95
16V	1,1-Dichloroethylene	ND	14	ND	ND	ND	90.0	101	ND	90.0	90
17V	1,2-Dichloropropane	ND	30	ND	ND	ND	90.0	101	ND	90.0	92
18V	cis-1,3-Dichloropropylene	ND	25	ND	ND	ND	90.0	100	ND	90.0	81
19V	Ethylbenzene	ND	36	ND	ND	ND	90.0	98	ND	90.0	97
20V	Methyl bromide	ND	50	ND	ND	ND	90.0	103	ND	90.0	97
21V	Methyl chloride	ND	50	ND	ND	ND	90.0	98	ND	90.0	78
22V	Methylene chloride	20.6	14	1.13	ND	64.5	90.0	63	430	90.0	0.
23V	1,1,2,2-Tetrachloroethane	ND	35	ND	ND	ND	90.0	121	ND	90.0	113
24V	Tetrachloroethylene	ND	21	ND	ND	ND	90.0	103	ND	90.0	96
25V	Toluene	ND	30	ND	ND	ND	90.0	102	ND	90.0	100
26V	1,2-Trans-dichloroethylene	ND	8.0	ND	ND	ND	90.0	101	ND	90.0	94
27V	1,1,1-Trichloroethane	ND	19	ND	ND	ND	90.0	102	ND	90.0	96
28V	1,1,2-Trichloroethane	ND	25	ND	ND	ND	90.0	110	ND	90.0	92
29V	Trichloroethylene	ND	9.5	ND	ND	ND	90.0	96	ND	90.0	90
30V	Trichlorofluoromethane	ND	50	ND	ND	ND	90.0	99	ND	90.0	87
31V	Vinyl chloride	ND	50	ND	ND	ND	90.0	99	ND	90.0	88
18V	trans-1,3-Dichloropropylene	ND	50	ND	ND	ND	90.0	98	ND	90.0	92

[illegible] Recovery normally variable using EPA Protocol Method 624.

[illegible] Spiked samples that contain compounds present at high levels do not provide valid spike recovery data.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 9, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Acid Compounds - GC/MS Analysis Data (QR02)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28804	BLI	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg[a]	Second ug/kg[a]	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1A	2-Chlorophenol	ND	120	ND	ND	ND	0	-	ND	4400	82
2A	2,4-Dichlorophenol	ND	96	ND	ND	ND	0	-	ND	4400	94
3A	2,4-Dimethylphenol	ND	96	ND	183	ND	0	-	ND	4400	88
4A	4,6-Dinitro-o-cresol	ND	850	ND	ND	ND	0	-	ND	4400	61
5A	2,4-Dinitrophenol	ND	1500	ND	ND	ND	0	-	ND	4400	55
6A	2-Nitrophenol	ND	130	ND	ND	ND	0	-	ND	4400	90
7A	4-Nitrophenol	ND	85	ND	ND	ND	0	-	ND	4400	99
8A	p-Chloro-m-cresol	ND	110	ND	ND	ND	0	-	ND	4400	120
9A	Pentachlorophenol	ND	130	ND	ND	ND	0	-	ND	4400	135
10A	Phenol	ND	53	ND	ND	ND	0	-	236	4400	193
11A	2,4,6-Trichlorophenol	ND	96	ND	ND	ND	0	-	ND	4400	102
	Catechol	ND	355	ND	ND	ND	0	-	ND	4400	1[b]
	Benzoic acid	BMDL	360	ND	ND	ND	0	-	ND	4400	29

[a] Variability in duplicate results due to non-homogenous nature of sample matrix.

[b] Recovery low due to sample matrix interference.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28604	BL1	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov a	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1B	Acenaphthene	ND	67	ND	ND	ND	0	-	ND	4400	78
2B	Acenaphthylene	ND	120	ND	ND	ND	0	-	ND	4400	109
3B	Anthracene	ND	67	ND	ND	ND	0	-	51.9	4400	99
4B	Benzidine	ND	1600	ND	ND	ND	0	-	ND	4400	40
5B	Benzo(a)anthracene	ND	280	ND	ND	ND	0	-	ND	4400	102
6B	Benzo(a)pyrene	ND	89	ND	ND	ND	0	-	ND	4400	85
7B	Benzo(b)fluoroanthene	ND	170	ND	ND	ND	0	-	ND	4400	100
8B	Benzo(ghi)perylene	ND	150	ND	ND	ND	0	-	ND	0	-
9B	Benzo(k)fluoranthene	ND	120	ND	ND	ND	0	-	ND	4400	83
10B	bis(2-Chloroethoxy)methane	ND	190	ND	ND	ND	0	-	ND	4400	66
11B	bis(2-Chloroethyl) ether	ND	200	ND	ND	ND	0	-	ND	4400	109
12B	bis(2-Chloroisopropyl)ether	ND	200	ND	ND	ND	0	-	ND	4400	71
13B	bis(2-Ethylhexyl)phthalate	ND	360	ND	ND	ND	0	-	ND	4400	213.
14B	4-Bromophenyl phenyl ether	ND	67	ND	ND	ND	0	-	ND	4400	137
15B	Butyl benzyl phthalate	ND	360	ND	ND	ND	0	-	ND	4400	146
16B	2-Chloronaphthalene	ND	67	ND	ND	ND	0	-	ND	4400	44
17B	4-Chlorophenyl phenyl ether	ND	150	ND	ND	ND	0	-	ND	4400	49
18B	Chrysene	ND	89	ND	ND	ND	0	-	ND	4400	108
19B	Dibenzo(a,h)anthracene	ND	360	ND	ND	ND	0	-	ND	0	-
20B	1,2-Dichlorobenzene	ND	67	ND	ND	ND	0	-	ND	4400	93
21B	1,3-Dichlorobenzene	ND	67	ND	ND	ND	0	-	ND	4400	90
22B	1,4-Dichlorobenzene	ND	160	ND	ND	ND	0	-	ND	4400	92
23B	3,3'-Dichlorobenzidine	ND	604	ND	ND	ND	0	-	ND	4400	0.
24B	Diethyl phthalate	ND	360	ND	ND	ND	0	-	ND	4400	52
25B	Dimethyl phthalate	ND	360	ND	ND	ND	0	-	52.9	4400	94
26B	Di-n-butyl phthalate	890	360	ND	ND	ND	0	-	85.3	4400	177.
27B	2,4-Dinitrotoluene	ND	200	ND	ND	ND	0	-	ND	4400	47
28B	2,6-Dinitrotoluene	ND	67	ND	ND	ND	0	-	ND	4400	38
29B	Di-n-octyl phthalate	ND	360	ND	ND	ND	0	-	ND	4400	108
30B	1,2-Diphenylhydrazine	ND	360	ND	ND	ND	0	-	ND	4400	0.
31B	Fluoranthene	ND	78	ND	ND	ND	0	-	35.8	4400	123
32B	Fluorene	ND	67	ND	ND	ND	0	-	ND	4400	64

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28804	BLI	051219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
33B	Hexachlorobenzene	ND	67	ND	ND	ND	0	-	ND	4400	133
34B	Hexachlorobutadiene	ND	32	ND	ND	ND	0	-	ND	4400	87
35B	Hexachlorocyclopentadiene	ND	360	ND	ND	ND	0	-	ND	0	-
36B	Hexachloroethane	ND	57	ND	ND	ND	0	-	ND	4400	22c
37B	Indeno(1,2,3-c,d)pyrene	ND	170	ND	ND	ND	0	-	ND	0	-
38B	Isophorone	ND	78	ND	ND	ND	0	-	ND	4400	62
39B	Naphthalene	ND	57	ND	ND	ND	0	-	ND	4400	119
40B	Nitrobenzene	ND	67	ND	ND	ND	0	-	ND	4400	127
41B	N-Nitrosodimethylamine	ND	360	ND	ND	ND	0	-	ND	0	-
42B	N-Nitrosodi-n-propylamine	ND	360	ND	ND	ND	0	-	ND	4400	140
43B	N-Nitrosodiphenylamine	ND	67	ND	ND	ND	0	-	75.1	4400	30
44B	Phenanthrene	ND	190	ND	ND	ND	0	-	ND	4400	127
45B	Pyrene	ND	67	ND	ND	ND	0	-	ND	4400	125
46B	1,2,4-Trichlorobenzene	ND	67	ND	ND	ND	0	-	ND	4400	77
	Benzyl alcohol	ND	360	88.6	227	ND	0	-	51.1	4400	37
	Benzaldehyde	ND	360	ND	ND	ND	0	-	ND	4400	48

a Reagent Blank. Solvent Blank cannot be performed for this sample matrix.

b Recovery normally variable using EPA Protocol Method 625.

c Recovery variable due to sample matrix interference.

ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Pesticide/PCB Compounds - GC/MS Analysis Data (QR04)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28804	BL1	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov a	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1P	Aldrin	ND	67	ND	ND	ND	0	-	ND	4400	44
2P	Alpha-BHC	ND	360	ND	ND	ND	0	-	ND	4400	39
3P	Beta-BHC	ND	160	ND	ND	ND	0	-	ND	4400	117
4P	Gamma-BHC	ND	360	ND	ND	ND	0	-	ND	4400	77
5P	Delta-BHC	ND	110	ND	ND	ND	0	-	ND	4400	14
6P	Chlordane	ND	360	ND	ND	ND	0	-	ND	8800	41
7P	4,4'-DDT	ND	99	ND	ND	ND	0	-	ND	4400	0
8P	4,4'-DDE	ND	200	ND	ND	ND	0	-	ND	4400	70
9P	4,4'-DDD	ND	170	ND	ND	ND	0	-	ND	4400	76
10P	Dieldrin	ND	89	ND	ND	ND	0	-	ND	4400	68
11P	Endosulfan I	ND	360	ND	ND	ND	0	-	ND	4400	78
12P	Endosulfan II	ND	360	ND	ND	ND	0	-	ND	4400	0
13P	Endosulfan sulfate	ND	200	ND	ND	ND	0	-	ND	4400	42
14P	Endrin	ND	360	ND	ND	ND	0	-	ND	4400	32
15P	Endrin aldehyde	ND	360	ND	ND	ND	0	-	ND	4400	35
16P	Heptachlor	ND	67	ND	ND	ND	0	-	ND	4400	0
17P	Heptachlor epoxide	ND	78	ND	ND	ND	0	-	ND	4400	56
18P	PCB-1242	ND	1300	ND	ND	ND	0	-	ND	0	-
19P	PCB-1254	ND	1300	ND	ND	ND	0	-	ND	0	-
20P	PCB-1221	ND	1100	ND	ND	ND	0	-	ND	0	-
21P	PCB-1232	ND	1300	ND	ND	ND	0	-	ND	0	-
22P	PCB-1248	ND	1300	ND	ND	ND	0	-	ND	0	-
23P	PCB-1260	ND	1300	ND	ND	ND	0	-	ND	4400	90
24P	PCB-1016	ND	1300	ND	ND	ND	0	-	ND	0	-
25P	Toxaphene	ND	360	ND	ND	ND	0	-	ND	0	-

a Recovery normally variable using EPA Protocol Method 625.

b Response Blank. Spiked Blank cannot be performed for this sample matrix.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 24, 1986

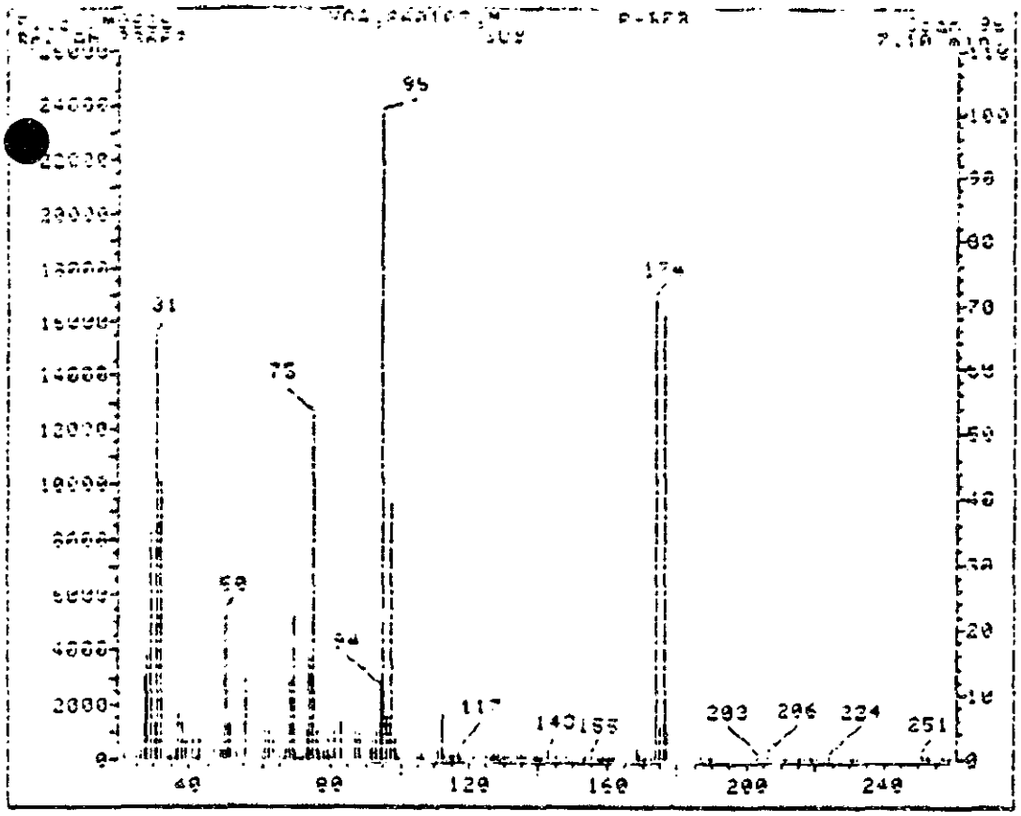
TABLE 2: METHOD PERFORMANCE DATA
Surrogate Recovery Soil - GC/MS Data (QR20)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8176	RESOURCE ENGINEERING	RES28804	BLI	85121		0

Compound	Amount added ug	% Recovery	Control Limits % Lower	Control Limits % Upper
VOLATILE FRACTION				
Toluene-D8	.250	83	50	160
p-Bromofluorobenzene	.250	79	50	160
1,2-Dichloroethane-D4	.250	81	50	160
ACID FRACTION				
Phenol-D5	100	67	20	140
2-Fluorophenol	100	64	20	140
2,4,6-Tribromophenol	100	77	10	140
BASE/NEUTRAL FRACTION				
Nitrobenzene-D5	50	99	20	140
2-Fluorobiphenyl	50	75	20	140
Terphenyl-D14	50	148	20	150

* IFB RPM control limits



002582

TABLE 2: METHOD PERFORMANCE DATA (QR21)

GC/MS Tuning Data - Bromofluorobenzene (BFB) for Volatiles Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
50	15-40% of mass 95	22.30	22.30	Ok
75	30-60% of mass 95	52.60	52.60	Ok
95	Base peak, 100% relative abundance	100.00	100.00	Ok
96	5-9% of mass 95	6.53	6.53	Ok
173	Less than 1% of mass 95	0.00	0.00	Ok
174	Greater than 50% of mass 95	70.93	70.93	Ok
175	5-9% of mass 174	4.79	6.76	Ok
176	95-101% of mass 174	68.49	96.56	Ok
177	5-9% of mass 176	3.80	5.55	Ok

Injection Date: 01/02/86 Analyst: Derrick M Simmons
Injection Time: 19:13 Processor: P. R. Rankin
Run No: SM0536 WC Batch: QV4206
Spectrum No: 96 Samples: K8557, K8171, K8174, K8175 1-4
K8176, K8173, K8684, ~~K8477~~ (10)
K4174, ~~K8470~~ (10)-4

1/6/86

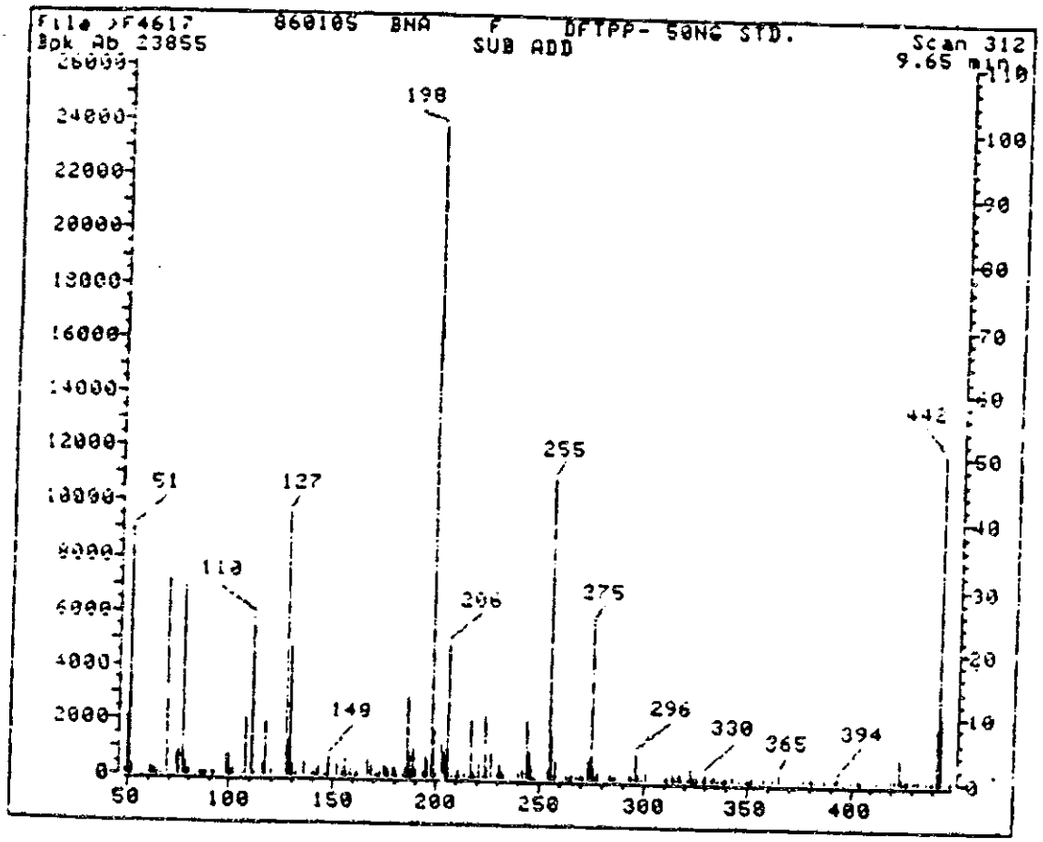


TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for Base/Neutral Acid Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
51	30-60% of mass 198	37.49	37.49	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	29.90	29.90	Ok
70	Less than 2% of mass 69	0.00	0.00	Ok
127	40-60% of mass 198	40.19	40.19	Ok
197	Less than 1% of mass 198	0.00	0.00	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	6.93	6.93	Ok
275	10-30% of mass 198	24.59	24.59	Ok
365	Greater than 1% of mass 198	1.31	1.31	Ok
441	0-100% of mass 443	8.34	85.48	Ok
442	Greater than 40% of mass 198	50.23	50.23	Ok
443	17-23% of mass 442	9.76	19.43	Ok

Injection Date: 01/06/86
Injection Time: 07:46
Run No: >F4617
Spectrun No: 312

Analyst: [signature]
Processor: [signature]
QC Batch: QA 4228 K8175
Samples: K8174, K8173, ~~K8176~~, K8171
J8439 K8176, K8484 K8485

K. Baker 1/6/86

002583

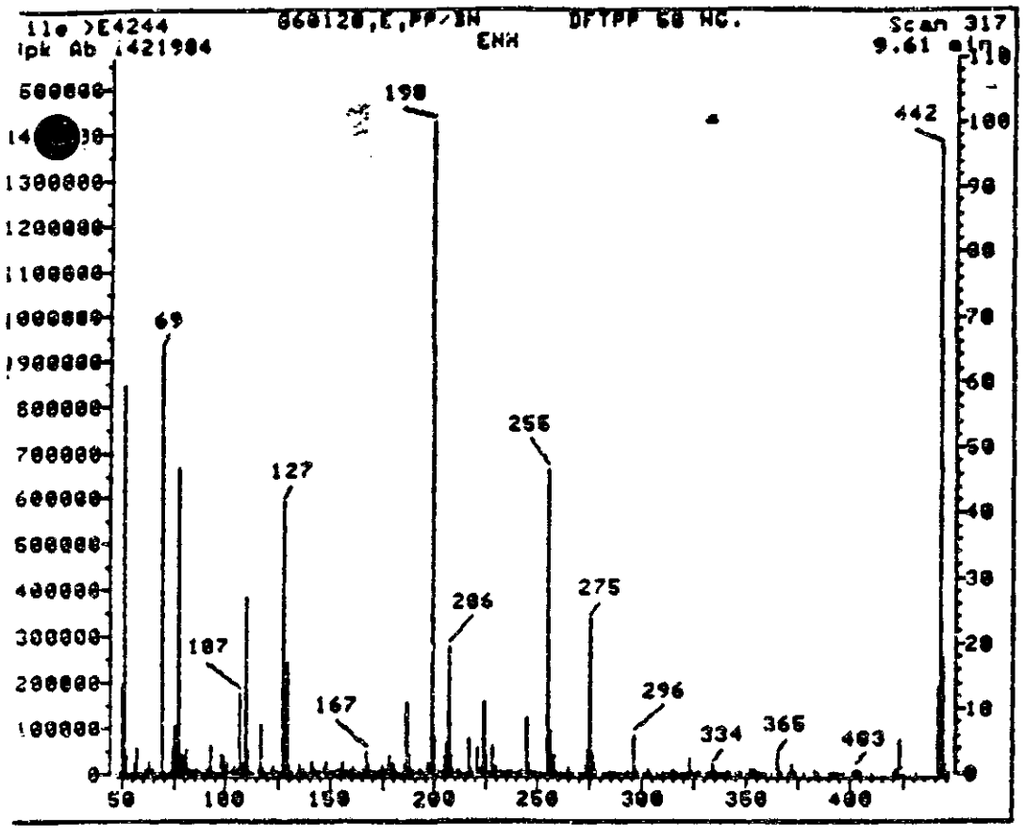


TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for Base/Neutral Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	Appropriate Peak	Status
51	30-60% of mass 198	59.31	59.31	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	64.94	64.94	Ok
70	Less than 2% of mass 69	.30	.46	Ok
127	40-60% of mass 198	41.64	41.64	Ok
197	Less than 1% of mass 198	.17	.17	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	5.88	5.88	Ok
275	10-30% of mass 198	23.67	23.67	Ok
365	Greater than 1% of mass 198	2.92	2.92	Ok
441	0-100% of mass 443	13.60	76.60	Ok
442	Greater than 40% of mass 198	96.33	96.33	Ok
443	17-23% of mass 442	17.75	18.43	Ok

Injection Date: 01/20/86 Analyst: [illegible]
Injection Time: 15:42 Processor: [illegible]
Run No: >E4244 QC Batch: QB4228
Spectrun No: 317 Samples: K8176

002584

Methodology
for
GC/MS Analysis of Priority Pollutant Compounds

The methods employed in the GC/MS analysis for priority pollutants are established EPA methods. Rigid compliance with the instrument parameters and performance criteria of the publisred methods was achieved. In some cases, the precise amounts of sample used and the sample handling procedures vary with the complexity of the sample matrix. Qualitative identification of the priority pollutants was performed using the relative retention times, the relative abundance of three characteristic ions and the abundance ratios. The entire mass spectrum was reviewed to confirm each identification. Quantitative analysis of detected compounds was performed by using a response factor generated by a major characteristic ion of the specific compound and an internal standard.

Compounds, in addition to those on the priority pollutant list, were identified through a computer-aided search of the NBS-EPA spectra library. After review the identifications are included in a separate tabulation and labelled "tentatively identified".

Volatile Priority Pollutant Compounds

For the analysis of Volatile priority pollutants in a soil matrix, a modified version of EPA Method 624 was used. The modification can be be summarized as follows: 1-3 gm of the solid sample are weighed into a 15 ml Hypo vial. The vial is sealed immediately with a teflon-backed silicone septum. A solution containing 3 internal standards is injected through the septum onto the sample. The vial is attached to the Purge and Trap sampler in series with a 5 ml organic-free water trap. The sample vial is heated at 80 degrees Centigrade for 20 minutes. An inert gas sweeps the volatile organic compounds through the water trap onto a sorbent column where they are trapped. When the purge cycle is complete, the sorbent column is heated and backflushed with helium to desorb the purgeable organic compounds onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeable mixture. The separated purgeable components are then identified and quantitated using a computerized mass spectrometer.

Acid, Base/Neutral and Pesticide Priority Pollutant Compounds

For the analysis of the Acid, Base/Neutral and Pesticide priority pollutants in a soil matrix, a modification of EPA Method 625 was used. The method can be summarized as follows: A 30 gm semi-wet soil sample is soxhlet extracted with a 1:1 mixture of acetone and hexane. The acetone is thermally stripped. The remaining hexane extract is diluted to 200 ml with methylene chloride and twice extracted with an aqueous NaOH solution followed by an extraction with deionized water. The methylene chloride extract is dried and concentrated to a 1 ml final volume. This concentrate is injected into a GC/MS instrument configured for the analysis of Base/Neutral priority pollutant compounds. The remaining aqueous extracts are combined and the pH adjusted to a value less than 2. The aqueous phase is serially extracted with 3 aliquots of methylene chloride. The methylene chloride extracts are dried, concentrated to a 1 ml final volume. The concentrate is injected into a GC/MS instrument configured for the analysis of acid extractable priority pollutant compounds.

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Summary of
Quality Assurance/Quality Control Procedures (QA/QC)

ETC bases its quality assurance protocols on the following government guidelines:

- "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", EPA-600/4-79-019, March 1979;
- National Enforcement Investigation Center Policies, and Procedures manual; EPA-330/9/79/001-R, October 1979;
- the recommended guidelines for EPA Methods 624 and 625. (Federal Register, December 3, 1979; updated on October 26, 1984);
- "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," EPA 600/8-80-038, June 1980;
- "Determination of 2,3,7,8-TCDD in Soil and Sediment" EPA, Region VII, Kansas City, September 1983;
- Organic Analysis: Multi-media, Multi Concentration-IFB WA84-A267; and
- Dioxin Analysis:Soil/Sediment Matrix; Multi-Concentration; Selected Ion Monitoring with Jar Extration Procedure-IFB WA84-A002

However, we have modified our protocols to provide a higher level of QA/QC than the guidelines require. For example, we analyze a higher than required number of quality control samples and we pay especially careful attention to the certification of the "reference standard" compounds we use in analysis. Below are listed the key QA/QC elements for the methods we used.

Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

- Each batch of 13 samples consists of 9 customer samples (at a maximun), one blank sample, one spiked blank, one spiked sample and one replicate sample. This amounts to a 30% quality control factor.
- Three surrogate compounds are added to each sample in the batch of 13.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on bromofluorobenzene (BFB) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of Volatile Organic Priority Pollutant "standards" at a minimum of 3 different concentrations and using a mixture of 3 internal standards at a constant concentration.
- The calibration curve is verified with a mixture of priority pollutant standards every day. If the response factors vary greater than 25%, the instrument must be recalibrated.

Analysis of Organic Compounds Extracted in Acid or Base/Neutral Solutions by Gas Chromatography/Mass Spectrometry

- Each batch of 20 samples consists of 16 customer samples (at a maximum), one blank sample, one spiked blank (for water matrices), one sample spiked with the priority pollutant standard mixture and a duplicate customer sample. This amounts to a 20% quality control factor.

- Three surrogate compounds are added to each sample in the batch for Base/Neutral analysis.
- Three surrogate compounds are added to each sample in the batch for Acid analysis.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on decafluorotriphenylphosphine (DFTPP) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of standards composed of either the Organic Acid or Base/Neutral Extractable Compounds at a minimum of 3 concentrations and using five internal standards for quantitation.

Analysis of Metals

All Samples

- New standards are prepared for each batch of samples.
- Normal calibration is performed using a blank sample and four standards that have been through the sample preparation procedure. A regression analysis is used to construct the calibration curve.
- All EP Toxicity samples and all samples determined by furnace atomic absorption are calculated by the "method of additions".
- For each sample analysis that requires the use of the "method of additions" technique, a three point calibration is performed using U.S. EPA "Methods for Chemical Analysis of Water and Wastes, 1979". Results are obtained using linear regression analysis. Any regression with a coefficient of correlation below 0.990 is considered suspect, necessitating review of calibration data or sample re-analysis.
- In constructing the normal calibration curves the lowest concentration levels we use are values greater than or equal to 5 times the Instrumental Detection Limit (IDL).
- All calibration standards are analyzed in duplicate, at a minimum.
- Independent reference standards are used to check the accuracy of calibration standards.
- A check standard is analyzed every ten samples to validate the normal calibration curve.
- One customer sample out of every ten is analyzed in triplicate.

Homogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are homogeneous, the QC program is a minimum of 25% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 independent reference standard;
- 4 Calibration standards (processed using the sample preparation method);
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Heterogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are heterogeneous, the QC program is a minimum of 35% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 Replicate independent reference standards;
- 4 Calibration standards (processed using the sample preparation method);
- 1 Procedural Blank;
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Analysis of Mercury

To analyze samples for mercury we group them by matrix in batches of 30 or less. Our QC program is a minimum of 30% and consists of analyzing:

- each of the 30 customer samples in duplicate;
- 3 sets of triplicate anaylses;
- 2 Replicate spikes;
- 2 Replicate independent reference standards;
- 10 Calibration standards (processed using the sample preparation method); and
- 2 Procedural Blanks.

Analysis of Pesticides, Herbicides and PCB's by Gas Chromatography

Pesticide, herbicide and PCB samples are grouped in batches of 16 customer samples or less according to the type of analysis to be performed. The QC program for each of these three types of analyses is a minimum of 20% and consists of analyzing:

- 1 procedural blank sample(a reagent blank is analyzed in the case of non-water matrices);
- 1 spiked blank sample (the spiked blank is eliminated in the case of non-water matrices);
- 1 replicate sample;
- 1 replicate spiked sample; and
- 1 known refernece QC sample for at least each 100 samples analyzed.

The instrument is calibrated each run with three standards, and checked every 10 samples.

Analysis of Cyanides, Phenols, Fluoride, Chloride, Nitrate and Nitrite

- All parameters are analyzed using a Technicon Autoanalyzer II GT.
- 3 calibration standards are analyzed at the beginning and end of each batch.

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- Each batch (up to 80 samples) consists of analyzing one blank, one spiked blank, one duplicate and spiked sample every 20 samples, and an EPA known reference sample.

Analysis of Total Organic Carbon (TOC)

TOC samples are analyzed on a daily basis with the number of samples analyzed per day dependent on the request for duplicate or quadruplicate analyses. The quality control program is designed to maintain the appropriate amount of QC and consists of the following elements:

- Daily instrument calibration
- One blank
- Standard recalibration every 10 samples
- Spiked samples at a low and high level
- Every sample is run in duplicate at a minimum

Analysis of Total Organic Halide (TOX)

- Blank reagent water for absolute carbon backround must contain less than 5 ug/l of halide (as chloride).
- Using a trichlorophenol standard, the mean adsorption efficiency must be within +/- 15% of the standard value.
- Calibration standards are run every 10 samples.
- Every sample is run in duplicate at a minimum.

Analysis of 2,3,7,8-TCDD (Dioxin) by GC/MS (SIM)

- Each sample is dosed with a known quantity of $^{13}C_{12}$-2,3,7,8-TCDD as internal standard and $^{37}Cl_4$-TCDD as surogate standard. The action limits for surrogate standard results is +/- 40% of the true value. Samples showing surrogate standard results outside of these limits are reextracted and reanalyzed.
- Two laboratory "method blanks" are run along with each set of 24 or fewer samples. The method blank is also dosed with the internal standard and surrrogate standard.
- At least one per set of 24 samples is run in duplicate to determine intralaboratory precision.
- Qualitative Requirements. The following are met in order to confirm the presence of native 2,3,7,8-TCDD:

  a. Isomer specificity must be demonstrated initially and verified once per 8-hour work shift. The verification consists of injecting a mixture containing TCDD isomers which elute close to 2,3,7,8-TCDD. The 2,3,7,8-TCDD must be separated from interferring isomers, with no more than 25% valley relative to the 2,3,7,8-TCDD peak.

  b. The 320/322 ratio is within the range of 0.67 to 0.87.

  c. Ions 320, 322, and 257 are all present and maximize together the signal to mean noise ratio must be 2.5 to 1 or better for all 3 ions.

  d. The retention time is equal (within 3 seconds) the retention time for the isotopically labeled 2,3,7,8-TCDD.

  e. At least one of the positives can be confirmed by obtaining partial scan spectra from mass 150 to mass 350. The partial scan guidelines are as follows:

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. the 320/324 ratio should be 1.58 +/- 0.16

. the 257/259 ratio should be 1.03 +/- 0.10

. the 194/196 ratio should be 1.54 +/- 0.15

- One sample is spiked with native 2,3,7,8-TCDD at a level of 1.0 PPB (for soil) for each set of 24 or fewer samples.
- In cases where no native 2,3,7,8-TCDD is detected, the actual detection limit is estimated and reported based on a signal to noise ratio of 2.5 to 1 at ions 320 and 322.
- For each sample, the internal standard is present with at least a 10 to 1 signal to noise ratio for both mass 332 and mass 334. Also, the internal standard 332/334 ratio must be within the range of 0.67 to 0.87.

Subcontractor QA/QC

Each subcontractoer is required to maintain an appropriate level of quality control. To insure this, each subcontractor is required to submit to ETC the quality control data for all analyses it performs. This data is kept on file at ETC. In general, the amount of quality control required is one duplicate sample with one spiked sample for every ten analyses.

Chain-of-Custody

The chain-of-custody procedure is part of our quality assurance protocol. We believe our chain-of-custody record fully complies with the legal requirements of federal, state and local government agencies and of the courts of law. The record covers:

- labeling of sample bottles, packing the Sample Shuttle and transferring the Shuttle under seal to the custody of a shipper;
- outgoing shipping manifests;
- the chain-of-custody form completed by the person(s) breaking the Shuttle seal, taking the sample, resealing the Shuttle and transferring custody to a shipper;
- incoming shipping manifests;
- breaking the Shuttle's reseal;
- storing each labeled sample bottle in a secured area;
- disposition of each sample to an analyst or technician; and
- the use of the sample in each bottle in a testing procedure appropriate to the intended purpose of the sample.

The records show for each link in this process:

- the person with custody; and
- the time and date each person accepted or relinquished custody.

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Appendix A

Mass Spectral Data for Quantitated Compounds

1) A total ion chromatogram for each sample analyzed by a GC/MS instrument.

2) A Quant. report used by the analyst to determine qualitative and quantitative results of the compounds present.

3) A mass spectrum and a reference spectrum for each priority pollutant compound detected in the sample.

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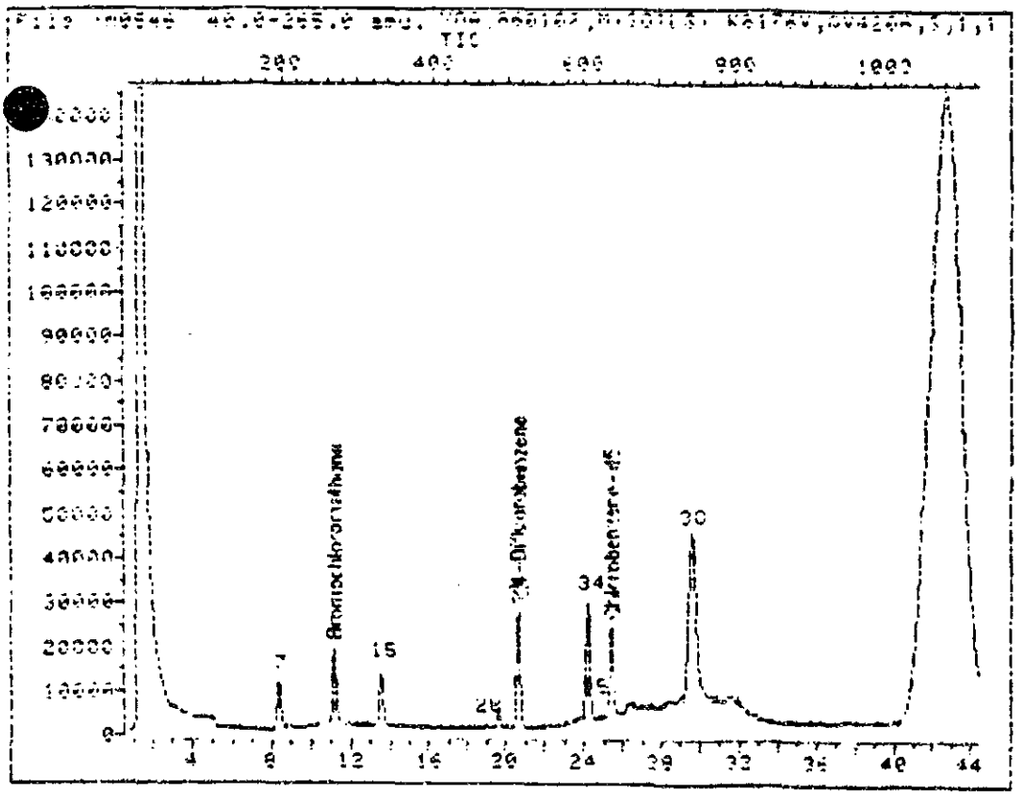
TOTAL ION CHROMATOGRAM



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Misc: [illegible]

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Last Calibration: [illegible]

Operator ID: [illegible]
Quant Time: [illegible]
Injected at: [illegible]

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QUANT REPORT

Operator ID: [illegible] Quant Rev: 4 Quant Time: 860103 05:[illegible]
Output File: [illegible]MU546::AU Injected at: 860103 04:47
Data File: [illegible]MU546::[illegible] Dilution Factor: 1.00
Name: VUA,860102,M(SOIL5)
Misc: [illegible]

ID File: MVUA::U5
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		11.16	268	31069	250.00	NG	91
2)	Methylene chloride		8.37	196	35471	~~[illegible]~~	~~NG~~ 64.46 = 20.6	[illegible]
15)	1,2-Dichloroethane-D4	(SURR)	13.57	330	26626	203.57	NG	89
17)	*1,4-Dichlorobenzene		20.62	512	119919	250.00	NG	93
~~28)~~	~~Bis(Chloromethyl)ether~~		~~18.88~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~NG~~	100
30)	*Chlorobenzene-B5		25.39	635	28619	250.00	NG	98
~~31)~~	~~2-Chloroethylvinyl ether~~		~~20.66~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~NG~~	100
34)	Toluene-D8	(SURR)	24.19	604	124[illegible]8	206.43	NG	90
~~35)~~	~~Toluene~~		~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~NG~~	~~81~~
38)	p-Bromofluorobenzene	(SURR)	29.[illegible]	[illegible]42	66643	197.94	NG	96

* Compound is ISTD

PDD

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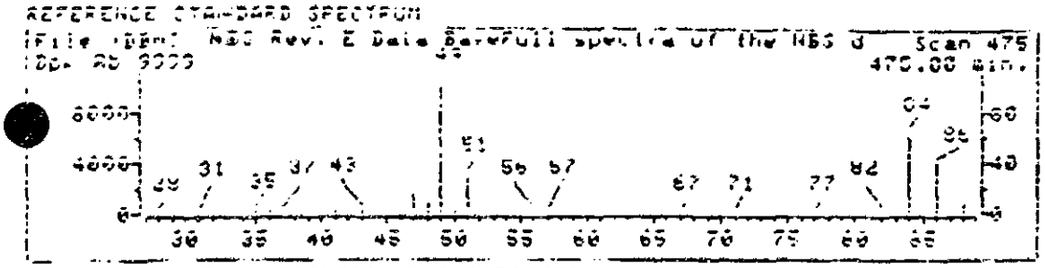
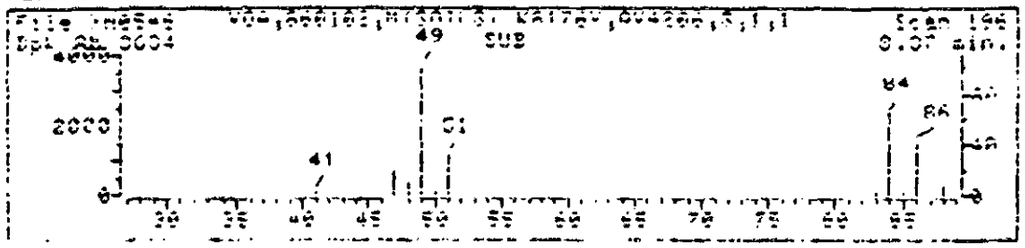
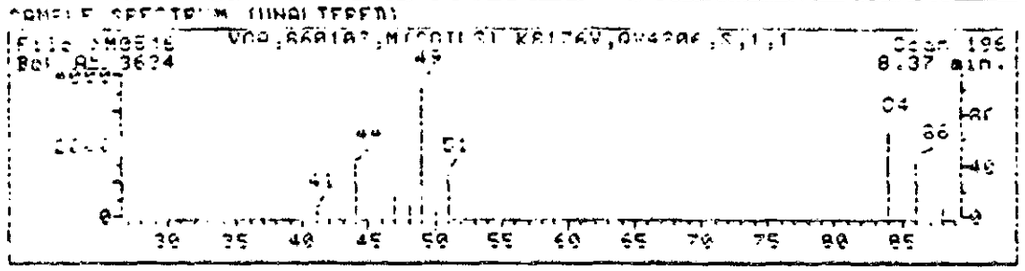
REFERENCE STANDARD SPECTRUM



SAMPLE SPECTRUM (BACKGROUND SUBTRACTED)



SAMPLE SPECTRUM (UNALTERED)



Data File: [illegible]
Name: [illegible]
Misc: [illegible]
Quant Time: 860103 05:32
Injected at: 860103 04:4[illegible]

Compound No: 2
Compound Name: Methylene chloride
Scan Number: 196
Retention Time: 8.37 min.
Area: 35471
Concentration: 85.06 NG
q-value: 9[illegible]

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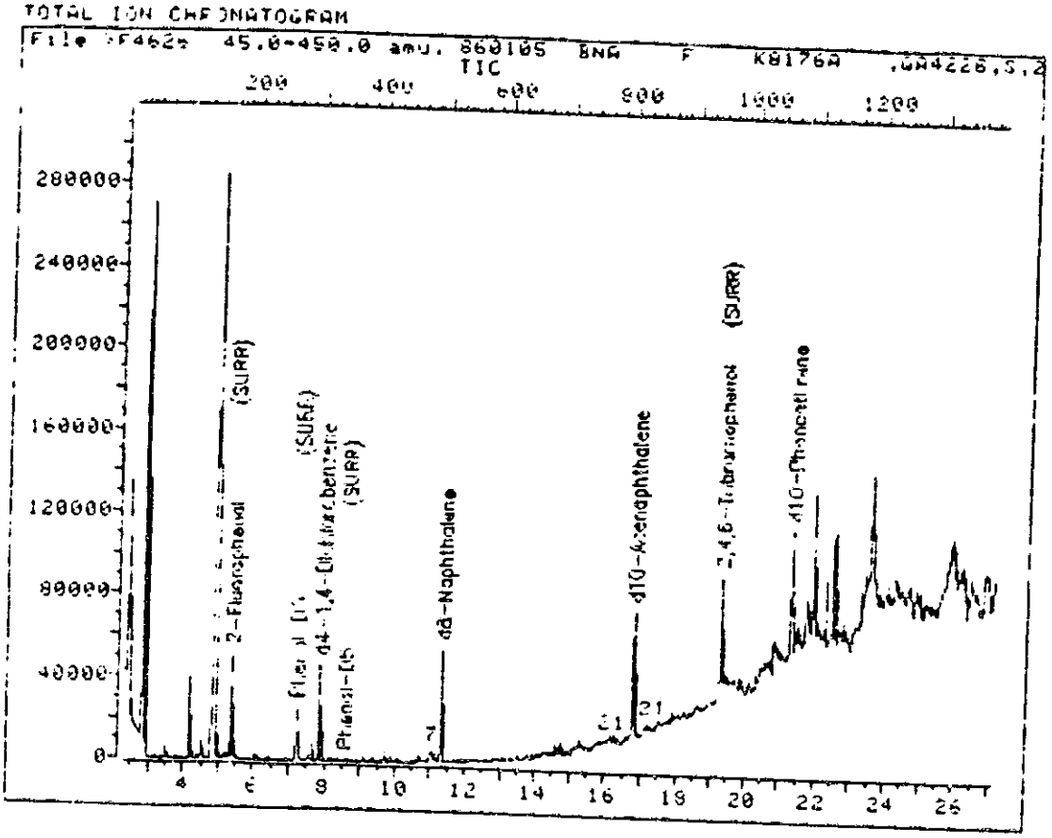
TOTAL ION CHROMATOGRAM



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Name: 860105 BNA F
Misc: K8176A ,QA4226,S,28.15,1

Id File: FACID::U5
Title: FP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

Operator ID: JH2150
Quant Time: 860106 14:46
Injected at: 860106 13:06

BTL#31

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QUANT REPORT

Operator ID: OH2180 Quant Rev: 4 Quant Time: 86010c 14:4c
Output File: F462c::AC Injected at: 86010c 13:0c
Data File: >F462c::U3 Dilution Factor: 1.00
Name: 860105 BNA F
Misc: K817cH ,OH4228,5,28.15,1 BTL#31

ID File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 86010c 11:33

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene		7.86	312	27201	40.00	UG/ML	90
3)	2-Fluorophenol	(SURR	5.3c	171	27908	64.04	UG/ML	93
7)	Benzoic acid		10.98	488	3448	7.07	UG/ML-	100
9)	Phenol-D5	(SURR	7.2c	275	32586	66.78	UG/ML	96
9)	Phenol-D5	(SURR)	8.55	351	683	~~1.40 UG~~/ML		92
10)	*d8-Naphthalene		11.31	507	61452	40.00	UG/ML	96
18)	*d10-Acenaphthalene		15.79	814	38523	40.00	UG/ML	96
21)	4-Nitrophenol		16.1c	77c	603	~~2.52 UG~~/ML		68
21)	4-Nitrophenol		17.24	840	674	~~2.82 UG~~/ML		73
24)	*d10-Phenanthrene		21.33	1069	86324	40.00	UG/ML	99
25)	2,4,6-Tribromophenol	(SURR)	19.27	954	23579	76.99	UG/ML	94

* Compound is ISTD

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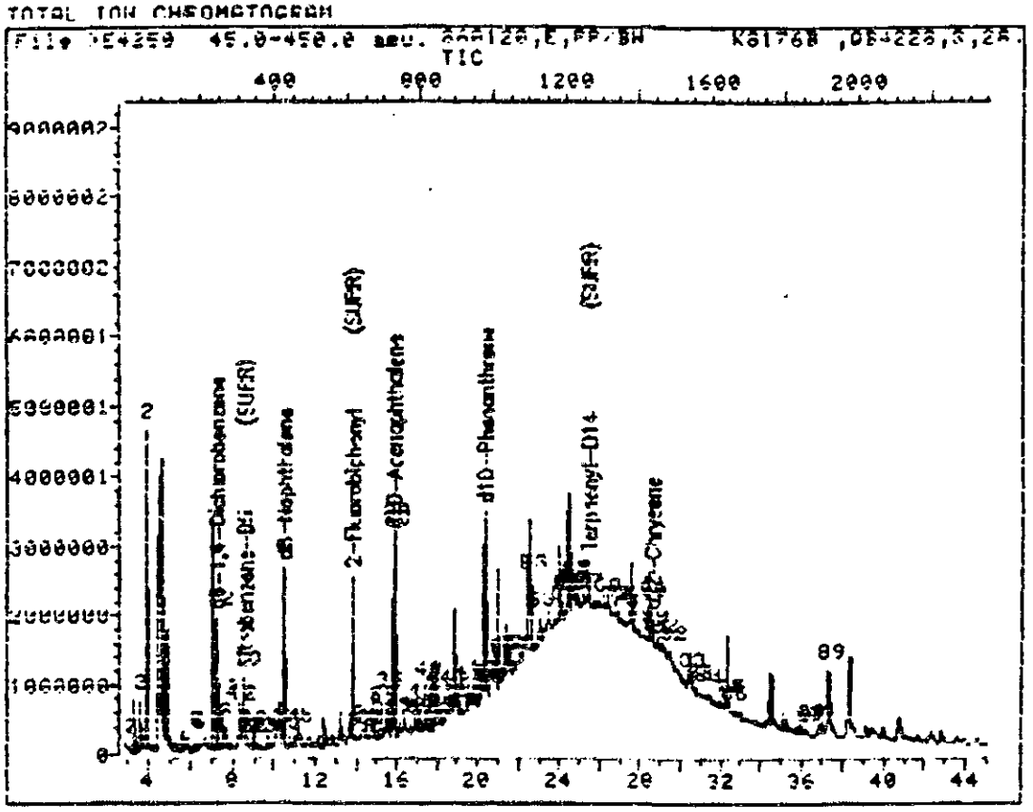
TOTAL ION CHROMATOGRAM



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Misc: K8176B ,WH422B,S,28.15,1

BTL# 6

Id File: FBNP::U5
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860116 19:36

Operator ID: PT2050
Quant Time: 860121 05:15
Injected at: 860120 21:26

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QUANT REPORT

Operator ID: PT2050
Output File: ^F4250::AQ
Data File: >F4250::U4
Name: 860120,F,PP/BN
Misc: K8176H ,QH4228,S,28.15,1

Quant Rev: 5

Quant Time: 860121 05:15
Injected at: 860120 21:26
Dilution Factor: 1.00

BTL# 6

ID File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860116 19:36

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene		7.18	243	632382	40.00	UG/ML	99
2)	~~N-Nitrosodimethylamine~~		3.17	17	20837	~~2.45~~	~~UG/ML~~	100
2)	~~N-Nitrosodimethylamine~~		3.59	41	7227	~~.92~~	~~UG/ML~~	100
2)	~~N-Nitrosodimethylamine~~		3.91	59	6734	~~.86~~	~~UG/ML~~	100
3)	~~Benzyl alcohol~~		7.27	248	2290	~~.08~~	~~UG/ML~~	72
3)	~~Benzyl alcohol~~		7.61	267	37492	~~1.79~~	~~UG/ML~~	87
5)	~~Benzaldehyde~~		6.28	192	86099	~~3.39~~	~~UG/ML~~	73
6)	~~bis(2-Chloroethyl)ether~~		6.37	197	3044	~~.21~~	~~UG/ML~~	91
11)	Nitrobenzene-D5	(SURR)	8.55	320	886699	49.36	UG/ML	69
12)	~~bis(2-Chloroisopropyl)ether~~		7.18	243	30807	~~13.40~~	~~UG/ML~~	83
12)	~~bis(2-Chloroisopropyl)ether~~		7.41	256	38490	~~16.74~~	~~UG/ML~~	63
12)	~~bis(2-Chloroisopropyl)ether~~		8.30	306	112133	~~48.76~~	~~UG/ML~~	75
17)	*d8-Naphthalene		10.44	426	3488839	40.00	UG/ML	97
18)	2-Fluorobiphenyl	(SURR)	13.29	614	2904910	37.46	UG/ML	99
19)	~~N-Nitrosodi-n-propylamine~~		8.55	320	139127	~~10.08~~	~~UG/ML~~	65
22)	~~Isophorone~~		8.77	332	6899	~~.70~~	~~UG/ML~~	69
22)	~~Isophorone~~		8.87	338	61634	~~1.78~~	~~UG/ML~~	62
22)	~~Isophorone~~		9.25	359	40543	~~1.17~~	~~UG/ML~~	86
23)	~~bis(2-Chloroethoxy)methane~~		9.48	372	3783	~~.15~~	~~UG/ML~~	67
23)	~~bis(2-Chloroethoxy)methane~~		10.53	431	1786	~~.07~~	~~UG/ML~~	87
24)	~~1,2,4-Trichlorobenzene~~		10.35	421	4391	~~.20~~	~~UG/ML~~	74
25)	~~Naphthalene~~		10.49	429	12462	~~.26~~	~~UG/ML~~	90
25)	~~Naphthalene~~		11.13	465	1406	~~.07~~	~~UG/ML~~	75
29)	*d10-Acenaphthalene		15.79	726	2644717	40.00	UG/ML	97
31)	~~2-Nitroaniline~~		14.36	646	11303	~~.46~~	~~UG/ML~~	69
31)	~~2-Nitroaniline~~		14.59	659	6681	~~.97~~	~~UG/ML~~	71
32)	~~2-Chloronaphthalene~~		14.04	628	2284	~~.04~~	~~UG/ML~~	50
33)	~~Dimethyl phthalate~~		15.80	727	444530	~~5.95~~	~~UG/ML~~	80
34)	~~Acenaphthylene~~		15.29	698	11792	~~.13~~	~~UG/ML~~	83
35)	~~2,6-Dinitrotoluene~~		15.16	691	14161	~~.76~~	~~UG/ML~~	86
35)	~~2,6-Dinitrotoluene~~		15.52	711	53729	~~2.87~~	~~UG/ML~~	67
35)	~~2,6-Dinitrotoluene~~		15.79	726	331600	~~17.78~~	~~UG/ML~~	54
36)	~~1-Chloro-3,4-dinitrobenzene~~		17.82	840	3975	~~.39~~	~~UG/ML~~	85
37)	~~Acenaphthene~~		15.88	731	2178	~~.04~~	~~UG/ML~~	76
39)	~~2,4-Dinitrotoluene~~		16.64	774	7264	~~.31~~	~~UG/ML~~	91
39)	~~2,4-Dinitrotoluene~~		16.98	793	7081	~~.30~~	~~UG/ML~~	61
40)	~~Diethyl phthalate~~		17.14	802	17670	~~.26~~	~~UG/ML~~	74
40)	~~Diethyl phthalate~~		17.45	819	69312	~~1.04~~	~~UG/ML~~	95
40)	~~Diethyl phthalate~~		18.23	863	6134	~~.09~~	~~UG/ML~~	72
41)	~~Fluorene~~		17.09	799	2413	~~.04~~	~~UG/ML~~	93
41)	~~Fluorene~~		18.13	857	7802	~~.14~~	~~UG/ML~~	69
4)	~~N-Nitrosodiphenylamine~~		17.45	819	10245	~~.24~~	~~UG/ML~~	79
4)	~~N-Nitrosodiphenylamine~~		17.93	846	15986	~~.37~~	~~UG/ML~~	87

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	Compound		R.T.	Scan#	Area	Conc	Units	q
44)	N-Nitrosodiphenylamine		18.00	850	4178	.18	UG/ML	[illegible]
45)	1,2-Diphenylhydrazine		17.25	808	2821	.31	UG/ML	78
45)	1,2-Diphenylhydrazine		18.18	860	16024	.72	UG/ML	59
47)	*d10-Phenanthrene		20.35	981	5273636	40.00	UG/ML	98
49)	Hexachlorobenzene		19.41	929	2207	.09	UG/ML	89
50)	4-Nitrobiphenyl		21.15	1026	20957	.66	UG/ML	64
50)	4-Nitrobiphenyl		21.26	1060	11685	.39	UG/ML	98
51)	Phenanthrene		20.40	984	39894	.43	UG/ML	77
51)	Phenanthrene		20.53	991	35813	.39	UG/ML	97
52)	Anthracene		20.40	984	39894	.44	UG/ML	78
52)	Anthracene		20.53	991	35813	.40	UG/ML	99
53)	Di-n-butyl phthalate		21.94	1070	25332	.29	UG/ML	98
53)	Di-n-butyl phthalate		22.55	1104	2179312	25.06	UG/ML	98
53)	Di-n-butyl phthalate		22.98	1128	22113	.25	UG/ML	97
54)	Fluoranthene		24.10	1190	21491	.43	UG/ML	75
55)	Benzidine		24.15	1193	3086	.83	UG/ML	100
55)	Benzidine		24.44	1209	2250	.68	UG/ML	100
55)	Benzidine		24.69	1223	2909	.81	UG/ML	100
56)	Pyrene		24.10	1190	21491	.48	UG/ML	76
58)	Alpha-BHC		19.45	931	1640	.17	UG/ML	42
58)	Alpha-BHC		19.61	940	4783	.41	UG/ML	64
59)	Beta-BHC		19.45	931	1640	.19	UG/ML	42
59)	Beta-BHC		19.61	940	4783	.54	UG/ML	64
60)	Gamma-BHC		19.45	931	1640	.14	UG/ML	42
60)	Gamma-BHC		19.61	940	4898	.36	UG/ML	64
61)	Delta-BHC		20.17	971	10823	1.18	UG/ML	[illegible]
63)	*d12-Chrysene		28.57	1438	476194	40.00	UG/ML	[illegible]
66)	Chlordane		24.55	1215	1413	4.83	UG/ML	87
67)	Endosulfan I		24.57	1216	1397	1.92	UG/ML	70
67)	Endosulfan I		24.91	1235	1222	1.02	UG/ML	34
67)	Endosulfan I		25.27	1255	1649	1.44	UG/ML	58
69)	Dieldrin		24.82	1230	9976	2.46	UG/ML	68
69)	Dieldrin		26.24	1309	6324	1.31	UG/ML	65
73)	Endrin aldehyde		26.51	1324	4844	2.41	UG/ML	45
73)	Endrin aldehyde		26.91	1346	18484	11.45	UG/ML	52
73)	Endrin aldehyde		27.00	1351	7880	4.71	UG/ML	41
76)	Terphenyl-D14	(SURR)	25.43	1264	1135755	73.91	UG/ML	92
78)	Butyl benzyl phthalate		26.73	1336	3318	.29	UG/ML	75
78)	Butyl benzyl phthalate		27.12	1358	18946	2.47	UG/ML	81
79)	Benzo(b)fluoranthene		28.51	1435	3739	.56	UG/ML	82
79)	Benzo(a)anthracene		28.62	1441	6481	.62	UG/ML	67
80)	Chrysene		28.51	1435	3739	.40	UG/ML	86
80)	Chrysene		28.62	1441	6481	.69	UG/ML	76
81)	3,3'-Dichlorobenzidine		27.85	1398	1859	.54	UG/ML	94
81)	3,3'-Dichlorobenzidine		28.69	1445	1841	.74	UG/ML	95
82)	bis(2-Ethylhexyl)phthalate		29.06	1465	81555	9.15	UG/ML	99
82)	bis(2-Ethylhexyl)phthalate		29.33	1480	11318	1.23	UG/ML	93
82)	bis(2-Ethylhexyl)phthalate		29.47	1488	20625	2.31	UG/ML	95
83)	Di-n-octyl phthalate		30.37	1538	16077	1.16	UG/ML	82
83)	Di-n-octyl phthalate		30.88	1566	32794	2.36	UG/ML	97
83)	Di-n-octyl phthalate		31.20	1584	19915	1.62	UG/ML	97
84)	Benzo(k)fluoranthene		32.41	1651	3155	.54	UG/ML	[illegible]
85)	Benzo(k)fluoranthene		32.41	1651	3155	.41	UG/ML	80
86)	Benzo(a)pyrene		32.41	1651	3975	.58	UG/ML	79
86)	Benzo(a)pyrene		32.58	1660	5543	.78	UG/ML	81

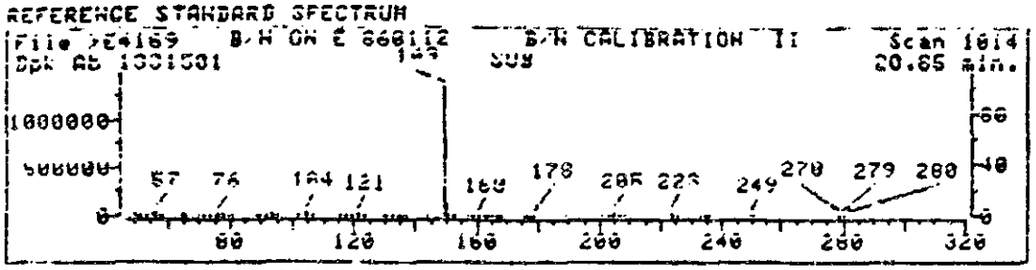
	Compound	R.T.	Scan#	Area	Conc	Units	Q
87)	~~Indeno(1,2,3-cd)pyrene~~	36.27	1865	13208	~~[illegible]~~	~~[illegible]~~	96
87)	~~Indeno(1,2,3-cd)pyrene~~	36.43	1874	1461	~~[illegible]~~	~~[illegible]~~	77
88)	~~Dibenz(a,h)anthracene~~	36.36	1870	10850	~~[illegible]~~	~~[illegible]~~	69
89)	~~Benzo(ghi)perylene~~	37.26	1920	11551	~~[illegible]~~	~~[illegible]~~	73

* Compound is ISTD

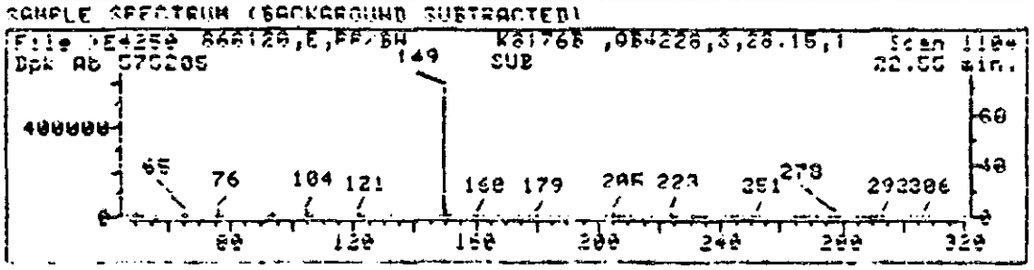
NO PCB's Found.

002600

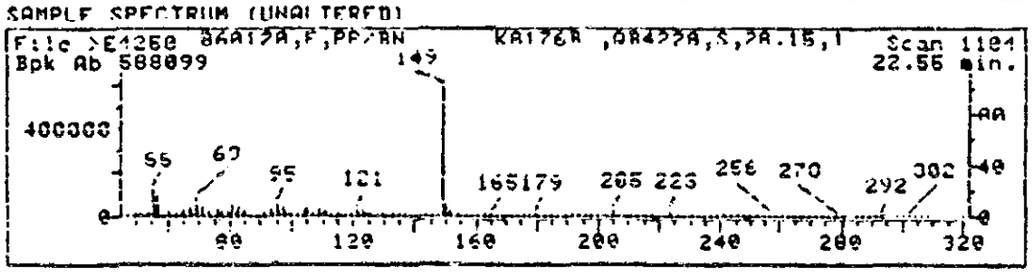
REFERENCE STANDARD SPECTRUM



SAMPLE SPECTRUM (BACKGROUND SUBTRACTED)



SAMPLE SPECTRUM (UNALTERED)



Data File: >E4250::114
Name: 860120,E,PP/BN
Misc: KB176B ,QB422B,S,28.15,1
Quant Time: 860121 05:15
Injected at: 860120 21:26

BIL# 6

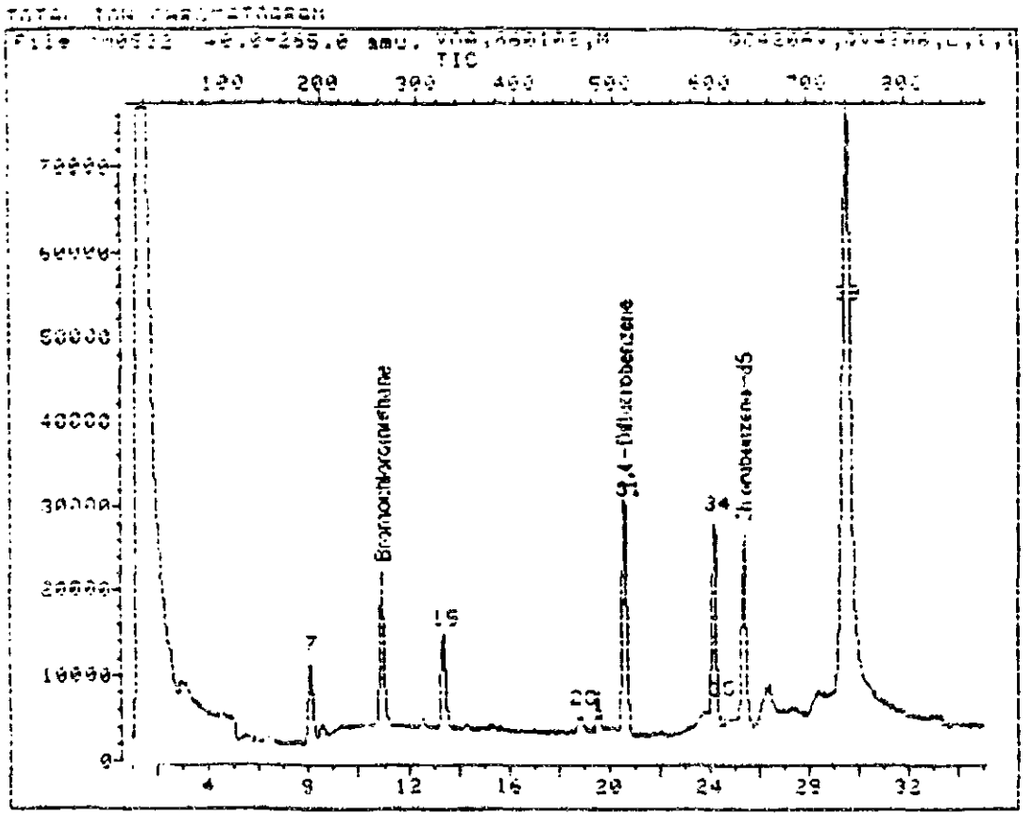
Compound No: 53
Compound Name: Di-n-butyl phthalate
Scan Number: 1104
Retention Time: 22.55 min.
Area: 2179317
Concentration: 25.06 UG/ML
q-value: 98

002601

Appendix C1

GC/MS Subsidiary Data

002602



Data File: [illegible]
Name: VOA,860102,M
Misc: [illegible],L,1,1, [illegible] BLANK

Id File: MVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

Operator ID: DS4 12
Quant Time: 860102 19:08
Injected at: 860102 19:09

002603

QUANT REPORT

Operator ID: [illegible]4212 Quant Rev: 4 Quant Time: [illegible]
Quant File: [illegible]M0532::A0 Injected at: 860102 15:09
Data File: M0532::03 Dilution Factor: 1.[illegible]
Name: VOA,860102,M
Misc: [illegible],S,1,1, NO BLANK

ID File: MVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

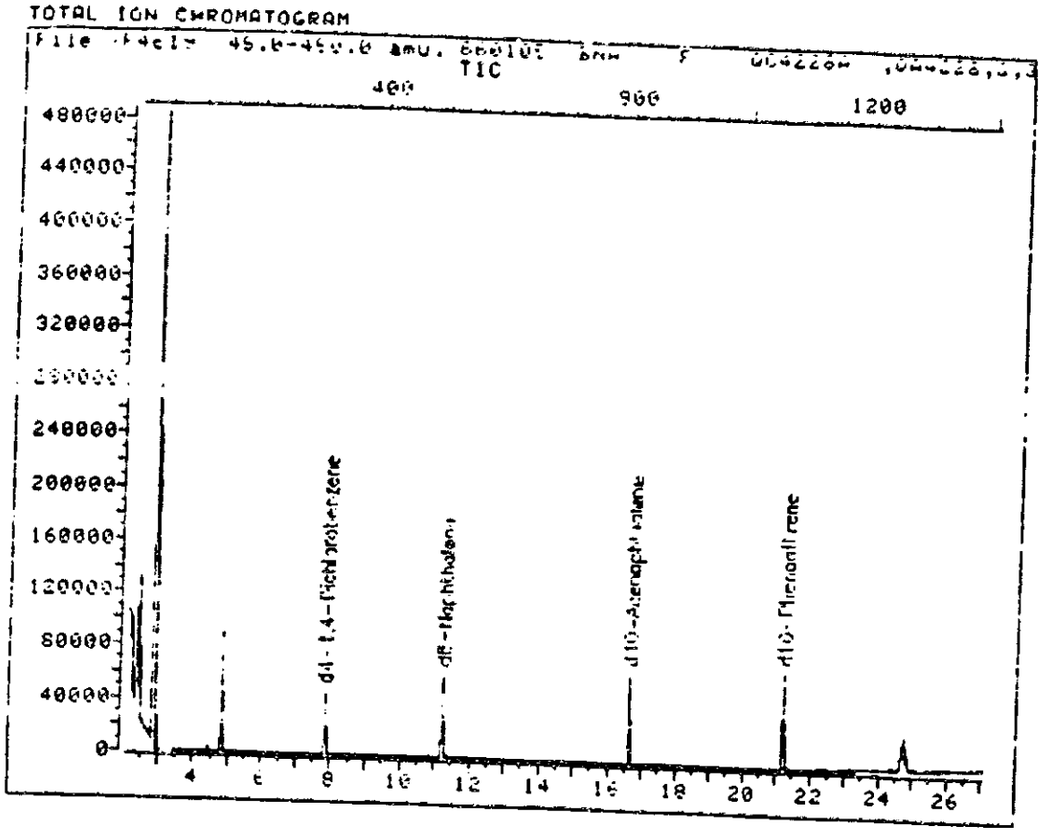
	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		10.96	263	34271	250.00	NG	92
2)	Methylene chloride		8.09	149	29651	64.46	NG	98
15)	1,2-Dichloroethane-D4	(SURR)	13.40	326	23094	159.77	NG	91
17)	*1,4-Dichlorobenzene		20.61	512	132[illegible]67	250.00	NG	95
28)	~~bis(Chloromethyl)ether~~		~~13.83~~	~~466~~	~~[illegible]~~	~~194.75~~	~~NG~~	100
30)	*Chlorobenzene-d5		25.[illegible]8	635	87605	250.00	NG	98
31)	~~2-Chloroethylvinyl ether~~		~~2[illegible].65~~	~~513~~	~~34[illegible]~~	~~159.42~~	NG	100
34)	Toluene-D8	(SURR)	24.18	604	108741	161.97	NG	92
35)	~~Toluene~~		~~24.37~~	~~609~~	~~2228~~	~~2.95~~	~~NG~~	96
38)	p-Bromofluorobenzene	(SURR)	29.[illegible]2	738	62448	166.46	NG	99

* Compound is ISTD

PAN

002604

TOTAL ION CHROMATOGRAM



Data File: /F4619::U3
Name: 860105 BNA F
Misc: QC4228A ,QA4228,S,30.00,1

ETL#24

Id File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

Operator ID: JH2180
Quant Time: 860106 14:02
Injected at: 860106 08:40

002605

QUANT REPORT

Operator ID: JH2150
Output File: F4619::AQ
Data File: F4619::U3
Name: 860105 BNA F
Misc: [illegible],[illegible],5,30.00,1

Quant Rev: 4
Quant Time: 860106 14:02
Injected at: 860106 08:40
Dilution Factor: 1.00

ETL#24

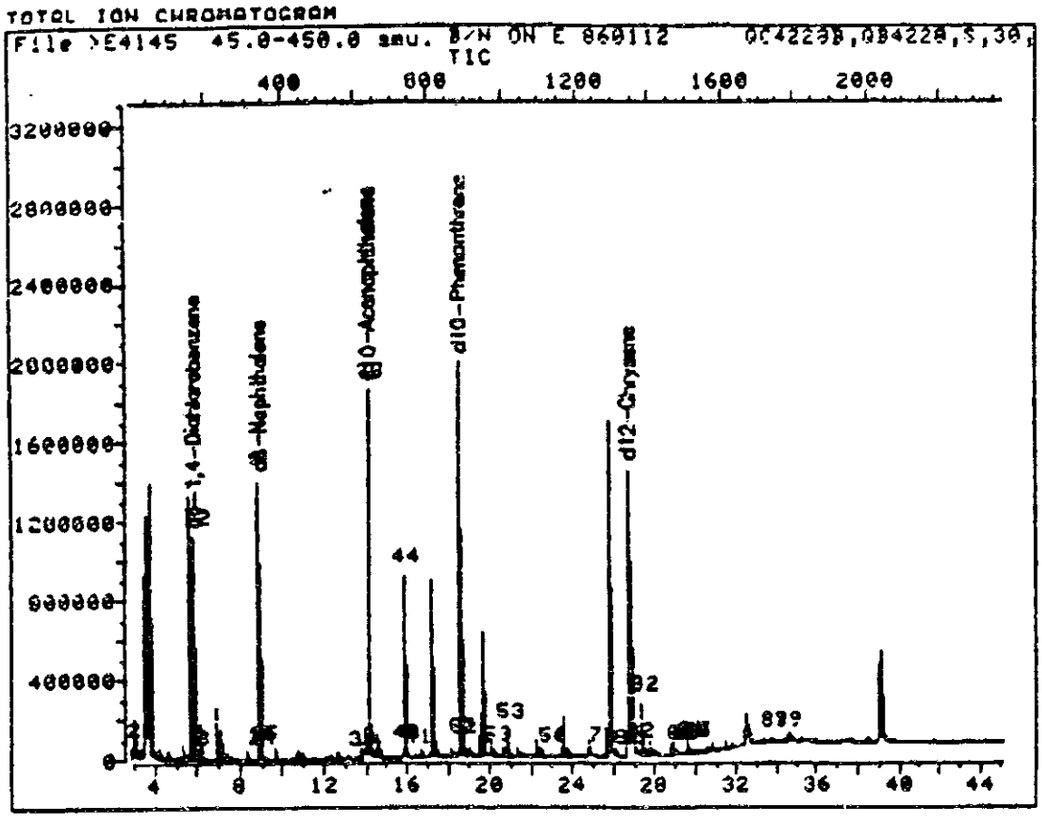
ID File: FACID::JS
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

Compound	R.T.	Scan#	Area	Conc.	Units	%
1) *d4-1,4-Dichlorobenzene	7.80	319	33041	40.00	UG/ML	88
10) *d8-Naphthalene	11.22	512	74465	40.00	UG/ML	95
18) *d10-Acenaphthalene	16.63	817	45053	40.00	UG/ML	[illegible]
24) *d10-Phenanthrene	21.20	1075	99903	40.00	UG/ML	99

* Compound is ISTD

002606

TOTAL ION CHROMATOGRAM



Data File: >E4145::U5
Name: B/N ON E 860112
Misc: QC42288,QB4228,S,30,1

BTL# 6

Id File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

Operator ID: WW9926
Quant Time: 860113 11:38
Injected at: 860113 03:14

002607

QUANT REPORT

Operator ID: WW9928 Quant Rev: 5 Quant Time: 860113 11:38
Output File: ^E4145::AQ Injected at: 860113 03:14
Data File: >E4145::U5 Dilution Factor: 1.00
Name: B/N ON E 860112
Misc: QC42288,Q84228,S,30,1 BTL# 6

ID File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

	Compound	R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene	5.85	169	368447	40.00	UG/ML	99
2)	~~N-Nitrosodimethylamine~~	~~2.93~~	~~4~~	~~2426~~	~~474.92~~	~~UG/ML~~	100
3)	~~Benzyl alcohol~~	~~6.26~~	~~192~~	~~8613~~	~~.51~~	~~UG/ML~~	87
12)	~~bis(2-Chloroisopropyl)ether~~	~~5.89~~	~~169~~	~~13740~~	~~5.07~~	~~UG/ML~~	99
17)	*d8-Naphthalene	8.88	340	1775324	40.00	UG/ML	93
~~24)~~	~~1,2,4-Trichlorobenzene~~	~~8.81~~	~~336~~	~~3674~~	~~.28~~	~~UG/ML~~	99
~~29)~~	~~Naphthalene~~	~~8.95~~	~~343~~	~~4607~~	~~.13~~	~~UG/ML~~	93
29)	*d10-Acenaphthalene	14.09	634	1378682	40.00	UG/ML	94
~~33)~~	~~Dimethyl phthalate~~	~~13.61~~	~~607~~	~~3385~~	~~.09~~	~~UG/ML~~	71
~~35)~~	~~Dimethyl phthalate~~	~~14.09~~	~~634~~	~~243961~~	~~6.17~~	~~UG/ML~~	66
~~36)~~	~~2,6-Dinitrotoluene~~	~~14.09~~	~~634~~	~~172607~~	~~16.92~~	~~UG/ML~~	54
~~40)~~	~~Diethyl phthalate~~	~~19.79~~	~~730~~	~~22483~~	~~.97~~	~~UG/ML~~	93
~~41)~~	~~Fluorene~~	~~16.43~~	~~786~~	~~1269~~	~~.05~~	~~UG/ML~~	81
~~44)~~	~~N-Nitrosodiphenylamine~~	~~19.85~~	~~733~~	~~5786~~	~~.25~~	~~UG/ML~~	90
47)	*d10-Phenanthrene	18.55	885	2866028	40.00	UG/ML	98
~~51)~~	~~Phenanthrene~~	~~18.60~~	~~888~~	~~10194~~	~~.18~~	~~UG/ML~~	94
~~5[illegible])~~	~~Anthracene~~	~~18.60~~	~~888~~	~~10194~~	~~.18~~	~~UG/ML~~	92
~~53)~~	~~Di-n-butyl phthalate~~	~~20.23~~	~~980~~	~~9854~~	~~.16~~	~~UG/ML~~	92
~~53)~~	~~Di-n-butyl phthalate~~	~~20.84~~	~~1014~~	~~182204~~	~~2.99~~	~~UG/ML~~	97
~~54)~~	~~Fluoranthene~~	~~22.98~~	~~1130~~	~~3422~~	~~.06~~	~~UG/ML~~	93
~~56)~~	~~Pyrene~~	~~22.98~~	~~1130~~	~~3422~~	~~.06~~	~~UG/ML~~	93
64)	*d12-Chrysene	26.68	1343	1855287	40.00	UG/ML	100
~~78)~~	~~Butyl benzyl phthalate~~	~~25.35~~	~~1268~~	~~4469~~	~~.14~~	~~UG/ML~~	79
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~26.58~~	~~1337~~	~~1391~~	~~.03~~	~~UG/ML~~	94
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~27.15~~	~~1369~~	~~4589~~	~~.10~~	~~UG/ML~~	87
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~27.33~~	~~1379~~	~~234144~~	~~5.34~~	~~UG/ML~~	93
~~83)~~	~~Di-n-octyl phthalate~~	~~29.12~~	~~1480~~	~~7817~~	~~.14~~	~~UG/ML~~	94
~~83)~~	~~Di-n-octyl phthalate~~	~~29.41~~	~~1496~~	~~1286~~	~~.02~~	~~UG/ML~~	88
~~83)~~	~~Di-n-octyl phthalate~~	~~29.64~~	~~1509~~	~~4568~~	~~.08~~	~~UG/ML~~	60
~~84)~~	~~Benzo(b)fluoranthene~~	~~29.89~~	~~1523~~	~~3362~~	~~.10~~	~~UG/ML~~	82
~~85)~~	~~Benzo(k)fluoranthene~~	~~29.89~~	~~1523~~	~~3362~~	~~.11~~	~~UG/ML~~	81
~~86)~~	~~Benzo(a)pyrene~~	~~29.89~~	~~1523~~	~~3362~~	~~.11~~	~~UG/ML~~	82
~~87)~~	~~Indeno(1,2,3-cd)pyrene~~	~~33.67~~	~~1735~~	~~8825~~	~~.29~~	~~UG/ML~~	92
~~88)~~	~~Dibenzo(a,h)anthracene~~	~~33.71~~	~~1737~~	~~2886~~	~~.31~~	~~UG/ML~~	91
~~89)~~	~~Benzo(ghi)perylene~~	~~33.67~~	~~1735~~	~~8825~~	~~.35~~	~~UG/ML~~	94
~~89)~~	~~Benzo(ghi)perylene~~	~~34.40~~	~~1776~~	~~8380~~	~~.33~~	~~UG/ML~~	92

* Compound is ISTD

No PCB's Found.

DMS
1/16/86

002608

Appendix E

Chain-of Custody Forms

1) A field Chain-of-Custody form (CC1) is included for all samples shipped by ETC shuttle.

2) An in-house sample Chain-of Custody form is included for all samples not shipped by ETC shuttle.

3) Any additional Chain-of-Custody material provided by a client or by a client's sampling agent is also included.

4) A subcontractor's Chain-of-Custody form is included for any analytical work not performed within ETC's laboratory.

5) Analysis and Extraction Custody forms are included for the period the sample was in ETC's possession.

TESTING AND CERTIFICATION

CHAIN OF CUSTODY FORM (CC1)

Date Sealed 12-6-85 By: M. Ickstadt

Company: RESOURCE ENGINEERING

Facility/Site:

Address: 3000 RICHMOND AVE.
HOUSTON, TX 77098

Attn.: CHRIS ITIN

Phone: ( )

SAMPLE IDENTIFICATION

Facility: RES288-04 (Facility/Site Code) CLARKE LAKE (Optional Sample Point Descriptions)

Sample Point: B-L1 (Source Code (from below) / Your Sample Point ID (left justify)) 85 12 19 (Start Date (YY/MM/DD)) (Start Time (2400 hr. clock)) (Elapsed Hours (composite))

Source Codes
Well (W) Outfall (O) Bottom Sediment (B) Surface Impoundment (I) Leachate Collection Sys. (C) Other (X)
Soil (S) River/Stream (R) Generation Point (G) Treatment Facility (T) Lake/Ocean (L) Specify

SHUTTLE CONTENTS

BOTTLE No	Type	Size	Preserv.	ANALYSIS	SAMPLER Fill (Y/N)	SAMPLER Observations	LAB Observations
1	E	500mL	BAKED	EXTRACTABLE			✓
2	F	40mL	BAKED	VOA			✓

002610

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) JOHN BINS Date: 12/9/85 Time: 6:30 PM
Signature: John Bins Seal #: 0047285 Intact: YES

2. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

3. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

Shuttle Sealed By: (print) JOHN BINS Date: 12/19/85 Time: 5:30 PM
Signature: John Bins Seal #: 0047286 Intact: YES

ETC USE ONLY Opened By: R. Rivera Date: 12/20/85 Time: 11:00
Seal #: 472F6 Condition: Intact

ETC ENVIRONMENTAL TESTING and CERTIFICATION

FIELD PARAMETER FORM (CC2)

ETC JOB # K8176

Sample Point [ ] Source Code [ ] Sample Point ID

FIELD PROCEDURES

PURGE DATE (YY MM DD) | START PURGE (2400 Hr Clock) | ELAPSED HRS | WATER VOL. IN CASING (Gallons) | VOLUME PURGED (Gallons)

SAMPLING METHOD: PETERSON DREDGE

Sampler Type [ ] A-Submersible Pump B-ISCO C-Bladder Pump D-Dipper/Bottle E-Bailer F-Scoop/Shovel X-Other _____ (SPECIFY OTHER)

Sampler Material [ ] A-Teflon B-Metal C-PVC D-Plastic X-Other _____ (SPECIFY OTHER)

Tubing Material [ ] A-Teflon B-Tygon C-Polyethylene D-Silicon X-Other _____ (SPECIFY OTHER)

Sample Composited [Y/N] _____ Procedure/Preservative

FIELD MEASUREMENTS

Well Elevation (ft/msl) _____

Depth to Ground water (ft) _____

Groundwater Elevation (ft msl) _____

Well Depth (ft) _____

Sample Depth (non-well) (ft) _____

00261

1st	pH (STD)	1st	spec. cond. µmhos at 25°C		(other parameter)	value	units
2nd	pH (STD)	2nd	spec. cond. µmhos at 25°C		(other parameter)	value	units
3rd	pH (STD)	3rd	spec. cond. µmhos at 25°C		(other parameter)	value	units
4th	pH (STD)	4th	spec. cond. µmhos at 25°C		(other parameter)	value	units

Sample Temp (°C) _____ Turbidity (NTU) _____

FIELD COMMENTS

Sample Appearance: ORGANIC DARK LAKE BOTTOM SEDIMENT

Weather Conditions: _____

Other: _____

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: JOHN BINS (Print) Employer: RESOURCE ENGINEERING INC

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

12/19/85 John Bins

Date Signature

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/2/88 SHIFT
FRACTION VOA
INSTRUMENT M
TUNE FILE APCI02
SEQUENCE FILE 0:M
METHOD FILE VOA
ID FILE MVA
ANALYST(S) Cengiz Sunar, Brenda Hawkins
SUPERVISOR
BATCH #'s BV4206

STANDARD	CONC PPM	LOT NO.	LOT VOL (ul)
pBFB	50	12151	1
Std	25	12066	10
Sumog	25	12019	10
ABC/SCUBA	18	12141	5, 10, 30
o,m,p Chlorotoluene	18	11852	5, 10, 30

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	1/2/88
WIP		BY	DMJ

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
p-BFB	7M0531	1µl			200003	OK 13:37	
QC4206V	7M0532					OK 15:05 PL Vial VIO	✓
QC4206VS	7M0533					5µl ABC/SCUBA, use [illegible]	
QC4206VS	7M0534					10	
QC4206VS	7M0535				15:09	30	
p-BFB	7M0536				19:[illegible]	OK	
K8557VS	7M0537	1.0g				NG spl[illegible] no metal	
K8557V	7M0538					OK	
K8558V	7M0539					NG OK re-run 1/100	
K8558VR	7M0540			1/100 medium		NG OK re-run 1/100	35.3%
K8559V	7M0541					NG OK re-run 1/100	
K8171V	7M0542					OK NG re-run compounds	
K8173V	7M0543					NG OK	
K8174V	7M0544					OK	
K8175V	7M0545					OK	
K8176V	7M0546					OK	
(B) K8557VS	7M0547					OK	
QC4206VSim	7M0548	1µl				OK 07:06	
p-BFB	7M0549	1µl				NG	
p-BFB	7M0550	1µl				OK 09:03	
(R) K8171V	7M0551	1.0g				OK	
(B) K8173VR	7M0552	1.0g				OK	
K8484V	7M0553	1.0g				OK	
K8471V	7M0554					OK	
K4174V	7M0555					OK PL3 Vial PL6 VIO	✓

ETC FORM 0102

002612

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/3/86 SHIFT
FRACTION VOA (Soils)
INSTRUMENT M
TUNE FILE APEI02
SEQUENCE FILE DSM
METHOD FILE VOAm
ID FILE MVOA
ANALYST(S) [signature]

SUPERVISOR [signature]
BATCH #'s QV4206

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL
Refer to pg. 1 of 2			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8470V	>M0556	1g			1 0000 8	OK	
(R) K8173V	>M0557	1g				Ng leaked	
QC4206V	>M0558					OK	
(R) K8173V	>M0559	1g				OK	

002613

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/5/86 SHIFT
FRACTION Acid; BNA
INSTRUMENT F
TUNE FILE MTF001
SEQUENCE FILE JHF
METHOD FILE Acid F; BNPF
ID FILE FAcid; FBNA
ANALYST(S) J. Hen[illegible]
SUPERVISOR [illegible]
BATCH #'s QC4159, QA4228

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ	JH 1/5	DATE	1/6
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.
Int Std	400	12,008	100 ml
B/N Cal std I		12,110	1 ml
B/N Cal std II		12,111	↓
B/N Cal std III		11,906	↓
Acid cal std I		12,020	↓
Acid cal std II		12,021	↓
Acid cal std III		12,022	↓
Spec #930	60	12,140	↓
Spec #930	100	12,139	↓
Spec #930	300	12,138	↓
DFTPP	25	11,972	✓

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP-60ng std.	>F4595					OK	
B/N Cal std III	F4596		1				
B/N Cal std II	F4597		2				
B/N Cal std I	F4598		3				
Acid cal std III	F4599		4				
Acid cal std II	F4600		5				
Acid cal std I	F4601		6				
Spec #930; 300ppm	F4602		7				
Spec #930; 100ppm	F4603		8				
Spec #930; 60ppm	F4604		9				
DFTPP-50ng std.	F4605		10			OK	
K8322CS	F4606		11				
QC4159C	F4607		12			BJ HS Act1	Y
K8323C	F4608		13			BJ HS Act1	Y
K8323CR	F4609		14				
K8320C	F4610		15			BJ HS Act1	Y
K8322C	F4611		16			Act1	Y
K8321C	F4612		17			Act1	Y
K8325C	F4613		18			Act1	Y
K8324C	F4614		19			Act1	Y
GPC BLANK	F4615		20				
K8173AS	F4616		21				
DFTPP-50ng std.	F4617		22			OK	
Acid cal std IV	F4618		23			CBCHK-OK	
QC4228A	F4619		24				

ETC FORM #102

002614

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE _____
METHOD FILE _____
ID FILE _____
ANALYST(S) S. Hewette-RA
SUPERVISOR [signature]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8174A	>F4620		25				
K8174AR	F4621		26				
K8173A	F4622		27				
5175A ~~K8176A~~	F4623		28				
K8171A	F4624		29				
J8439A	F4625		30				
K8176A	F4626		31				
K8484A	F4627		32				
K8485A	F4628		33				

002615

ETC TESTING AND CERTIFICATION — LABORATORY CHRONICLE: Sample Preparation Department

Sample Number	Log Link	Sample Weight (gm)	Extract Vol. (ml) BN	Extract Vol. (ml) ACID	Comments
* ~~K4174~~	~~12865~~	~~29.95~~			~~PP/ORG/PST/PCB~~ RESOXHLET AT 3.0 gram. MK 12/30
+ K8439	12825	30.02	5.0	1.0	
K8484	12847	29.51	1.0	1.0	
K8485	↓	29.27	1.0	1.0	↓
K8171	12847	30.00	1.0	1.0	PP/ORG/PST/PCB CMPD/BN
* ~~K8172~~		~~30.01~~			RESOXHLET AT 3.0 gram. MK 12/30
K8173		30.00	1.0	1.0	
K8174		30.01	1.0	1.0	
K8175		29.95	1.0	1.0	
K8176	↓	28.15	1.0	1.0	↓
K3246	11759	30.60	1.0		PP/BN
J2204	12890	31.01	1.0		BN+15
J2205		30.16	1.0		
J2206		30.79	1.0		
J2207		30.24	1.0		
J2208	↓	30.10	1.0		↓ ↓
QC 4228			1.0	1.0	
~~K8173~~ K8173 S		22.72	1.0	1.0	
K8174 R		~~20.38~~ 24.84	1.0	1.0	

QC Batch # 4228

Analysis PP/ACID

1-2 PP/BN

Matrix Soil

Turnaround Normal

Date 12/24/87

Extraction Method:

Sep. Funnel

Continuous

Soxhlet ✓

Other

002616

COMMENTS

Log 12847 Cmpd/BN:
Benzyl Aldehyde
Benzoic Acid
Catechol (O-Hydroxybenzene)
- Spec Sheet #930
Benzyl Alcohol

*K4174 } RESOXHLET AT 3.0 gram. MK 12/30
*K8172 }

+ F.V 5.0 ml a 1 ml Aliquot was packaged

FRACTION	SPIKE Amt (ml)	Conc.	Lot #
BN	1.0	100 ug/ml	12,098
ACID	1.0	100 ug/ml	11,825
Arochlor 1260	1.0	100 ug/ml	12,097
Pest	1.0	100/200 ug/ml	12,059
SPEC #930 BN SPIKE	1.0	100 ug/ml	12,137
Semi-VOA			

SURROGATE Amt. (ml)	Conc.	Lot #
1.0	BN: 50 ug/ml ACID: 100 ug/ml	12,093

Set-up: L.M. Zyk 12/27/85 J. Vajda 12-27-85 UPD/Supervisor: Marc Gaudin 1/2/88

BN Conc.: Judie C 12/30/85 Acid Conc.: L.M. Zyk 1/2/86 Spike/Surr. Verified: Mina Gandhi 12/27/85

ETC FORM 8110

DATE 1/20/86 SHIFT
FRACTION
INSTRUMENT 6
TUNE FILE MTE001
SEQUENCE FILE UBE
METHOD FILE BNPE
FILE EBNP
ANALYST(S) [illegible]

SUPERVISOR [illegible]
BATCH #'s QB4228, QB4279

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	1/21/86
WIP		BY	[illegible]

STANDARD	CONC PPM	LOT NO.	LOT VOL.
BNIV	150	12112	
BNIII	200	11906	
BNII	100	12247	
BNI	60	12246	

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP	E4243.					NG	
DFTPP	>E4244					OK	
BNIV	>E4245		1				
BNIII	>E4246		2				
BNII	>E4247		3				
BNI	>E4248		4				
K6406B	>E4249		5	These are		QB4279	
K8176B	>E4250		6	reinjections.		QB4228 28.15,1	
K8173B5 —	>E4251		7			↓ 22.72,1	

FORM 9102

002617

ETC ENVIRONMENTAL TESTING and CERTIFICATION

Technical Report

for

RESOURCE ENGINEERING

ATTENTION: CHRIS ITIN

3000 RICHMOND AVENUE

HOUSTON, TX 77098

CLARK LAKE
SAMPLE # L2

002618

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

Denis C. K. Lin, Ph.D.
Vice President
Research and Operations

This Technical Report is an INSITE™ service generated by LODESTAR™ Data Management Software.

284 RARITAN CENTER PARKWAY • EDISON, NJ 08837 (201) 225-5800

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Introduction

This report contains the analytical results on your soil sample, BL2 85/12/19. It is designed to include comprehensive data from the entire analytical process in order to satisfy the needs of various levels of review.

The results obtained from your sample are presented in tabular format immediately following this introduction. Quality assurance data is tabulated along with the appropriate sample results for verification. Depending on the analyses ordered, the quality assurance data may include results from blank, spiked blank, spiked sample (i.e. matrix spike) and replicate sample as well as results from surrogate compound analyses. Quality assurance data for verification of proper instrument performance is also included where appropriate. The report appendices include the chain of custody record for your sample and, where appropriate, the gas chromatograms and mass spectra.

The procedures used in the analysis of the sample are described in this report's methodology section. All analytical procedures within our laboratory are performed within a strictly enforced Quality Assurance Protocol. A description of this Protocol is included in the report.

Results

Sample results, and associated quality assurance data, are always tabulated in one or more of this report's Quantitative Results Tables. The format of each table varies with the class of analysis.

Priority Pollutants

The priority pollutant compounds and elements are listed with their NPDES (National Pollution Discharge Elimination System) numbers, and the Method Detection Limit (MDL) published in the Federal Register. When a compound or element is present below its published MDL it is reported as BMDL (Below Method Detection Limit). When a compound or element is not present at any detectable concentrations it is reported as ND (Not Detected). MDL's for non-aqueous matrices are based on USEPA published MDL's but are adjusted as per sample weight. Matrix spike and replicate analyses, where included, were performed on samples randomly chosen within each quality assurance batch and are therefore not necessarily spikes and replicates of this report's sample. Surrogate compound recovery data and instrument calibration data are included in the Method Performance Data Tables.

002620

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 7, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds – GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

NPDES Number	Compound (Acrolein and Acrylonitrile values are screen only.)	Results: Sample Concen. ug/kg	Results: MDL ug/kg	QC Replicate: First ug/kg	QC Replicate: Second ug/kg	QC Blank and Spiked Blank: Blank Data ug/kg	QC Blank and Spiked Blank: Concen. Added ug/kg	QC Blank and Spiked Blank: % Recov	QC Matrix Spike: Unspiked Sample ug/kg	QC Matrix Spike: Concen. Added ug/kg	QC Matrix Spike: % Recov
1V	Acrolein	ND	500	ND	ND	ND	4000	90	ND	4000	126
2V	Acrylonitrile	ND	500	ND	ND	ND	400	99	ND	400	81
3V	Benzene	ND	22	ND	ND	ND	90.0	105	ND	90.0	92
4V	bis(Chloromethyl)ether	ND	50	ND	ND	ND	0	-	ND	0	-
5V	Bromoform	ND	24	ND	ND	ND	90.0	114	ND	90.0	91
6V	Carbon tetrachloride	ND	14	ND	ND	ND	90.0	103	ND	90.0	89
7V	Chlorobenzene	ND	30	ND	ND	ND	90.0	101	ND	90.0	93
8V	Chlorodibromomethane	ND	16	ND	ND	ND	90.0	107	ND	90.0	90
9V	Chloroethane	ND	50	ND	ND	ND	90.0	96	ND	90.0	91
10V	2-Chloroethylvinyl ether	ND	50	ND	ND	ND	90.0	180.	ND	90.0	196.
11V	Chloroform	ND	8.0	ND	ND	ND	90.0	100	ND	90.0	96
12V	Dichlorobromomethane	ND	11	ND	ND	ND	90.0	101	ND	90.0	91
13V	Dichlorodifluoromethane	ND	50	ND	ND	ND	90.0	104	ND	90.0	84
14V	1,1-Dichloroethane	ND	24	ND	ND	ND	90.0	100	ND	90.0	96
15V	1,2-Dichloroethane	ND	14	ND	ND	ND	90.0	100	ND	90.0	95
16V	1,1-Dichloroethylene	ND	14	ND	ND	ND	90.0	101	ND	90.0	90
17V	1,2-Dichloropropane	ND	30	ND	ND	ND	90.0	101	ND	90.0	92
18V	cis-1,3-Dichloropropylene	ND	25	ND	ND	ND	90.0	100	ND	90.0	81
19V	Ethylbenzene	ND	36	ND	ND	ND	90.0	98	ND	90.0	97
20V	Methyl bromide	ND	50	ND	ND	ND	90.0	103	ND	90.0	97
21V	Methyl chloride	ND	50	ND	ND	ND	90.0	98	ND	90.0	78
22V	Methylene chloride	ND	14	1.13	ND	64.5	90.0	63	430	90.0	0.
23V	1,1,2,2-Tetrachloroethane	ND	35	ND	ND	ND	90.0	121	ND	90.0	113
24V	Tetrachloroethylene	ND	21	ND	ND	ND	90.0	103	ND	90.0	96
25V	Toluene	ND	30	ND	ND	ND	90.0	102	ND	90.0	100
26V	1,2-Trans-dichloroethylene	ND	8.0	ND	ND	ND	90.0	101	ND	90.0	94
27V	1,1,1-Trichloroethane	ND	19	ND	ND	ND	90.0	102	ND	90.0	96
28V	1,1,2-Trichloroethane	ND	25	ND	ND	ND	90.0	110	ND	90.0	92
29V	Trichloroethylene	ND	9.5	ND	ND	ND	90.0	96	ND	90.0	90
30V	Trichlorofluoromethane	ND	50	ND	ND	ND	90.0	99	ND	90.0	87
31V	Vinyl chloride	ND	50	ND	ND	ND	90.0	99	ND	90.0	88
18V	trans-1,3-Dichloropropylene	ND	50	ND	ND	ND	90.0	98	ND	90.0	92

A Recovery normally variable using EPA Protocol Method 624.

B Spiked samples that contain compounds present at high levels do not provide valid spike recovery data.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 9, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Acid Compounds - GC/MS Analysis Data (QR02)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg*	Second ug/kg*	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1A	2-Chlorophenol	ND	110	ND	ND	ND	0	-	ND	4400	82
2A	2,4-Dichlorophenol	ND	91	ND	ND	ND	0	-	ND	4400	94
3A	2,4-Dimethylphenol	ND	91	ND	183	ND	0	-	ND	4400	88
4A	4,6-Dinitro-o-cresol	ND	810	ND	ND	ND	0	-	ND	4400	61
5A	2,4-Dinitrophenol	ND	1400	ND	ND	ND	0	-	ND	4400	55
6A	2-Nitrophenol	ND	120	ND	ND	ND	0	-	ND	4400	90
7A	4-Nitrophenol	ND	81	ND	ND	ND	0	-	ND	4400	99
8A	p-Chloro-m-cresol	ND	100	ND	ND	ND	0	-	ND	4400	120
9A	Pentachlorophenol	ND	120	ND	ND	ND	0	-	ND	4400	135
10A	Phenol	ND	51	ND	ND	ND	0	-	236	4400	193
11A	2,4,6-Trichlorophenol	ND	91	ND	ND	ND	0	-	ND	4400	102

* Variability in Replicate results due to non-homogeneous nature of sample matrix.

\# Recovery low due to sample matrix interference.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1B	Acenaphthene	ND	64	ND	ND	ND	0	-	ND	4400	78
2B	Acenaphthylene	ND	120	ND	ND	ND	0	-	ND	4400	109
3B	Anthracene	ND	64	ND	ND	ND	0	-	51.9	4400	99
4B	Benzidine	ND	1500	ND	ND	ND	0	-	ND	4400	40
5B	Benzo(a)anthracene	ND	260	ND	ND	ND	0	-	ND	4400	102
6B	Benzo(a)pyrene	ND	85	ND	ND	ND	0	-	ND	4400	85
7B	Benzo(b)fluoroanthene	ND	160	ND	ND	ND	0	-	ND	4400	100
8B	Benzo(ghi)perylene	ND	140	ND	ND	ND	0	-	ND	0	-
9B	Benzo(k)fluoranthene	ND	120	ND	ND	ND	0	-	ND	4400	83
10B	bis(2-Chloroethoxy)methane	ND	180	ND	ND	ND	0	-	ND	4400	66
11B	bis(2-Chloroethyl) ether	ND	190	ND	ND	ND	0	-	ND	4400	109
12B	bis(2-Chloroisopropyl)ether	ND	190	ND	ND	ND	0	-	ND	4400	71
13B	bis(2-Ethylhexyl)phthalate	ND	340	ND	ND	ND	0	-	ND	4400	213
14B	4-Bromophenyl phenyl ether	ND	64	ND	ND	ND	0	-	ND	4400	137
15B	Butyl benzyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	146
16B	2-Chloronaphthalene	ND	64	ND	ND	ND	0	-	ND	4400	84
17B	4-Chlorophenyl phenyl ether	ND	140	ND	ND	ND	0	-	ND	4400	49
18B	Chrysene	ND	85	ND	ND	ND	0	-	ND	4400	108
19B	Dibenzo(a,h)anthracene	ND	340	ND	ND	ND	0	-	ND	0	-
20B	1,2-Dichlorobenzene	ND	64	ND	ND	ND	0	-	ND	4400	93
21B	1,3-Dichlorobenzene	ND	64	ND	ND	ND	0	-	ND	4400	90
22B	1,4-Dichlorobenzene	ND	150	ND	ND	ND	0	-	ND	4400	92
23B	3,3'-Dichlorobenzidine	ND	576	ND	ND	ND	0	-	ND	4400	0
24B	Diethyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	52
25B	Dimethyl phthalate	ND	340	ND	ND	ND	0	-	52.9	4400	94
26B	Di-n-butyl phthalate	ND	340	ND	ND	ND	0	-	85.3	4400	177
27B	2,4-Dinitrotoluene	ND	190	ND	ND	ND	0	-	ND	4400	47
28B	2,6-Dinitrotoluene	ND	64	ND	ND	ND	0	-	ND	4400	38
29B	Di-n-octyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	108
30B	1,2-Diphenylhydrazine	ND	340	ND	ND	ND	0	-	ND	4400	0
31B	Fluoranthene	ND	75	ND	ND	ND	0	-	35.8	4400	123
32B	Fluorene	ND	64	ND	ND	ND	0	-	ND	4400	64

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov a	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
33B	Hexachlorobenzene	ND	64	ND	ND	ND	0	-	ND	4400	133
34B	Hexachlorobutadiene	ND	30	ND	ND	ND	0	-	ND	4400	87
35B	Hexachlorocyclopentadiene	ND	340	ND	ND	ND	0	-	ND	0	-
36B	Hexachloroethane	ND	54	ND	ND	ND	0	-	ND	4400	22c
37B	Indeno(1,2,3-c,d)pyrene	ND	160	ND	ND	ND	0	-	ND	0	-
38B	Isophorone	ND	75	ND	ND	ND	0	-	ND	4400	62
39B	Naphthalene	ND	54	ND	ND	ND	0	-	ND	4400	119
40B	Nitrobenzene	ND	64	ND	ND	ND	0	-	ND	4400	127
41B	N-Nitrosodimethylamine	ND	340	ND	ND	ND	0	-	ND	0	-
42B	N-Nitrosodi-n-propylamine	ND	340	ND	ND	ND	0	-	ND	4400	140
43B	N-Nitrosodiphenylamine	ND	64	ND	ND	ND	0	-	75.1	4400	30
44B	Phenanthrene	ND	180	ND	ND	ND	0	-	ND	4400	127
45B	Pyrene	ND	64	ND	ND	ND	0	-	ND	4400	125
46B	1,2,4-Trichlorobenzene	ND	64	ND	ND	ND	0	-	ND	4400	77

a Duplicate Block. Spiked Blank cannot be performed for this sample matrix.

b Recovery currently variable using EPA Protocol Method 625.

c Recovery variable due to sample matrix interference.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

JAN 26, 1986

Pesticide/PCB Compounds – GC/MS Analysis Data (QR04)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	851219		

NPDES Number	Compound	Results: Sample Concen. ug/kg	Results: MDL ug/kg	QC Replicate: First ug/kg	QC Replicate: Second ug/kg	QC Blank and Spiked Blank: Blank Data ug/kg	QC Blank and Spiked Blank: Concen. Added ug/kg	QC Blank and Spiked Blank: % Recov	QC Matrix Spike: Unspiked Sample ug/kg	QC Matrix Spike: Concen. Added ug/kg	QC Matrix Spike: % Recov
1P	Aldrin	ND	64	ND	ND	ND	0	-	ND	4400	44
2P	Alpha-BHC	ND	340	ND	ND	ND	0	-	ND	4400	39
3P	Beta-BHC	ND	150	ND	ND	ND	0	-	ND	4400	117
4P	Gamma-BHC	ND	340	ND	ND	ND	0	-	ND	4400	77
5P	Delta-BHC	ND	110	ND	ND	ND	0	-	ND	4400	14a
6P	Chlordane	ND	340	ND	ND	ND	0	-	ND	8800	41
7P	4,4'-DDT	ND	95	ND	ND	ND	0	-	ND	4400	0a
8P	4,4'-DDE	ND	190	ND	ND	ND	0	-	ND	4400	70
9P	4,4'-DDD	ND	160	ND	ND	ND	0	-	ND	4400	76
10P	Dieldrin	ND	85	ND	ND	ND	0	-	ND	4400	68
11P	Endosulfan I	ND	340	ND	ND	ND	0	-	ND	4400	78
12P	Endosulfan II	ND	340	ND	ND	ND	0	-	ND	4400	0a
13P	Endosulfan sulfate	ND	190	ND	ND	ND	0	-	ND	4400	42
14P	Endrin	ND	340	ND	ND	ND	0	-	ND	4400	32
15P	Endrin aldehyde	ND	340	ND	ND	ND	0	-	ND	4400	35
16P	Heptachlor	ND	64	ND	ND	ND	0	-	ND	4400	0a
17P	Heptachlor epoxide	ND	75	ND	ND	ND	0	-	ND	4400	56
18P	PCB-1242	ND	1200	ND	ND	ND	0	-	ND	0	-
19P	PCB-1254	ND	1200	ND	ND	ND	0	-	ND	0	-
20P	PCB-1221	ND	1000	ND	ND	ND	0	-	ND	0	-
21P	PCB-1232	ND	1200	ND	ND	ND	0	-	ND	0	-
22P	PCB-1248	ND	1200	ND	ND	ND	0	-	ND	0	-
23P	PCB-1260	ND	1200	ND	ND	ND	0	-	ND	4400	90
24P	PCB-1016	ND	340	ND	ND	ND	0	-	ND	0	-
25P	Toxaphene						0	-	ND	0	-

a Recovery normally variable using EPA Protocol Method 625.

B Reagent Blank. Spiked Blank cannot be performed for this sample matrix.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 24, 1985

TABLE 2: METHOD PERFORMANCE DATA
Surrogate Recovery Soil - GC/MS Data (QR20)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8484	RESOURCE ENGINEERING	RES28804	BL2	85121		0

Compound	Amount added ug	% Recovery	Control Limits *	
			Lower	Upper
VOLATILE FRACTION				
Toluene-D8	.250	96	50	160
p-Bromofluorobenzene	.250	104	50	160
1,2-Dichloroethane-D4	.250	100	50	160
ACID FRACTION				
Phenol-D5	100	66	20	140
2-Fluorophenol	100	65	20	140
2,4,6-Tribromophenol	100	80	10	140
BASE/NEUTRAL FRACTION				
Nitrobenzene-D5	50	109	20	140
2-Fluorobiphenyl	50	72	20	140
Terphenyl-D14	50	29	20	150

* 1/3 EPA Control Limits

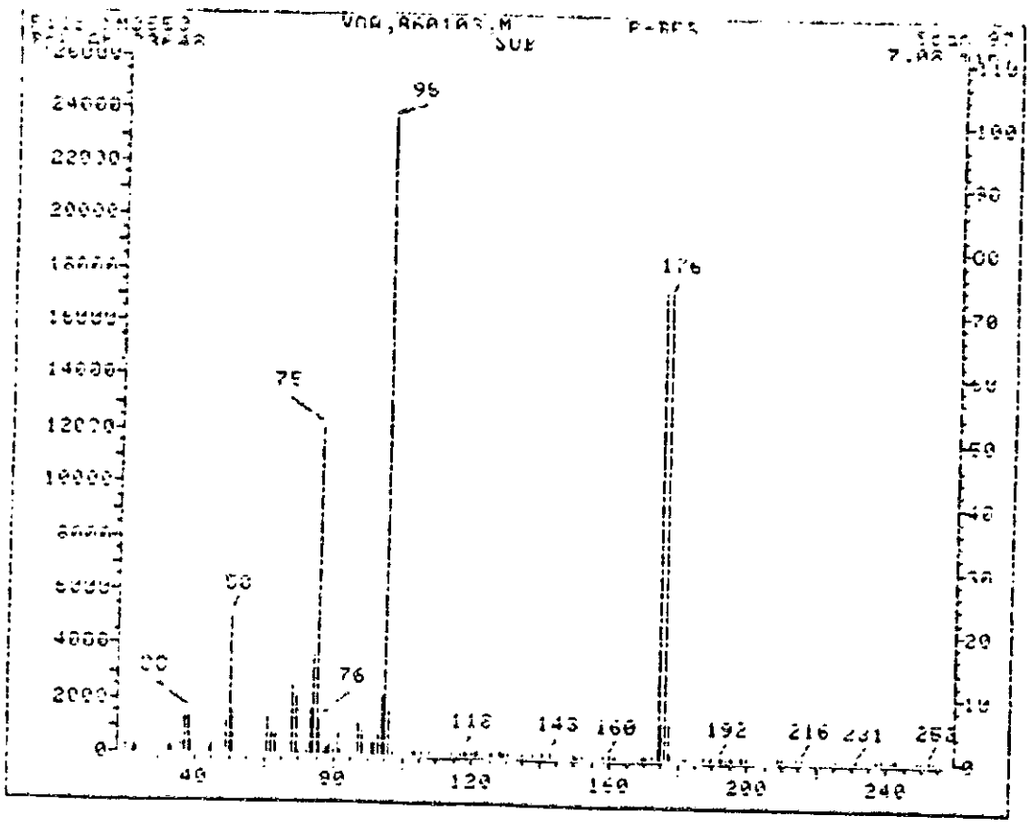

TABLE 2: METHOD PERFORMANCE DATA (WP71)

GC/MS Tuning Data - Bromofluorobenzene (BFB) for Volatiles Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
50	15-40% of mass 95	21.56	21.56	Ok
75	30-60% of mass 95	51.15	51.15	Ok
95	Base peak, 100% relative abundance	100.00	100.00	Ok
96	5-9% of mass 95	7.39	7.39	Ok
173	Less than 1% of mass 95	0.00	0.00	Ok
174	Greater than 50% of mass 95	23.03	23.03	Ok
175	5-9% of mass 174	5.59	7.66	Ok
176	95-101% of mass 174	23.02	100.05	Ok
177	5-9% of mass 176	5.98	8.18	Ok

Injection Date: 01/03/86
Injection Time: 09:03
Run No: >M0550
Spectrum No: 97

Analyst: [signature]
Processor: P.R. [signature]
QC Batch: G64206
Samples: K8171, K8173, K8484, ~~K8471~~ 1-4 JD
K4174, ~~K8470~~ JD 1-4, K8173

Ky 1/6/86

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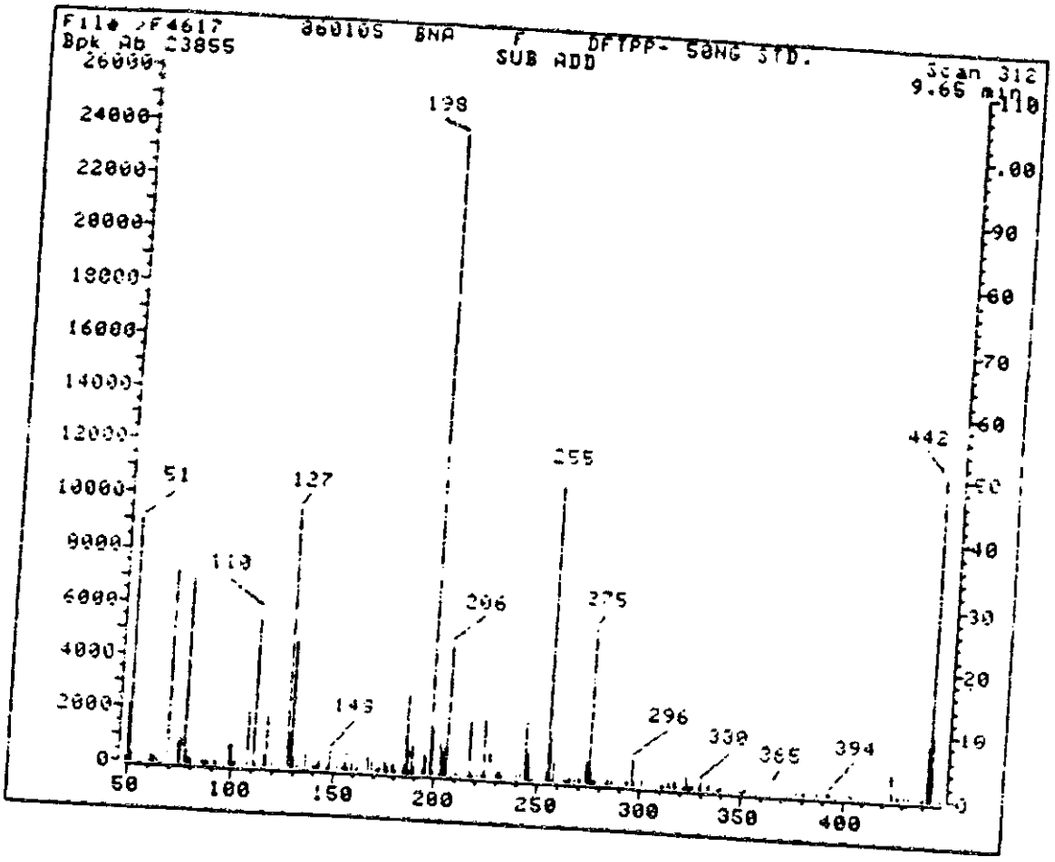

TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for ~~Base/Neutral~~ Acid Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	Appropriate Peak	Status
51	30-60% of mass 198	37.49	37.49	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	29.90	29.90	Ok
70	Less than 2% of mass 69	0.00	0.00	Ok
127	40-60% of mass 198	40.19	40.19	Ok
197	Less than 1% of mass 198	0.00	0.00	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	6.93	6.93	Ok
275	10-30% of mass 198	24.59	24.59	Ok
365	Greater than 1% of mass 198	1.31	1.31	Ok
441	0-100% of mass 443	8.34	85.48	Ok
442	Greater than 40% of mass 198	50.23	50.23	Ok
443	17-23% of mass 442	9.76	19.43	Ok

Injection Date: 01/06/86
Injection Time: 07:46
Run No: >F4617
Spectrun No: 312

Analyst: [illegible]
Processor: [illegible]
QC Batch: QA4228
Samples: K8174, K8173, ~~K8176~~, K8171, K8175, J8439, K8176, K8484, K8485

K. Baker 1/9/86

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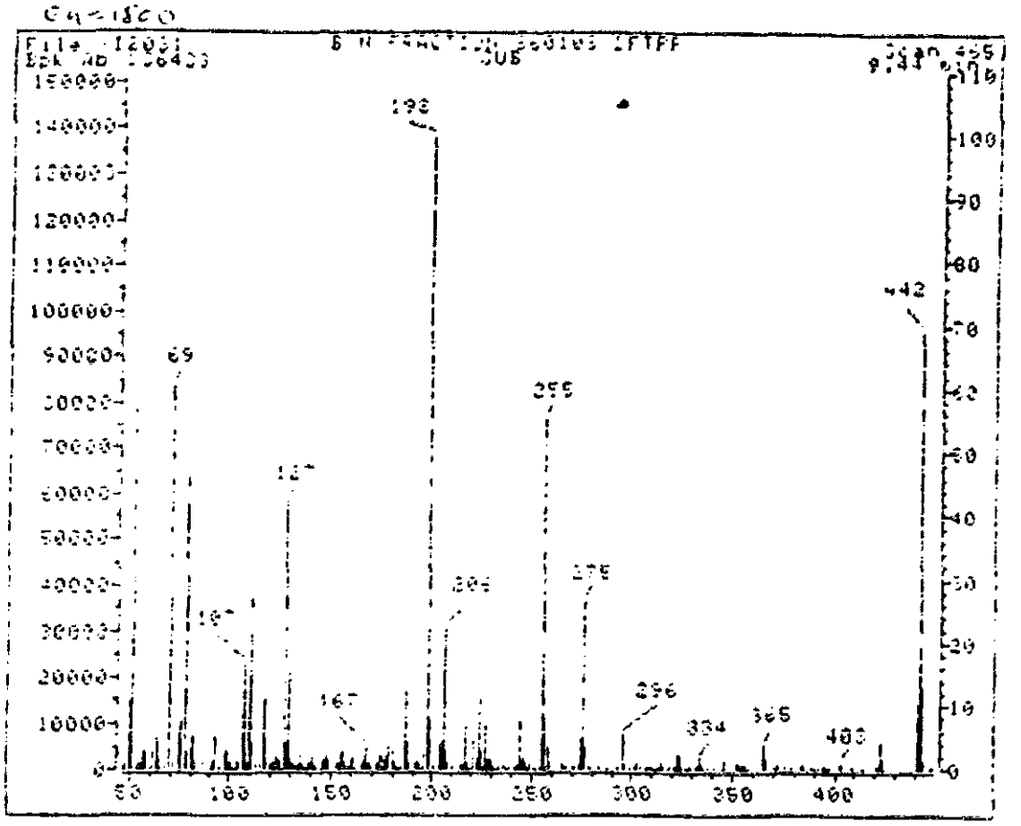

TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for Base/Neutral Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
51	30-60% of mass 198	58.00	58.00	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	60.38	60.38	Ok
70	Less than 2% of mass 69	0.00	0.00	Ok
127	40-60% of mass 198	42.20	42.20	Ok
197	Less than 1% of mass 198	0.00	0.00	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	7.65	7.65	Ok
275	10-30% of mass 198	26.44	26.44	Ok
365	Greater than 1% of mass 198	3.90	3.90	Ok
441	0-100% of mass 443	10.20	78.74	Ok
442	Greater than 40% of mass 198	69.01	69.01	Ok
443	17-23% of mass 442	12.96	18.78	Ok

Injection Date: 01/08/86
Injection Time: 19:27
Run No: >I2031
Spectrun No: 465

Analyst: Pearl Trant.
Processor: J. Hendel, D. Simons
QC Batch: QB4228
Samples: J8439B, K8484B, K8485B, K8171B, K8173B, K8174B, K8175B, K8176B, K3246B, J8204B-J2208B

KB 1/25/86

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Methodology
for
GC/MS Analysis of Priority Pollutant Compounds

The methods employed in the GC/MS analysis for priority pollutants are established EPA methods. Rigid compliance with the instrument parameters and performance criteria of the published methods was achieved. In some cases, the precise amounts of sample used and the sample handling procedures vary with the complexity of the sample matrix. Qualitative identification of the priority pollutants was performed using the relative retention times, the relative abundance of three characteristic ions and the abundance ratios. The entire mass spectrum was reviewed to confirm each identification. Quantitative analysis of detected compounds was performed by using a response factor generated by a major characteristic ion of the specific compound and an internal standard.

Compounds, in addition to those on the priority pollutant list, were identified through a computer-aided search of the NBS-EPA spectra library. After review the identifications are included in a separate tabulation and labelled "tentatively identified".

Volatile Priority Pollutant Compounds

For the analysis of Volatile priority pollutants in a soil matrix, a modified version of EPA Method 624 was used. The modification can be be summarized as follows: 1-3 gm of the solid sample are weighed into a 15 ml Hypo vial. The vial is sealed immediately with a teflon-backed silicone septum. A solution containing 3 internal standards is injected through the septum onto the sample. The vial is attached to the Purge and Trap sampler in series with a 5 ml organic-free water trap. The sample vial is heated at 80 degrees Centigrade for 20 minutes. An inert gas sweeps the volatile organic compounds through the water trap onto a sorbent column where they are trapped. When the purge cycle is complete, the sorbent column is heated and backflushed with helium to desorb the purgeable organic compounds onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeable mixture. The separated purgeable components are then identified and quantitated using a computerized mass spectrometer

Acid, Base/Neutral and Pesticide Priority Pollutant Compounds

For the analysis of the Acid, Base/Neutral and Pesticide priority pollutants in a soil matrix, a modification of EPA Method 625 was used. The method can be summarized as follows: A 30 gm semi-wet soil sample is soxhlet extracted with a 1:1 mixture of acetone and hexane. The acetone is thermally stripped. The remaining hexane extract is diluted to 200 ml with methylene chloride and twice extracted with an aqueous NaOH solution followed by an extraction with deionized water. The methylene chloride extract is dried and concentrated to a 1 ml final volume. This concentrate is injected into a GC/MS instrument configured for the analysis of Base/Neutral priority pollutant compounds. The remaining aqueous extracts are combined and the pH adjusted to a value less than 2. The aqueous phase is serially extracted with 3 aliquots of methylene chloride. The methylene chloride extracts are dried, concentrated to a 1 ml final volume. The concentrate is injected into a GC/MS instrument configured for the analysis of acid extractable priority pollutant compounds.

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

Summary of
Quality Assurance/Quality Control Procedures (QA/QC)

ETC bases its quality assurance protocols on the following government guidelines:

- "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", EPA-600/4-79-019, March 1979;
- National Enforcement Investigation Center Policies, and Procedures manual; EPA-330/9/79/001-R, October 1979;
- the recommended guidelines for EPA Methods 624 and 625. (Federal Register, December 3, 1979; updated on October 26, 1984);
- "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," EPA 600/8-80-038, June 1980;
- "Determination of 2,3,7,8-TCDD in Soil and Sediment" EPA, Region VII, Kansas City, September 1983;
- Organic Analysis: Multi-media, Multi Concentration-IFB WA84-A267; and
- Dioxin Analysis:Soil/Sediment Matrix; Multi-Concentration; Selected Ion Monitoring with Jar Extration Procedure-IFB WA84-A002

However, we have modified our protocols to provide a higher level of QA/QC than the guidelines require. For example, we analyze a higher than required number of quality control samples and we pay especially careful attention to the certification of the "reference standard" compounds we use in analysis. Below are listed the key QA/QC elements for the methods we used.

Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

- Each batch of 13 samples consists of 9 customer samples (at a maximun), one blank sample, one spiked blank, one spiked sample and one replicate sample. This amounts to a 30% quality control factor.
- Three surrogate compounds are added to each sample in the batch of 13.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on bromofluorobenzene (BFB) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of Volatile Organic Priority Pollutant "standards" at a minimum of 3 different concentrations and using a mixture of 3 internal standards at a constant concentration.
- The calibration curve is verified with a mixture of priority pollutant standards every day. If the response factors vary greater than 25%, the instrument must be recalibrated.

Analysis of Organic Compounds Extracted in Acid or Base/Neutral Solutions by Gas Chromatography/Mass Spectrometry

- Each batch of 20 samples consists of 16 customer samples (at a maximum), one blank sample, one spiked blank (for water matrices), one sample spiked with the priority pollutant standard mixture and a duplicate customer sample. This amounts to a 20% quality control factor.

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- Three surrogate compounds are added to each sample in the batch for Base/Neutral analysis.
- Three surrogate compounds are added to each sample in the batch for Acid analysis.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on decafluorotriphenylphosphine (DFTPP) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of standards composed of either the Organic Acid or Base/Neutral Extractable Compounds at a minimum of 3 concentrations and using five internal standards for quantitation.

Analysis of Metals

All Samples

- New standards are prepared for each batch of samples.
- Normal calibration is performed using a blank sample and four standards that have been through the sample preparation procedure. A regression analysis is used to construct the calibration curve.
- All EP Toxicity samples and all samples determined by furnace atomic absorption are calculated by the "method of additions".
- For each sample analysis that requires the use of the "method of additions" technique, a three point calibration is performed using U.S. EPA "Methods for Chemical Analysis of Water and Wastes, 1979". Results are obtained using linear regression analysis. Any regression with a coefficient of correlation below 0.990 is considered suspect, necessitating review of calibration data or sample re-analysis.
- In constructing the normal calibration curves the lowest concentration levels we use are values greater than or equal to 5 times the Instrumental Detection Limit (IDL).
- All calibration standards are analyzed in duplicate, at a minimum.
- Independent reference standards are used to check the accuracy of calibration standards.
- A check standard is analyzed every ten samples to validate the normal calibration curve.
- One customer sample out of every ten is analyzed in triplicate.

Homogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are homogeneous, the QC program is a minimum of 25% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 independent reference standard;
- 4 Calibration standards (processed using the sample preparation method);
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Heterogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are heterogeneous, the QC program is a minimum of 35% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 Replicate independent reference standards;
- 4 Calibration standards (processed using the sample preparation method);
- 1 Procedural Blank;
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Analysis of Mercury

To analyze samples for mercury we group them by matrix in batches of 30 or less. Our QC program is a minimum of 30% and consists of analyzing:

- each of the 30 customer samples in duplicate;
- 3 sets of triplicate anaylses;
- 2 Replicate spikes;
- 2 Replicate independent reference standards;
- 10 Calibration standards (processed using the sample preparation method); and
- 2 Procedural Blanks.

Analysis of Pesticides, Herbicides and PCB's by Gas Chromatography

Pesticide, herbicide and PCB samples are grouped in batches of 16 customer samples or less according to the type of analysis to be performed. The QC program for each of these three types of analyses is a minimum of 20% and consists of analyzing:

- 1 procedural blank sample(a reagent blank is analyzed in the case of non-water matrices);
- 1 spiked blank sample (the spiked blank is eliminated in the case of non-water matrices);
- 1 replicate sample;
- 1 replicate spiked sample; and
- 1 known refernece QC sample for at least each 100 samples analyzed.

The instrument is calibrated each run with three standards, and checked every 10 samples.

Analysis of Cyanides, Phenols, Fluoride, Chloride, Nitrate and Nitrite

- All parameters are analyzed using a Technicon Autoanalyzer II GT.
- 3 calibration standards are analyzed at the beginning and end of each batch.

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- Each batch (up to 80 samples) consists of analyzing one blank, one spiked blank, one duplicate and spiked sample every 20 samples, and an EPA known reference sample.

Analysis of Total Organic Carbon (TOC)

TOC samples are analyzed on a daily basis with the number of samples analyzed per day dependent on the request for duplicate or quadruplicate analyses. The quality control program is designed to maintain the appropriate amount of QC and consists of the following elements:

- Daily instrument calibration
- One blank
- Standard recalibration every 10 samples
- Spiked samples at a low and high level
- Every sample is run in duplicate at a minimum

Analysis of Total Organic Halide (TOX)

- Blank reagent water for absolute carbon backround must contain less than 5 ug/l of halide (as chloride).
- Using a trichlorophenol standard, the mean adsorption efficiency must be within +/- 15% of the standard value.
- Calibration standards are run every 10 samples.
- Every sample is run in duplicate at a minimum.

Analysis of 2,3,7,8-TCDD (Dioxin) by GC/MS (SIM)

- Each sample is dosed with a known quantity of $^{13}C_{12}$-2,3,7,8-TCDD as internal standard and $^{37}Cl_4$-TCDD as surogate standard. The action limits for surrogate standard results is +/- 40% of the true value. Samples showing surrogate standard results outside of these limits are reextracted and reanalyzed.
- Two laboratory "method blanks" are run along with each set of 24 or fewer samples. The method blank is also dosed with the internal standard and surrrogate standard.
- At least one per set of 24 samples is run in duplicate to determine intralaboratory precision.
- Qualitative Requirements. The following are met in order to confirm the presence of native 2,3,7,8-TCDD:

  a. Isomer specificity must be demonstrated initially and verified once per 8-hour work shift. The verification consists of injecting a mixture containing TCDD isomers which elute close to 2,3,7,8-TCDD. The 2,3,7,8-TCDD must be separated from interferring isomers, with no more than 25% valley relative to the 2,3,7,8-TCDD peak.

  b. The 320/322 ratio is within the range of 0.67 to 0.87.

  c. Ions 320, 322, and 257 are all present and maximize together the signal to mean noise ratio must be 2.5 to 1 or better for all 3 ions.

  d. The retention time is equal (within 3 seconds) the retention time for the isotopically labeled 2,3,7,8-TCDD.

  e. At least one of the positives can be confirmed by obtaining partial scan spectra from mass 150 to mass 350. The partial scan guidelines are as follows:

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. the 320/324 ratio should be 1.58 +/- 0.16

. the 257/259 ratio should be 1.03 +/- 0.10

. the 194/196 ratio should be 1.54 +/- 0.15

- One sample is spiked with native 2,3,7,8-TCDD at a level of 1.0 PPB (for soil) for each set of 24 or fewer samples.
- In cases where no native 2,3,7,8-TCDD is detected, the actual detection limit is estimated and reported based on a signal to noise ratio of 2.5 to 1 at ions 320 and 322.
- For each sample, the internal standard is present with at least a 10 to 1 signal to noise ratio for both mass 332 and mass 334. Also, the internal standard 332/334 ratio must be within the range of 0.67 to 0.87.

Subcontractor QA/QC

Each subcontractoer is required to maintain an appropriate level of quality control. To insure this, each subcontractor is required to submit to ETC the quality control data for all analyses it performs. This data is kept on file at ETC. In general, the amount of quality control required is one duplicate sample with one spiked sample for every ten analyses.

Chain-of-Custody

The chain-of-custody procedure is part of our quality assurance protocol. We believe our chain-of-custody record fully complies with the legal requirements of federal, state and local government agencies and of the courts of law. The record covers:

- labeling of sample bottles, packing the Sample Shuttle and transferring the Shuttle under seal to the custody of a shipper;
- outgoing shipping manifests;
- the chain-of-custody form completed by the person(s) breaking the Shuttle seal, taking the sample, resealing the Shuttle and transferring custody to a shipper;
- incoming shipping manifests;
- breaking the Shuttle's reseal;
- storing each labeled sample bottle in a secured area;
- disposition of each sample to an analyst or technician; and
- the use of the sample in each bottle in a testing procedure appropriate to the intended purpose of the sample.

The records show for each link in this process:

- the person with custody; and
- the time and date each person accepted or relinquished custody.

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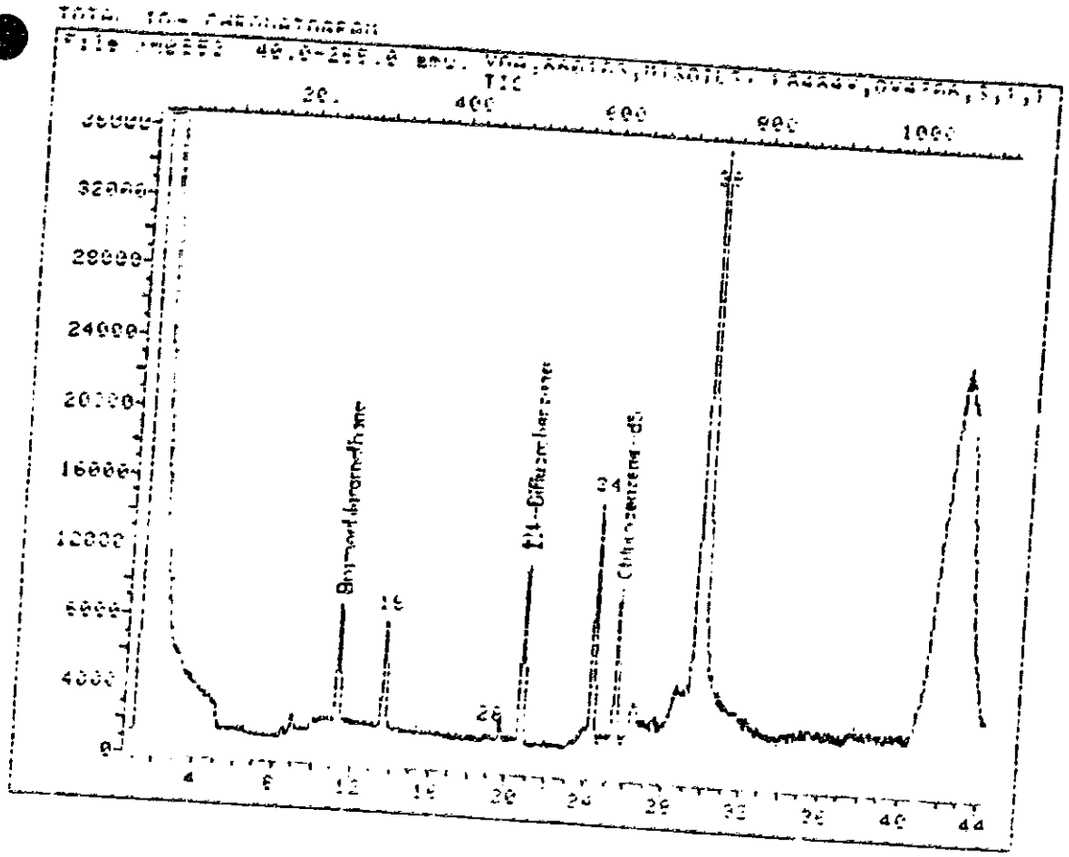
Appendix A

Mass Spectral Data for Quantitated Compounds

1) A total ion chromatogram for each sample analyzed by a GC/MS instrument.

2) A Quant. report used by the analyst to determine qualitative and quantitative results of the compounds present.

3) A mass spectrum and a reference spectrum for each priority pollutant compound detected in the sample.



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Id File: [illegible]
Title: [illegible]
Last Calibration: [illegible] 19:[illegible]

Operator ID: [illegible]
Quant Time: [illegible] 12:14
Injected at: [illegible]

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QUANT REPORT

Operator ID: [illegible] Quant Rev: 4 Quant Time: 860103 12:14
Output File: [illegible] Injected at: 860103 11:28
Data File: [illegible] Dilution Factor: 1.00
Name: VOA,860103,M(SOILS)
Misc: [illegible]

ID File: MVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		11.23	220	12825	250.00	NG	99
15)	1,2-Dichloroethane-D4	(SURR)	13.56	330	13565	250.77	NG	90
17)	*1,4-Difluorobenzene		20.65	513	50298	250.00	NG	97
~~28)~~	~~[illegible]~~		~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~NG~~	~~100~~
30)	*Chlorobenzene-d5		25.42	636	33904	250.00	NG	99
~~31)~~	~~[illegible]~~		~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~NG~~	~~100~~
34)	Toluene-D8	(SURR)	24.22	605	62420	240.42	NG	94
38)	p-Bromofluorobenzene	(SURR)	29.49	741	[illegible]	[illegible]	NG	[illegible]

* Compound is ISTD

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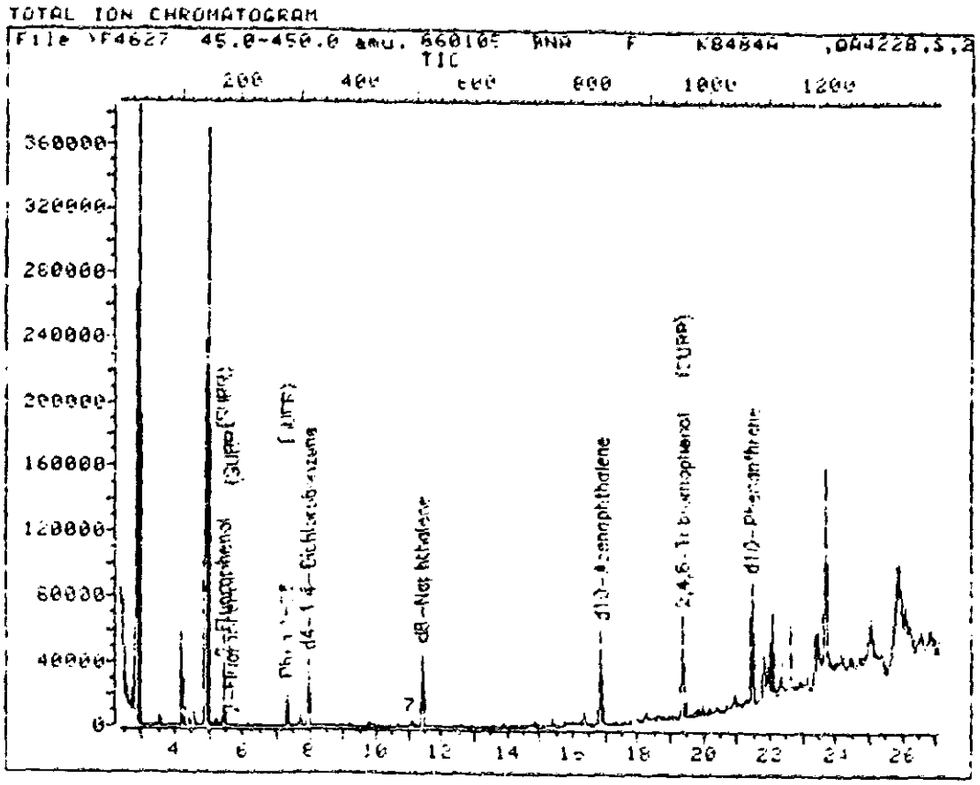
PM

TOTAL ION CHROMATOGRAM



Data File: >F4627::US
Name: 860105 BNA F
Misc: KB484H ,QH4228,S,29.61,1

BTL432

Id File: FHCID::US
Title: PP>HCID IDFILE...INST. F
Last Calibration: 860106 11:33

Operator ID: JH2180
Quant Time: 860106 14:52
Injected at: 860106 14:18

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QUANT REPORT

Operator ID: JH2180
Output File: ^F4627::AQ
Data File: >F4627::U3
Name: 860105 BNA F
Misc: K8484A ,QA4228,S,29.51,1

Quant Rev: 4

Quant Time: 860106 14:52
Injected at: 860106 14:18
Dilution Factor: 1.00

ID File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

BTL#32

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene		7.94	313	28700	40.00	UG/ML	89
3)	2-Fluorophenol	(SUPR)	5.40	170	29963	65.17	UG/ML	92
3)	2-Fluorophenol	(SUPR)	5.63	183	620	~~1.35~~	~~UG/ML~~	99
7)	Benzoic acid		11.02	487	1142	2.22	UG/ML	100
9)	Phenol-D5	(SUPR)	7.28	276	33[illegible]19	65.69	UG/ML	97
10)	*d8-Naphthalene		11.35	508	61[illegible]	40.00	UG/ML	97
18)	*d10-Acenaphthalene		16.86	816	39360	40.00	UG/ML	98
24)	*d10-Phenanthrene		21.41	1072	91295	40.00	UG/ML	99
25)	2,4,6-Tribromophenol	(SUPR)	19.35	9[illegible]	25966	80.17	UG/ML	97

* Compound is ISTD

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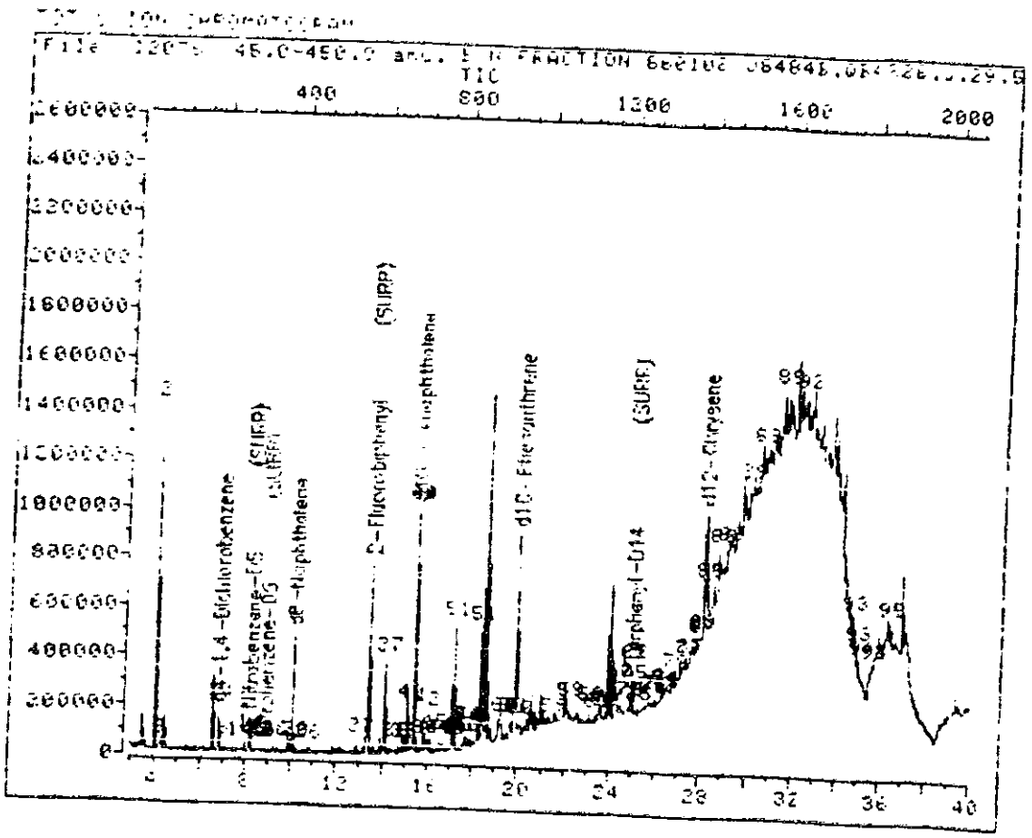


Data File: :I2076::US
Name: B/N FRACTION 860108
Misc: JB4848,QB4228,S,29.51,1

BTL#46

Id File: IBNP::US
Title: B/N+PEST ID FILE .... FOP I 850326
Last Calibration: 860109 18:45

Operator ID: KV0786
Quant Time: 860110 17:04
Injected at: 860110 16:21

002641

QUANT REPORT

Operator ID: KV0786 Quant Rev: 5 Quant Time: 860110 17:04
Output File: I2076::AD Injected at: 860110 16:21
Data File: >I2076::U5 Dilution Factor: 1.00
Name: B/N FRACTION 860108
Misc: Q84848,Q84228,S,29.51,1 BTL#46

ID File: IBNF::U5
Title: B/N+PEST ID FILE .... FOR I 850326
Last Calibration: 860109 18:45

	Compound		R.T.	Scan#	Area	Conc	Units	Q
1)	*d4-1,4-Dichlorobenzene		6.77	214	39926	40.00	UG/ML	94
2)	N-Nitrosodimethylamine		4.02	61	1393	91.75	UG/ML	100
2)	N-Nitrosodimethylamine		4.10	70	1129	74.41	UG/ML	100
6)	Benzyl alcohol		6.97	225	455	.36	UG/ML	[illegible]
6)	Benzyl alcohol		8.28	298	651	.52	UG/ML	91
6)	Benzyl alcohol		9.09	341	815	.65	UG/ML	75
13)	Nitrobenzene-D5	(SURR)	8.14	290	78202	54.68	UG/ML	79
13)	Nitrobenzene-D5	(SURR)	8.34	329	1172	.82	UG/ML	69
14)	bis(2-Chloroisopropyl)ether		6.77	214	2610	10.61	UG/ML	93
14)	bis(2-Chloroisopropyl)ether		7.69	265	1615	6.57	UG/ML	
14)	bis(2-Chloroisopropyl)ether		8.12	289	1699	6.91	UG/ML	[illegible]
19)	*d8-Naphthalene		10.04	396	399472	40.00	UG/ML	91
20)	2-Fluorobiphenyl	(SURR)	13.40	583	531568	36.12	UG/ML	
23)	Nitrobenzene		8.44	307	1857	.40	UG/ML	
24)	Isophorone		8.99	313	1385	.21	UG/ML	46
26)	2-Nitrotoluene		9.21	350	1172	.45	UG/ML	62
27)	3-Nitrotoluene		10.53	424	2084	.80	UG/ML	80
30)	Naphthalene		10.09	399	3720	.35	UG/ML	64
34)	*d10-Acenaphthalene		15.36	692	480181	40.00	UG/ML	92
37)	2-Chloronaphthalene		12.99	560	4767	.45	UG/ML	62
37)	2-Chloronaphthalene		14.12	623	4885	.46	UG/ML	72
38)	Dimethyl phthalate		14.48	643	2372	.12	UG/ML	56
38)	Dimethyl phthalate		15.36	692	87014	4.42	UG/ML	74
38)	Dimethyl phthalate		15.78	711	3507	.18	UG/ML	81
39)	Acenaphthylene		14.36	664	2037	.10	UG/ML	41
40)	2,6-Dinitrotoluene		15.13	679	8800	2.26	UG/ML	70
40)	2,6-Dinitrotoluene		15.36	692	60565	15.54	UG/ML	55
40)	2,6-Dinitrotoluene		15.61	700	1719	.44	UG/ML	41
42)	Acenaphthene		15.31	717	2090	.14	UG/ML	89
44)	2,4-Dinitrotoluene		15.36	692	60565	8.73	UG/ML	60
44)	2,4-Dinitrotoluene		16.44	752	1184	.17	UG/ML	74
44)	2,4-Dinitrotoluene		17.02	784	1309	.20	UG/ML	63
45)	Diethyl phthalate		16.23	740	1597	.06	UG/ML	78
45)	Diethyl phthalate		16.94	780	2615	.09	UG/ML	70
45)	Diethyl phthalate		17.05	786	14699	.53	UG/ML	93
46)	Fluorene		17.02	784	2489	.11	UG/ML	85
46)	Fluorene		17.65	819	3568	.16	UG/ML	89
46)	Fluorene		17.74	824	2744	.12	UG/ML	71
50)	N-Nitrosodiphenylamine		18.02	840	1368	.07	UG/ML	
51)	1,2-Diphenylhydrazine		17.11	789	6046	.19	UG/ML	68
51)	1,2-Diphenylhydrazine		17.74	824	3565	.11	UG/ML	81
51)	1,2-Diphenylhydrazine		18.20	854	23185	.72	UG/ML	58
53)	d10-Phenanthrene		19.86	943	798366	40.00	UG/ML	97

OK

1/17/86

	Compound		R.T.	Scan#	Area	Conc	Units	q
57)	Phenanthrene		19.64	936	5576	.35	UG/ML	87
57)	Phenanthrene		19.93	946	5820	.37	UG/ML	88
58)	Anthracene		19.64	936	5576	.34	UG/ML	82
58)	Anthracene		19.93	946	5820	.35	UG/ML	90
59)	Di-n-butyl phthalate		21.45	1030	1925	.09	UG/ML	70
59)	Di-n-butyl phthalate		22.13	1068	38027	1.86	UG/ML	95
59)	Di-n-butyl phthalate		23.05	1119	2258	.11	UG/ML	95
60)	Fluoranthene		23.61	1158	1980	.12	UG/ML	71
60)	Fluoranthene		24.26	1186	2015	.12	UG/ML	45
61)	Benzidine		23.27	1131	1248	.76	UG/ML	100
61)	Benzidine		24.96	1225	4856	3.13	UG/ML	20
62)	Pyrene		23.61	1158	1980	.12	UG/ML	71
62)	Pyrene		24.26	1186	2015	.12	UG/ML	45
62)	Pyrene		24.36	1225	1546	.09	UG/ML	46
64)	Alpha-BHC		19.25	908	1422	.48	UG/ML	87
65)	Beta-BHC		19.25	908	1422	.58	UG/ML	8[illegible]
66)	Gamma-BHC		19.25	908	1422	.49	UG/ML	87
70)	*d12-Chrysene		28.07	1397	144937	40.00	UG/ML	100
73)	Endosulfan I		23.72	1156	1879	4.24	UG/ML	38
73)	Endosulfan I		24.76	1215	7155	7.12	UG/ML	30
73)	Endosulfan I		25.13	1234	1523	3.44	UG/ML	20
75)	Dieldrin		24.35	1224	4200	1.69	UG/ML	60
75)	Dieldrin		25.22	1239	1768	.71	UG/ML	54
75)	Dieldrin		25.92	1275	1566	.63	UG/ML	70
76)	Endrin		24.64	1216	2463	4.77	UG/ML	3[illegible]
76)	Endrin		25.81	1272	2107	3.36	UG/ML	47
76)	Endrin		26.28	1298	3365	5.37	UG/ML	39
78)	Endrin aldehyde		25.72	1267	3674	4.39	UG/ML	5[illegible]
78)	Endrin aldehyde		26.72	1322	4567	5.41	UG/ML	36
78)	Endrin aldehyde		27.26	1352	3714	4.40	UG/ML	52
82)	Terphenyl-D14	(SURR)	24.96	1225	138029	14.70	UG/ML	92
84)	Butyl benzyl phthalate		25.80	1271	1295	.38	UG/ML	92
84)	Butyl benzyl phthalate		26.26	1298	1632	.37	UG/ML	79
84)	Butyl benzyl phthalate		26.32	1300	1686	.38	UG/ML	68
85)	Benzo(a)anthracene		28.13	1400	2716	.67	UG/ML	85
86)	Chrysene		28.13	1400	2716	.68	UG/ML	79
87)	3,3'-Dichlorobenzidine		27.39	1359	1345	1.83	UG/ML	70
87)	3,3'-Dichlorobenzidine		27.86	1385	2064	2.50	UG/ML	96
88)	bis(2-Ethylhexyl)phthalate		27.97	1389	4725	1.36	UG/ML	61
88)	bis(2-Ethylhexyl)phthalate		28.69	1431	52571	15.13	UG/ML	95
88)	bis(2-Ethylhexyl)phthalate		29.07	1455	5249	1.51	UG/ML	65
89)	Di-n-octyl phthalate		29.94	1500	6226	1.44	UG/ML	52
89)	Di-n-octyl phthalate		30.50	1531	15711	3.64	UG/ML	95
89)	Di-n-octyl phthalate		31.36	1578	7253	1.68	UG/ML	75
92)	Benzo(a)pyrene		32.26	1625	4312	1.68	UG/ML	73
93)	Indeno(1,2,3-c,d)pyrene		34.64	1759	1229	.44	UG/ML	71
93)	Indeno(1,2,3-c,d)pyrene		34.83	1769	1198	.43	UG/ML	65
93)	Indeno(1,2,3-c,d)pyrene		35.53	1808	1119	.40	UG/ML	96
94)	Dibenz(a,h)anthracene		34.97	1777	1142	.46	UG/ML	84
95)	Benzo(ghi)perylene		36.22	1846	1246	.51	UG/ML	73

* Compound is ISTD

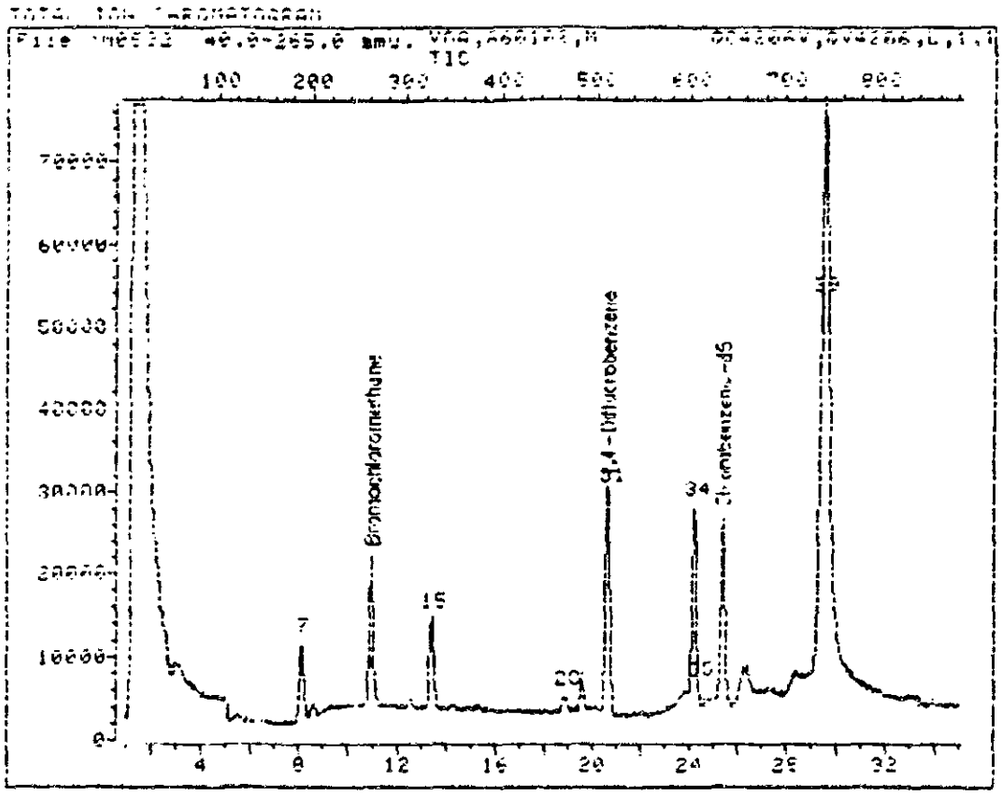
No PCB's Found.

1/17/86

Appendix C1

GC/MS Subsidiary Data

002644



Data File: MU532::U3
Name: VOA,860102,M
Misc: [illegible],[illegible],1,1,1, [illegible] BLANK

Id File: MVOA::U5
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

Operator ID: DS4 12
Quant Time: 860102 19:08
Injected at: 860102 15:09

002645

QUANT REPORT

Operator ID: [illegible]
Output File: [illegible]532::AQ
Data File: [illegible]532::U3
Name: UOA,860102,M
Misc: [illegible],S,[illegible],[illegible] BLANK

Quant Rev: 4
Quant Time: 860102 [illegible]
Injected at: 860102 15:09
Dilution Factor: 1.[illegible]

ID File: M[illegible]A::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860102 19:03

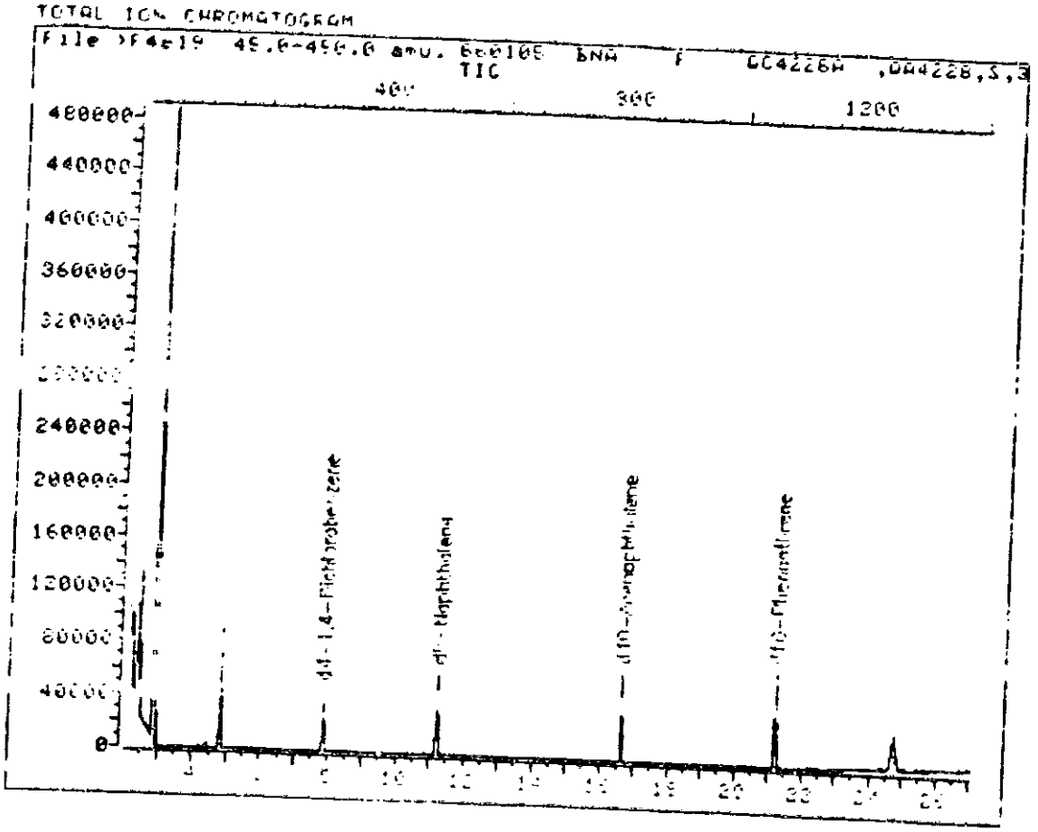
	Compound		P.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		10.96	263	34271	250.00	NG	97
2)	Methylene chloride		8.09	139	29651	64.46	NG	[illegible]
15)	1,2-Dichloroethane-D4	(SURR)	13.40	326	23094	159.77	NG	91
17)	*1,4-Difluorobenzene		20.61	512	132[illegible]67	250.00	NG	[illegible]
28)	~~bis(Chloromethyl)ether~~		~~18.83~~	~~466~~	~~9096~~	~~184.75~~	~~NG~~	100
30)	*Chlorobenzene-d5		25.[illegible]8	635	87605	250.00	NG	99
31)	~~2-Chloroethylvinyl ether~~		~~20.65~~	~~513~~	~~34798~~	~~159.42~~	~~NG~~	100
34)	Toluene-D8	(SURR)	24.18	604	108741	161.97	NG	[illegible]
35)	~~Toluene~~		~~24.37~~	~~609~~	~~2228~~	~~2.95~~	~~NG~~	96
38)	p-Bromofluorobenzene	(SURR)	29.37	238	62448	166.46	NG	99

* Compound is ISTD

PMM

002646

TOTAL ION CHROMATOGRAM



Data File: >F4619::U3
Name: 860106 BNA F
Misc: GC4228H ,GH4228,S,30.00,1

Id File: FACID::U9
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

Operator ID: JH2180
Quant Time: 860106 14:02
Injected at: 860106 08:40

BTL#2

002647

QUANT REPORT

Operator ID: JHC180
Output File: F4619::AQ
Data File: >F4619::U3
Name: 860105 BNA F
Misc: QC4223F ,Q44226,5,30.00,1

Quant Rev: 4
Quant Time: 860106 14:02
Injected at: 860106 08:40
Dilution Factor: 1.00

ETLACID

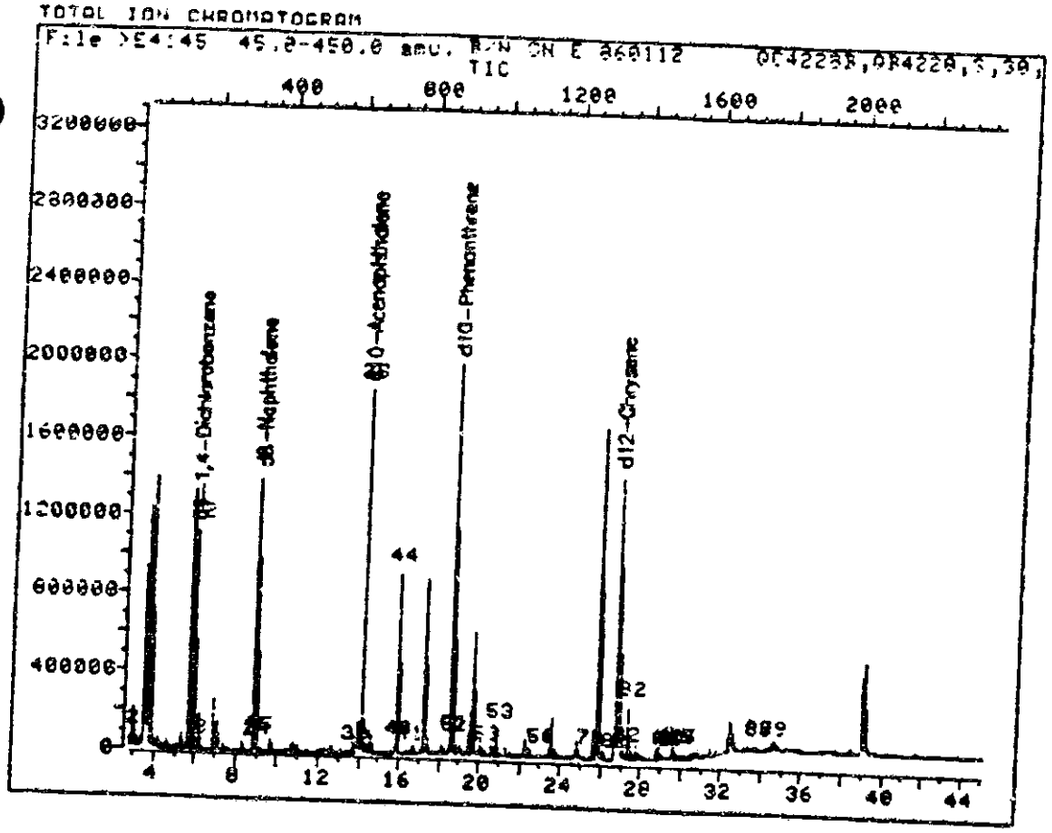
ID File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:37

	Compound	R.T.	scan#	Area	Conc	Units	%
1)	*d4-1,4-Dichlorobenzene	7.80	319	33041	40.00	UG/ML	88
10)	*d8-Naphthalene	11.22	512	74465	40.00	UG/ML	95
18)	*d10-Acenaphthalene	16.63	817	49053	40.00	UG/ML	75
24)	*d10-Phenanthrene	21.20	1079	99903	40.00	UG/ML	99

* Compound is ISTD

002648

TOTAL ION CHROMATOGRAM



Data File: >E4145::U5
Name: B/N ON E 860112
Misc: QC4228B,QB4228,S,30,1

BTL# 6

Id File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

Operator ID: WW9928
Quant Time: 860113 11:38
Injected at: 860113 03:14

002649

QUANT REPORT

Operator ID: WW9928 Quant Rev: 5 Quant Time: 860113 11:38
Output File: ^E4145::AQ Injected at: 860113 03:14
Data File: >E4145::US Dilution Factor: 1.00
Name: B/N ON E 860112
Misc: QC4228B,QB4228,S,30,1 BTL# 6

ID File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

	Compound	R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene	5.85	169	368447	40.00	UG/ML	99
2)	N-Nitrosodimethylamine	2.93	4	2426	424.52	UG/ML	100
3)	Benzyl alcohol	6.26	192	8613	.51	UG/ML	87
12)	bis(2-Chloroisopropyl)ether	5.89	169	13740	5.07	UG/ML	99
17)	*d8-Naphthalene	8.88	340	1775324	40.00	UG/ML	93
24)	1,2,4-Trichlorobenzene	8.81	336	3674	.28	UG/ML	99
29)	Naphthalene	8.95	343	4687	.13	UG/ML	93
29)	*d10-Acenaphthalene	14.09	634	1378682	40.00	UG/ML	94
33)	Dimethyl phthalate	13.61	607	3385	.09	UG/ML	71
33)	Dimethyl phthalate	14.09	634	241961	6.17	UG/ML	66
35)	2,6-Dinitrotoluene	14.09	634	172607	16.52	UG/ML	54
40)	Diethyl phthalate	15.79	730	22463	.97	UG/ML	93
41)	Fluorene	16.43	766	1269	.03	UG/ML	81
44)	N-Nitrosodiphenylamine	19.85	933	5786	.25	UG/ML	90
47)	*d10-Phenanthrene	18.55	885	2866028	40.00	UG/ML	91
51)	Phenanthrene	18.60	888	10194	.18	UG/ML	94
52)	Anthracene	18.60	888	10194	.18	UG/ML	92
53)	Di-n-butyl phthalate	20.23	980	9854	.15	UG/ML	92
53)	Di-n-butyl phthalate	20.84	1014	187206	2.99	UG/ML	97
54)	Fluoranthene	22.90	1130	3422	.06	UG/ML	93
56)	Pyrene	22.90	1130	3422	.06	UG/ML	93
64)	*d12-Chrysene	26.68	1343	1855287	40.00	UG/ML	100
78)	Butyl benzyl phthalate	25.35	1260	4469	.14	UG/ML	79
82)	bis(2-Ethylhexyl)phthalate	26.58	1337	1391	.03	UG/ML	94
82)	bis(2-Ethylhexyl)phthalate	27.15	1369	4389	.10	UG/ML	87
82)	bis(2-Ethylhexyl)phthalate	27.33	1379	234144	5.34	UG/ML	93
83)	Di-n-octyl phthalate	29.12	1480	7817	.14	UG/ML	94
85)	Di-n-octyl phthalate	29.41	1496	1286	.02	UG/ML	88
85)	Di-n-octyl phthalate	29.64	1509	4568	.08	UG/ML	80
84)	Benzo(b)fluoranthene	29.89	1523	3362	.10	UG/ML	82
85)	Benzo(k)fluoranthene	29.89	1523	3362	.11	UG/ML	81
86)	Benzo(a)pyrene	29.89	1523	3362	.11	UG/ML	82
87)	Indeno(1,2,3-cd)pyrene	33.67	1735	8825	.29	UG/ML	92
88)	Dibenzo(a,h)anthracene	33.71	1737	2846	.31	UG/ML	91
89)	Benzo(ghi)perylene	33.67	1735	8825	.35	UG/ML	94
89)	Benzo(ghi)perylene	34.40	1776	8380	.33	UG/ML	92

* Compound is ISTD

NO PCB's Found.

DMS
1/16/86

002650

Appendix E

Chain-of Custody Forms

1) A field Chain-of-Custody form (CC1) is included for all samples shipped by ETC shuttle.

2) An in-house sample Chain-of Custody form is included for all samples not shipped by ETC shuttle.

3) Any additional Chain-of-Custody material provided by a client or by a client's sampling agent is also included.

4) A subcontractor's Chain-of-Custody form is included for any analytical work not performed within ETC's laboratory.

5) Analysis and Extraction Custody forms are included for the period the sample was in ETC's possession.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

CHAIN OF CUSTODY FORM (CC1)

Seal No 47011 ETC Job # K8484

Date Sealed 12/10/85 By: R. Rivera

Company: Resource Eng.

Facility/Site:

Address: 3000 Richmond Ave
Houston Tx 77098

Attn.: Chris Itin

Phone: (713) 520-9900

SAMPLE IDENTIFICATION

Facility: RES 21818-1041 (Facility/Site Code) CLARK LAKE SEDIMENT (Optional Sample Point Descriptions)

Sample Point: LB-42 (Source Code (from below); Your Sample Point ID (left justify)) 851219 (Start Date (YY/MM/DD)) (Start Time (2400 hr. clock)) (Elapsed Hours (composite))

Q16
0

Source Codes:
Well ..(W) Outfall ....(O) Bottom Sediment ..(B) Surface Impoundment ....(I) Leachate Collection Sys. ....(C) Other ..... (X)
Soil ..(S) River/Stream ..(R) Generation Point ..(G) Treatment Facility ....(T) Lake/Ocean ..... (L) Specify

SHUTTLE CONTENTS

BOTTLE No	Type	Size	Preserv.	ANALYSIS	SAMPLER Filt. (Y/N)	SAMPLER Observations	LAB Observations
1	A	1 l	Baked	EXT 1			✓
2	E	40 ml	Baked	VOA			✓
1	TB	40 ml	60 ml H2O	Trip Blank			✓

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CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) JOHN BINS Date: 12/11/85 Time: 6:00 PM
Signature: John Bins Seal #: 047011 Intact: YES

2. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

3. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

4. Shuttle Sealed By: (print) JOHN BINS Date: 12/19/85 Time: 6:30 PM
Signature: John Bins Seal #: 0047012 Intact: YES

ETC USE ONLY Opened By: Date: 12 20 85 Time: 1100

ORIGINAL Seal #: 47012 Condition: INTACT

ETC ENVIRONMENTAL TESTING and CERTIFICATION

FIELD PARAMETER FORM (CC2)

ETC JOB # K 8484

Sample Point B K2 (Source Code / Sample Point ID)

FIELD PROCEDURES

PURGE DATE (YY MM DD) | START PURGE (2400 Hr Clock) | ELAPSED HRS | WATER VOL IN CASING (Gallons) | VOLUME PURGED (Gallons)

SAMPLING METHOD: PETERSON DREDGE

Sampler Type: A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other (SPECIFY OTHER)

Sampler Material: A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other (SPECIFY OTHER)

Tubing Material: A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other (SPECIFY OTHER)

Sample Composited Y/N — Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl)

Depth to Ground water (ft)

Groundwater Elevation (ft msl)

Well Depth (ft)

Sample Depth (non-well) (ft)

1st ph (STD) — 1st spec. cond. um/cm at 25°C — (other parameter) value units

2nd ph (STD) — 2nd spec. cond. um/cm at 25°C — (other parameter) value units

3rd ph (STD) — 3rd spec. cond. um/cm at 25°C — (other parameter) value units

4th ph (STD) — 4th spec. cond. um/cm at 25°C — (other parameter) value units

Sample Temp (°C) — Turbidity NTU

FIELD COMMENTS

Sample Appearance:

Weather Conditions:

Other:

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: JOHN BINS (Print) Employer: RESOURCE ENGINEERING INC

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

12/19/85 (Date) John Bins (Signature)

002653

ORIGINAL

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/2/86 SHIFT
FRACTION VOA
INSTRUMENT M
TUNE FILE APCI02
SEQUENCE FILE DXM
METHOD FILE VOAM
ID FILE MWA
ANALYST(S) Deepak Sum
Brenda Hawkins
SUPERVISOR
BATCH #'s QV4206

STANDARD	CONC PPM	LOT NO.	LOT VOL (ml)
pBFB	50	12151	1
ISTD	25	12066	10
Surrog	25	12019	10
ABC/SGWA	18	12141	5, 10, 30
o,m,p chlorotoluene	18	11852	5, 10, 30

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	1/2/86
WIP		BY	DJ

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A TYPE)	PLUS Y/N
p-BFB	7M0531	1µl			000003	OK 13:37	
QC4206V	7M0532					OK 15:05 PLSV10	✓
QC4206VS	7M0533					5µl ABC/SGWA, use chpl std	
QC4206VS	7M0534					10	
QC4206VS	7M0535				18:09	30	
p-BFB	7M0536				19:13	OK	
K8557VS	7M0537	1.0g				NG splashes no metal	
K8557V	7M0538					OK	
K8558V	7M0539			Cerium 1/100 Metallics		NG re-run 1/100	
K8558VR	7M0540					NG re-run 1/100	35.36
K8559V	7M0541					NG re-run 1/100	
K8171V	7M0542					NG cerium compounds	
K8173V	7M0543					NG	
K8174V	7M0544					OK	
K8175V	7M0545					OK	
K8176V	7M0546					OK	
K8557VS	7M0547					OK	
QC4206VS	7M0548	1.0g				OK 07:06	
p-BFB	7M0549	1µl				NG	
p-BFB	7M0550	1µl				OK 09:03	
K8171V	7M0551	1.0g				OK	
K8173VR	7M0552	1.0g				OK	
K8484V	7M0553	1.0g				OK	
K8471V	7M0554					OK	
K4174V	7M0555					OK PLSV04 PLSV10	✓

ETC FORM #102

002654

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/3/86 SHIFT
FRACTION VOA (Soils)
INSTRUMENT M
TUNE FILE APEI-02
SEQUENCE FILE DSM
METHOD FILE VOAM
ID FILE MVOA
ANALYST(S) Dennis M Simons

SUPERVISOR [signature]
BATCH #'s QV4206

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.
Refer to pg 1 of 2			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8470V	>M0556	1g			L0008	OK	
(R) K8173V	>M0557	1g				Ng leaked	
QC4206V	>M0558					OK	
(R) K8173V	>M0559	1g				OK	

ETC FORM #102

002655

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/5/86 SHIFT
FRACTION Acid; BNA
INSTRUMENT F
TUNE FILE MTF001
SEQUENCE FILE JHF
METHOD FILE AcidF; BNPF
ID FILE FAcid; FBNA
ANALYST(S) J. Hen
SUPERVISOR
BATCH #'s QC4159, QA4228

STANDARD	CONC PPM	LOT NO.	LOT VOL.
Int Std	400	12,008	100 ml
B/N Cal std I		12,110	1 ml
B/N Cal std II		12,111	
B/N Cal std III		11,906	
Acid cal std I		12,020	
Acid cal std II		12,021	
Acid cal std III		12,022	
Spec #930	60	12,140	
Spec #930	100	12,139	
Spec #930	300	12,138	
DFTPP	25	11,972	

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACO	JH 1/5	DATE	1/6
WIP		BY	

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP-60ng std.	>F4595						
B/N Cal std III	F4596		1			OK	
B/N Cal std II	F4597		2				
B/N Cal std I	F4598		3				
Acid cal std III	F4599		4				
Acid cal std II	F4600		5				
Acid cal std I	F4601		6				
Spec #930; 300ppm	F4602		7				
Spec #930; 100ppm	F4603		8				
Spec #930; 60ppm	F4604		9				
DFTPP-50ng std.	F4605		10				
K8322CS	F4606		11			OK	
QC4159C	F4607		12				
K8323C	F4608		13			BJ+15 Act+1	Y
K8323CR	F4609		14			BJ+15 Act+1	Y
K8320C	F4610		15				
K8322C	F4611		16			BJ+15 Act+1	Y
K8321C	F4612		17			Act+1	Y
K8325C	F4613		18			Act+1	Y
K8324C	F4614		19			Act+1	Y
GPC BLANK	F4615		20			Act+1	Y
K8173AS	F4616		21				
DFTPP-50ng std.	F4617		22				
Acid cal std II	F4618		23			OK	
QC4228A	F4619		24			CBCHK-OK	

ETC FORM 5103

002656

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE _____
METHOD FILE _____
ID FILE _____
ANALYST(S) J. Hewlle-RA
SUPERVISOR [signature]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8174A	>F4620		25				
K8174AR	F4621		26				
K8173A	F4622		27				
5175A ~~K8176A~~	F4623		28				
K8171A	F4624		29				
J8439A	F4625		30				
K8176A	F4626		31				
K8484A	F4627		32				
K8485A	F4628		33				

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ETC FORM 0102

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: Sample Preparation Department

Sample Number	Log Link	Sample Weight (gm)	Extract Vol. (ml) BN	Extract Vol. (ml) ACID	Comments
* ~~K4174~~	~~12865~~	~~29.95~~			~~PP/ORG/PST/PCB~~ RESOXHLET AT 3.0 gram MG 12/30
+ J8439	12825	30.02	5.0	1.0	
K8484	12847	29.51	1.0	1.0	
K8485	↓	29.27	1.0	1.0	↓
K8171	12847	30.00	1.0	1.0	PP/ORG/PST/PCB CMPD/BN
* ~~K8172~~		~~30.01~~			RESOXHLET AT 3.0 gram MG 12/30
K8173		30.00	1.0	1.0	
K8174		30.01	1.0	1.0	
K8175		29.95	1.0	1.0	
K8176	↓	28.15	1.0	1.0	↓
K3246	11759	30.60	1.0		PP/BN
J2204	12890	31.01	1.0		BN+15
J2205		30.16	1.0		
J2206		30.79	1.0		
J2207		30.24	1.0		
J2208	↓	30.10	1.0		↓ ↓
QC 4228			1.0	1.0	
~~K8173~~ ~~K 81 7[illegible]3~~ S		22.72	1.0	1.0	
K 8174 R		~~20.38~~ 24.84 D.V. 12/27	1.0	1.0	

QC Batch # 4228

Analysis PP/ACID

1-2 PP/BN

Matrix Soil

Turnaround Normal

Date 12/24/85

Extraction Method:

Sep. Funnel

Continuous

Soxhlet ✓

Other

002658

COMMENTS

Log 12847 Cmpd/BN:
Benzyl Aldehyde
Benzoic Acid
Catechol (O-Hydroxybenzen
- Spec Sheet #930
Benzyl Alcohol

*K 4174 } RESOXHLET AT 3.0 grams. MG 12/30
*K 8172 }

+ F.V 5.0 ml a 1 ml Aliquot was packaged

FRACTION	SPIKE Amt (ml)	SPIKE Conc.	SPIKE Lot #
BN	1.0	100 ug/ml	12,098
ACID	1.0	100 ug/ml	11,825
Aroclor 1260	1.0	100 ug/ml	12,097
Pest	1.0	100/200 ug/ml	12,059
Spec #930 Spike	1.0	100 ug/ml	12,137
Semi-VOA			

SURROGATE Amt. (ml)	Conc.	Lot #
1.0	BN: 50 ug/ml ACID: 100 ug/ml	12,093

Set-up: L.M. Zok 12/27/85 J. Vejda 12-27-85 UPD/Supervisor: Mary Quinlan 1/2/85

BN Cone.: Acid Conc.: L.M. Zok Spike/Surr. Verified: Mina Gandhi 12/27/85

TESTING AND CERTIFICATION

LABORATORY CHRONICLE: Sample Preparation Department

Sample Number	Log Link	Sample Weight (gm)	Extract Vol. (ml) BN	Extract Vol. (ml) ACID	Comments
* ~~K4174~~	~~12865~~	~~29.95~~			~~PP/ORG/PST/PCB~~ RESOXHLET AT 3.0 grams MG 12/30
J8439	12825	30.02	5.0	1.0	
K8484	12847	29.51	1.0	1.0	
K8485		29.27	1.0	1.0	
K8171	12847	30.00	1.0	1.0	PP/ORG/PST/PCB CMPD/BN
* ~~K8172~~		~~30.01~~			RESOXHLET AT 3.0 grams MG 12/30
K8173		30.00	1.0	1.0	
K8174		30.01	1.0	1.0	
K8175		29.95	1.0	1.0	
K8176		28.15	1.0	1.0	
K3246	11759	30.60	1.0		PP/BN
J2204	12890	31.01	1.0		Bn+15
J2205		30.16	1.0		
J2206		30.79	1.0		
J2207		30.24	1.0		
J2208		30.10	1.0		
QC 4228			1.0	1.0	
27 ~~K8173~~ ~~K8173~~ S		22.72	1.0	1.0	
K8174 R		~~20.38~~ 24.84	D.V 12/27 1.0	1.0	

QC Batch # 4228

Analysis PP/ACID

1-2 PP/BN

Matrix Soil

Turnaround Normal

Date 12/24/85

Extraction Method:

Sep. Funnel

Continuous

Soxhlet ✓

Other

COMMENTS

Log 12847 Cmpd/BN:
Benzyl Aldehyde
Benzoic Acid
Catechol (O-Hydroxybenzene)
- Spec Sheet #930
Benzyl Alcohol

*K4174 } RESOXHLET AT 3.0 grams. MG 12/30
*K8172 }

+ F.V 5.0 ml a 1 ml Aliquot was packaged

MT 8501

FRACTION	SPIKE Amt (ml)	Conc.	Lot #
BN	1.0	100 ug/ml	12,098
ACID	1.0	100 ug/ml	11,825
Prochlor 1260	1.0	100 ug/ml	12,097
Pest	1.0	100/200 ug/ml	12,059
Spec #930 Spike	1.0	100 ug/ml	12,137
Semi-VOA			

SURROGATE Amt. (ml)	Conc.	Lot #
1.0	BN: 50 ug/ml ACID: 100 ug/ml	12,093

Set-up: L.M. Zyk 12/27/85 J. Vejda 12-27-85 UPD/Supervisor: Marc Quahn 1/2/86

BN Conc.: Guido C 12/30/85 Acid Conc.: L.M. Zyk 12/30/85 Spike/Surr. Verified: Mina Gandhi 12/27/85

ETC FORM 8110

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ETC ENVIRONMENTAL TESTING AND CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/8/86 SHIFT
FRACTION B/N
INSTRUMENT "I"
TUNE FILE MTI001
SEQUENCE FILE MBI
METHOD FILE BNPI.
ID FILE IBNP, ISPPJ +
ANALYST(S) M Bailey

SUPERVISOR [illegible]
BATCH #'s QB4228, QP0002, QP0007

+ ID File for QC P0002 and QC P0007.
PLEASE INITIAL

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	Jan. 9, 1986
WIP		BY	KV

STANDARD	CONC PPM	LOT NO.	LOT VOL
INT. STD.	400	12006	
DFTPP	25	11972	
BN IV	150	12112	
BN III	200	11906	
BN II	100	12111	
BN I	60	12110	
HSLPPIBN III	300	11837	
II	100	11838	
I	30	11839	
SPEC. 930 III	300	12138	
930 II	100	12139	
930 I	60	12140	
o,m,p-nitrotoluene III	500	11244	
II	300	11245	
I	100	11246	

to ISTPJ, CB-file: CBISPJ

MS, MG, MJ, MB.

NAME	DATA FILE	uL INJ	ALS #	OIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP-50ng	>I2031		1	OK		Lowered EMV to 1600.	
BN IV - 150ppm	>I2032		2		I00373		
BN III - 200ppm	>I2033		3				
BN II - 100ppm	>I2034		4			AR1260	
BNI - 60ppm	>I2035		5				
HSLPPIBN - 300ppm	>I2036		6				
HSLPPIBN - 100ppm	>I2037		7		fn2 - Methylnaphthalene in ISOOJ		
HSLPPIBN - 30ppm	>I2038		8			IDFile.	
SPEC. 930 - 300ppm	>I2039		9				
SPEC. 930 - 100ppm	>I2040		10				
SPEC. 930 - 60ppm	>I2041		11				
o,m,p-nitrotoluene 500ppm	>I2042		12				
o,m,p-nitrotoluene 300ppm	>I2043		13		I00374		
o,m,p-nitrotoluene 100ppm	>I2044		14				
DFTPP-50ng	>I2045		15	OK			
QC4183B	>I2046		16			QB4183	
QCP0002B	>I2047		17				
QCP0002BS	>I2048		18				
L+.#2-3	>I2049		19			L+.#2-3	
QCP0007B	>I2050		20				
QCP0007BS	>I2051		21				
L+.#1	>I2052		22				
QCP0007B1	>I2053		23			QC1	
KY572B	>I2054		24	X10		QB4241	
KY583B	>I2055		25	X10		QB4241	

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE see
METHOD FILE _____
ID FILE _____
ANALYST(S) M Barkley
SUPERVISOR [illegible]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL
see page			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K4585B	>I2056		26	X20	I00374	QB4241	
K4585BS	>I2057		27	X20		QB4241	
DFTPP-50ng	>I2058		28				
BN II - 100ppm	>I2059		29				
K7562B	>I2060		30	X5	I00375	QB4243	
K7559B	>I2061		31	X5		QB4243	
K7561B	>I2062		32	X5		QB4243	
K7551B	>I2063		33			QB4242	
K7553B	>I2064		34				
K7554B	>I2065		35				
K7545B	>I2066		36				
K7544B	>I2067		37				
K7550B	>I2068		38				
K7557B	>I2069		39				
K7556B	>I2070		40				
DFTPP-50ng	>I2071		41				
BN II - 100ppm	>I2072		42				
QC4228B	>I2073		43			PCBSCR	PB
K8173BS	>I2074		44			AR1260	
J8439B	>I2075		45			PCBSCR	
K8484B	>I2076		46				
K8485B	>I2077		47		I00376		
K8171B	>I2078		48				
K8173B	>I2079		49				
K8174B	>I2080		50				

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE see 1
METHOD FILE _____
ID FILE _____
ANALYST(S) M Barkly
SUPERVISOR Pearl Trant
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.
see page 1			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8174BR	>I2081		51		I00376	pcB55R	
K8175B	>I2082		52				
K8176B	>I2083		53				
DFTPP-50ng	>I2084		54				
BN II - 100ppm	>I2085		55				
K3246B	>I2086		56				
J2204B	>I2087		57				
J2205B	>I2088		58				PB
J2206B	>I2089		59				
J2207B	>I2090		60				
J2208B	>I2091		61				

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ETC FORM #102

APPENDIX 5A

CLARK LAKE AND

BRAZOS RIVER ANALYTICAL DATA

002663

ETC ENVIRONMENTAL TESTING and CERTIFICATION

Technical Report

for

RESOURCE ENGINEERING

ATTENTION: CHRIS ITIN

3000 RICHMOND AVENUE

HOUSTON, TX 77098

CLARK LAKE

SAMPLE # L3

002664

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
KB485	RESOURCE ENGINEERING	RES28804	BL3	851219		

Denis C. K. Lin, Ph.D.
Vice President
Research and Operations

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Introduction

This report contains the analytical results on your soil sample, BL3 85/12/19. It is designed to include comprehensive data from the entire analytical process in order to satisfy the needs of various levels of review.

The results obtained from your sample are presented in tabular format immediately following this introduction. Quality assurance data is tabulated along with the appropriate sample results for verification. Depending on the analyses ordered, the quality assurance data may include results from blank, spiked blank, spiked sample (i.e. matrix spike) and replicate sample as well as results from surrogate compound analyses. Quality assurance data for verification of proper instrument performance is also included where appropriate. The report appendices include the chain of custody record for your sample and, where appropriate, the gas chromatograms and mass spectra.

The procedures used in the analysis of the sample are described in this report's methodology section. All analytical procedures within our laboratory are performed within a strictly enforced Quality Assurance Protocol. A description of this Protocol is included in the report.

Results

Sample results, and associated quality assurance data, are always tabulated in one or more of this report's Quantitative Results Tables. The format of each table varies with the class of analysis.

Priority Pollutants

The priority pollutant compounds and elements are listed with their NPDES (National Pollution Discharge Elimination System) numbers, and the Method Detection Limit (MDL) published in the Federal Register. When a compound or element is present below its published MDL it is reported as BMDL (Below Method Detection Limit). When a compound or element is not present at any detectable concentrations it is reported as ND (Not Detected). MDL's for non-aqueous matrices are based on USEPA published MDL's but are adjusted as per sample weight. Matrix spike and replicate analyses, where included, were performed on samples randomly chosen within each quality assurance batch and are therefore not necessarily spikes and replicates of this report's sample. Surrogate compound recovery data and instrument calibration data are included in the Method Performance Data Tables.

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 11, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28804	BL3	851219		

NPDES Number	Compound (Acrolein and Acrylonitrile values are screen only.)	Results: Sample Concen. ug/kg	Results: MDL ug/kg	QC Replicate: First ug/kg	QC Replicate: Second ug/kg	QC Blank and Spiked Blank: Blank Data ug/kg	QC Blank and Spiked Blank: Concen. Added ug/kg	QC Blank and Spiked Blank: % Recov	QC Matrix Spike: Unspiked Sample ug/kg	QC Matrix Spike: Concen. Added ug/kg	QC Matrix Spike: % Recov
1V	Acrolein	ND	500	ND	ND	ND	4000	98	ND	4000	90
2V	Acrylonitrile	ND	500	ND	ND	ND	400	96	ND	400	83
3V	Benzene	ND	22	ND	ND	ND	90.0	96	ND	90.0	96
4V	bis(Chloromethyl)ether	ND	50	ND	ND	ND	0	-	ND	0	-
5V	Bromoform	ND	24	ND	ND	ND	90.0	88	ND	90.0	82
6V	Carbon tetrachloride	ND	14	ND	ND	ND	90.0	98	ND	90.0	100
7V	Chlorobenzene	ND	30	1050	1540	ND	90.0	99	ND	90.0	97
8V	Chlorodibromomethane	ND	16	ND	ND	ND	90.0	93	ND	90.0	93
9V	Chloroethane	ND	50	ND	ND	ND	90.0	107	ND	90.0	97
10V	2-Chloroethylvinyl ether	ND	50	ND	ND	ND	90.0	0.	ND	90.0	0.
11V	Chloroform	ND	8.0	ND	ND	ND	90.0	107	ND	90.0	97
12V	Dichlorobromomethane	ND	11	ND	ND	ND	90.0	93	ND	90.0	94
13V	Dichlorodifluoromethane	ND	50	ND	ND	ND	90.0	137	ND	90.0	111
14V	1,1-Dichloroethane	ND	24	ND	ND	ND	90.0	104	ND	90.0	96
15V	1,2-Dichloroethane	ND	14	ND	ND	ND	90.0	104	ND	90.0	95
16V	1,1-Dichloroethylene	ND	14	ND	ND	ND	90.0	105	ND	90.0	104
17V	1,2-Dichloropropane	ND	30	ND	ND	ND	90.0	96	ND	90.0	95
18V	cis-1,3-Dichloropropylene	ND	25	ND	ND	ND	90.0	87	ND	90.0	88
19V	Ethylbenzene	ND	36	ND	ND	ND	90.0	99	ND	90.0	95
20V	Methyl bromide	ND	50	ND	ND	ND	90.0	114	ND	90.0	108
21V	Methyl chloride	ND	50	ND	ND	ND	90.0	112	ND	90.0	121
22V	Methylene chloride	ND	14	ND	ND	BMDL	90.0	117	N	90.0	85
23V	1,1,2,2-Tetrachloroethane	ND	35	ND	ND	ND	90.0	98	N	90.0	86
24V	Tetrachloroethylene	ND	21	ND	ND	ND	90.0	105	ND	90.0	96
25V	Toluene	ND	30	885	1280	ND	90.0	106	ND	90.0	94
26V	1,2-Trans-dichloroethylene	ND	8.0	ND	ND	ND	90.0	106	ND	90.0	97
27V	1,1,1-Trichloroethane	ND	19	ND	ND	ND	90.0	98	ND	90.0	102
28V	1,1,2-Trichloroethane	ND	25	ND	ND	ND	90.0	96	ND	90.0	95
29V	Trichloroethylene	ND	9.5	ND	ND	ND	90.0	94	ND	90.0	113
30V	Trichlorofluoromethane	ND	50	ND	ND	ND	90.0	112	ND	90.0	68
31V	Vinyl chloride	ND	50	ND	ND	ND	90.0	116	ND	90.0	104
18V	trans-1,3-Dichloropropylene	ND	50	ND	ND	ND	90.0	93	ND	90.0	101

B Recovery normally variable using EPA Protocol Method 624.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 9, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Acid Compounds – GC/MS Analysis Data (QR02)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28804	BL3	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1A	2-Chlorophenol	ND	110	ND	ND	ND	0	-	ND	4400	82
2A	2,4-Dichlorophenol	ND	92	ND	ND	ND	0	-	ND	4400	94
3A	2,4-Dimethylphenol	ND	92	ND	183	ND	0	-	ND	4400	88
4A	4,6-Dinitro-o-cresol	ND	820	ND	ND	ND	0	-	ND	4400	61
5A	2,4-Dinitrophenol	ND	1400	ND	ND	ND	0	-	ND	4400	55
6A	2-Nitrophenol	ND	120	ND	ND	ND	0	-	ND	4400	90
7A	4-Nitrophenol	ND	82	ND	ND	ND	0	-	ND	4400	99
8A	p-Chloro-m-cresol	ND	100	ND	ND	ND	0	-	ND	4400	120
9A	Pentachlorophenol	ND	120	ND	ND	ND	0	-	ND	4400	135
10A	Phenol	ND	51	ND	ND	ND	0	-	236	4400	193
11A	2,4,6-Trichlorophenol	ND	92	ND	ND	ND	0	-	ND	4400	102

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28804	BL3	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1B	Acenaphthene	ND	65	ND	ND	ND	0	-	ND	4400	78
2B	Acenaphthylene	ND	120	ND	ND	ND	0	-	ND	4400	109
3B	Anthracene	ND	65	ND	ND	ND	0	-	51.9	4400	99
4B	Benzidine	ND	1500	ND	ND	ND	0	-	ND	4400	40
5B	Benzo(a)anthracene	ND	270	ND	ND	ND	0	-	ND	4400	102
6B	Benzo(a)pyrene	ND	85	ND	ND	ND	0	-	ND	4400	85
7B	Benzo(b)fluoroanthene	ND	160	ND	ND	ND	0	-	ND	4400	100
8B	Benzo(ghi)perylene	ND	140	ND	ND	ND	0	-	ND	0	-
9B	Benzo(k)fluoranthene	ND	120	ND	ND	ND	0	-	ND	4400	83
10B	bis(2-Chloroethoxy)methane	ND	180	ND	ND	ND	0	-	ND	4400	66
11B	bis(2-Chloroethyl) ether	ND	190	ND	ND	ND	0	-	ND	4400	109
12B	bis(2-Chloroisopropyl)ether	ND	190	ND	ND	ND	0	-	ND	4400	71
13B	bis(2-Ethylhexyl)phthalate	ND	340	ND	ND	ND	0	-	ND	4400	213.
14B	4-Bromophenyl phenyl ether	ND	65	ND	ND	ND	0	-	ND	4400	137
15B	Butyl benzyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	146
16B	2-Chloronaphthalene	ND	65	ND	ND	ND	0	-	ND	4400	44
17B	4-Chlorophenyl phenyl ether	ND	140	ND	ND	ND	0	-	ND	4400	49
18B	Chrysene	ND	85	ND	ND	ND	0	-	ND	4400	108
19B	Dibenzo(a,h)anthracene	ND	340	ND	ND	ND	0	-	ND	0	-
20B	1,2-Dichlorobenzene	ND	65	ND	ND	ND	0	-	ND	4400	93
21B	1,3-Dichlorobenzene	ND	65	ND	ND	ND	0	-	ND	4400	90
22B	1,4-Dichlorobenzene	ND	150	ND	ND	ND	0	-	ND	4400	92
23B	3,3'-Dichlorobenzidine	ND	560	ND	ND	ND	0	-	ND	4400	0c
24B	Diethyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	52
25B	Dimethyl phthalate	ND	340	ND	ND	ND	0	-	52.9	4400	94
26B	Di-n-butyl phthalate	ND	340	ND	ND	ND	0	-	85.3	4400	177.
27B	2,4-Dinitrotoluene	ND	190	ND	ND	ND	0	-	ND	4400	47
28B	2,6-Dinitrotoluene	ND	65	ND	ND	ND	0	-	ND	4400	38
29B	Di-n-octyl phthalate	ND	340	ND	ND	ND	0	-	ND	4400	108
30B	1,2-Diphenylhydrazine	ND	340	ND	ND	ND	0	-	ND	4400	0c
31B	Fluoranthene	ND	75	ND	ND	ND	0	-	35.8	4400	123
32B	Fluorene	ND	65	ND	ND	ND	0	-	ND	4400	64

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28604	BL3	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov a	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
33B	Hexachlorobenzene	ND	65	ND	ND	ND	0	-	ND	4400	133
34B	Hexachlorobutadiene	ND	31	ND	ND	ND	0	-	ND	4400	87
35B	Hexachlorocyclopentadiene	ND	340	ND	ND	ND	0	-	ND	0	-
36B	Hexachloroethane	ND	55	ND	ND	ND	0	-	ND	4400	22c
37B	Indeno(1,2,3-c,d)pyrene	ND	160	ND	ND	ND	0	-	ND	0	-
38B	Isophorone	ND	75	ND	ND	ND	0	-	ND	4400	62
39B	Naphthalene	ND	55	ND	ND	ND	0	-	ND	4400	119
40B	Nitrobenzene	ND	65	ND	ND	ND	0	-	ND	4400	127
41B	N-Nitrosodimethylamine	ND	340	ND	ND	ND	0	-	ND	0	-
42B	N-Nitrosodi-n-propylamine	ND	340	ND	ND	ND	0	-	ND	4400	140
43B	N-Nitrosodiphenylamine	ND	65	ND	ND	ND	0	-	75.1	4400	30
44B	Phenanthrene	ND	180	ND	ND	ND	0	-	ND	4400	127
45B	Pyrene	ND	65	ND	ND	ND	0	-	ND	4400	125
46B	1,2,4-Trichlorobenzene	ND	65	ND	ND	ND	0	-	ND	4400	77

a Reagent Blank. Spiked Blank cannot be performed for this sample matrix.

b Recovery normally variable using EPA Protocol Method 625.

c Recovery variable due to sample matrix interference.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 26, 1986

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Pesticide/PCB Compounds - GC/MS Analysis Data (QR04)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28804	BL3	851219		

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/kg	MDL ug/kg	First ug/kg	Second ug/kg	Blank Data ug/kg	Concen. Added ug/kg	% Recov	Unspiked Sample ug/kg	Concen. Added ug/kg	% Recov
1P	Aldrin	ND	65	ND	ND	ND	0	-	ND	4400	44
2P	Alpha-BHC	ND	340	ND	ND	ND	0	-	ND	4400	39
3P	Beta-BHC	ND	150	ND	ND	ND	0	-	ND	4400	117
4P	Gamma-BHC	ND	340	ND	ND	ND	0	-	ND	4400	77
5P	Delta-BHC	ND	110	ND	ND	ND	0	-	ND	4400	14.
6P	Chlordane	ND	340	ND	ND	ND	0	-	ND	8800	41
7P	4,4'-DDT	ND	96	ND	ND	ND	0	-	ND	4400	0.
8P	4,4'-DDE	ND	190	ND	ND	ND	0	-	ND	4400	70
9P	4,4'-DDD	ND	160	ND	ND	ND	0	-	ND	4400	76
10P	Dieldrin	ND	85	ND	ND	ND	0	-	ND	4400	68
11P	Endosulfan I	ND	340	ND	ND	ND	0	-	ND	4400	78
12P	Endosulfan II	ND	340	ND	ND	ND	0	-	ND	4400	0.
13P	Endosulfan sulfate	ND	190	ND	ND	ND	0	-	ND	4400	42
14P	Endrin	ND	340	ND	ND	ND	0	-	ND	4400	32
15P	Endrin aldehyde	ND	340	ND	ND	ND	0	-	ND	4400	35
16P	Heptachlor	ND	65	ND	ND	ND	0	-	ND	4400	0.
17P	Heptachlor epoxide	ND	75	ND	ND	ND	0	-	ND	4400	56
18P	PCB-1242	ND	1200	ND	ND	ND	0	-	ND	0	-
19P	PCB-1254	ND	1200	ND	ND	ND	0	-	ND	0	-
20P	PCB-1221	ND	1000	ND	ND	ND	0	-	ND	0	-
21P	PCB-1232	ND	1200	ND	ND	ND	0	-	ND	0	-
22P	PCB-1248	ND	1200	ND	ND	ND	0	-	ND	0	-
23P	PCB-1260	ND	1200	ND	ND	ND	0	-	ND	4400	90
24P	PCB-1016	ND	1200	ND	ND	ND	0	-	ND	0	-
25P	Toxaphene	ND	340	ND	ND	ND	0	-	ND	0	-

& Recovery normally variable using EPA Protocol Method 625.

& Reagent Blank, Spiked Blank cannot be performed for this sample matrix.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JAN 24, 1986

TABLE 2: METHOD PERFORMANCE DATA
Surrogate Recovery Soil - GC/MS Data (QR20)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
K8485	RESOURCE ENGINEERING	RES28804	BL3	85121		0

Compound	Amount added ug	% Recovery	Control Limits *	
			Lower	Upper
VOLATILE FRACTION				
Toluene-D8	.250	121	50	160
p-Bromofluorobenzene	.250	106	50	160
1,2-Dichloroethane-D4	.250	114	50	160
ACID FRACTION				
Phenol-D5	100	66	20	140
2-Fluorophenol	100	68	20	140
2,4,6-Tribromophenol	100	82	10	140
BASE/NEUTRAL FRACTION				
Nitrobenzene-D5	50	118	20	140
2-Fluorobiphenyl	50	65	20	140
Terphenyl-D14	50	39	20	150

* 1/90 EPA Control Limits

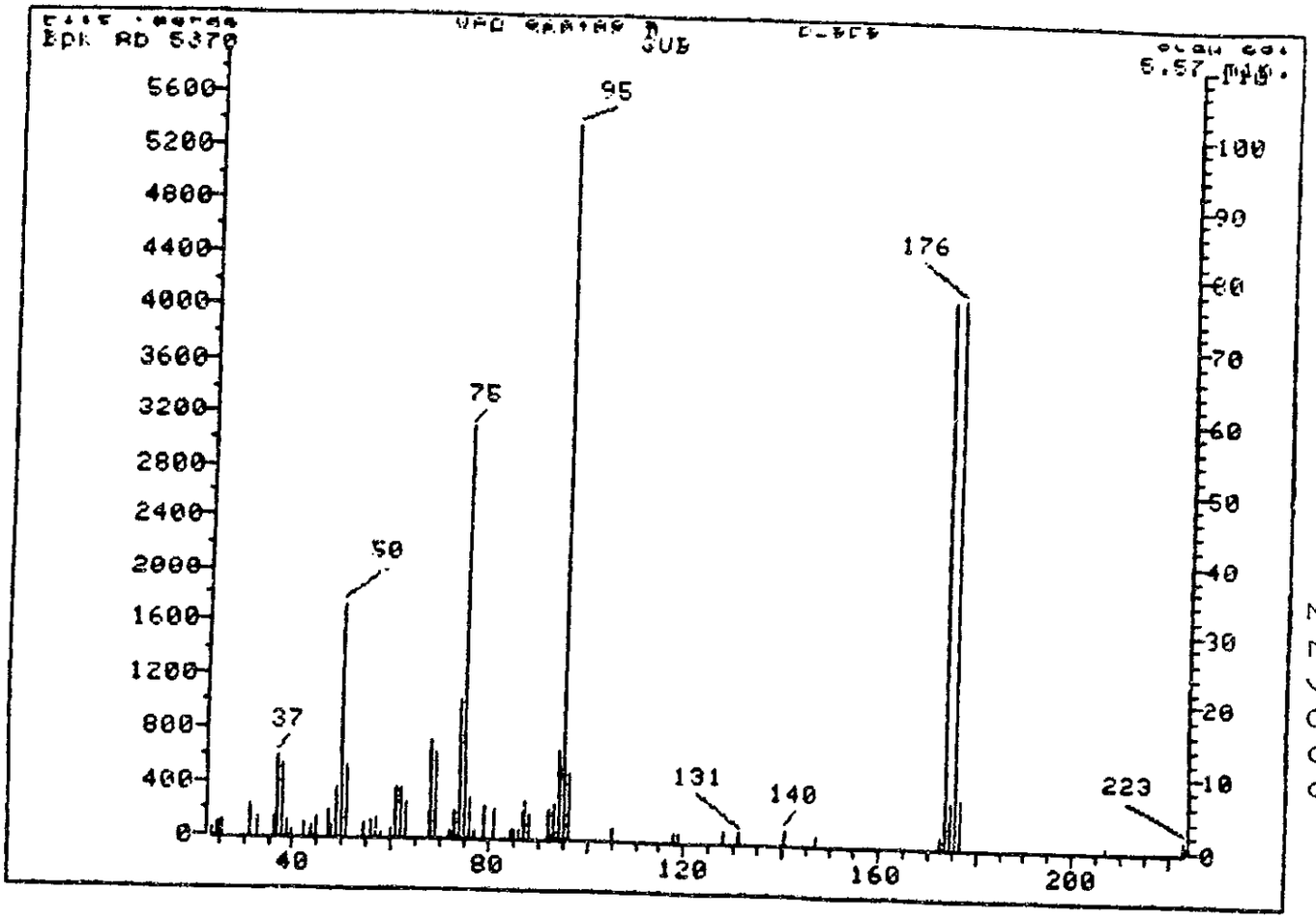

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TABLE 2: METHOD PERFORMANCE DATA (QR21)

GC/MS Tuning Data - Bromofluorobenzene (BFB) for Volatiles Analysis

M/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
50	15-40% of mass 95	32.07	32.07	Ok
75	30-60% of mass 95	57.43	57.43	Ok
95	Base peak, 100% relative abundance	100.00	100.00	Ok
96	5-9% of mass 95	8.58	8.58	Ok
173	Less than 1% of mass 95	0.00	0.00	Ok
174	Greater than 50% of mass 95	76.31	76.31	Ok
175	5-9% of mass 174	6.11	8.00	Ok
176	95-101% of mass 174	76.65	100.44	Ok
177	5-9% of mass 176	6.16	8.04	Ok

Injection Date: 01/08/86
Injection Time: 07:57
Run No: >D3792
Spectrum No: 231

Analyst: [signature]
Processor: [signature]
QC Batch: QV4233
Samples: K8558-K8560, K8485
J2202-J2205, J2207, J2208
K8407, Calib. Stds

KS 1/8/86

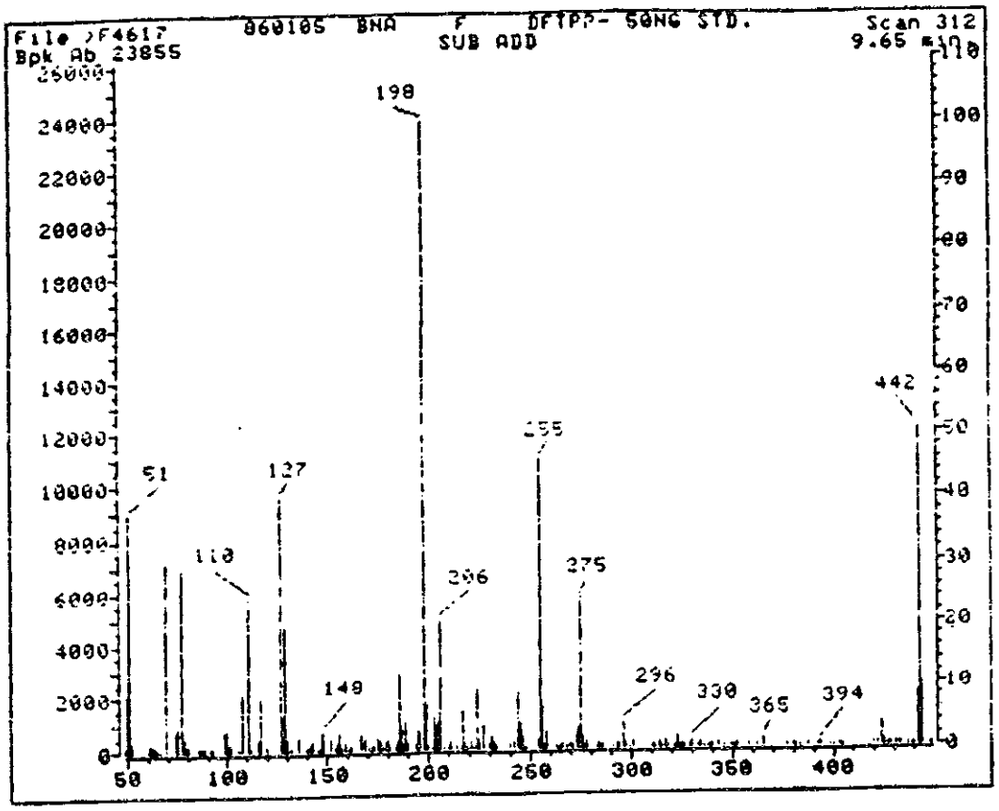

TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for Base/Neutral Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
51	30-60% of mass 198	37.49	37.49	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	29.90	29.90	Ok
70	Less than 2% of mass 69	0.00	0.00	Ok
127	40-60% of mass 198	40.19	40.19	Ok
197	Less than 1% of mass 198	0.00	0.00	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	6.93	6.93	Ok
275	10-30% of mass 198	24.59	24.59	Ok
365	Greater than 1% of mass 198	1.31	1.31	Ok
441	0-100% of mass 443	8.34	85.48	Ok
442	Greater than 40% of mass 198	50.23	50.23	Ok
443	17-23% of mass 442	9.76	19.43	Ok

Injection Date: 01/06/86
Injection Time: 07:46
Run No: >F4617
Spectrun No: 312

Analyst: [illegible]
Processor: [illegible]
QC Batch: QA4228 K8175
Samples: K8174, K8173, K8176, K8171, T8439, K8176, K8484, K8485

K. Baker 1/9/86

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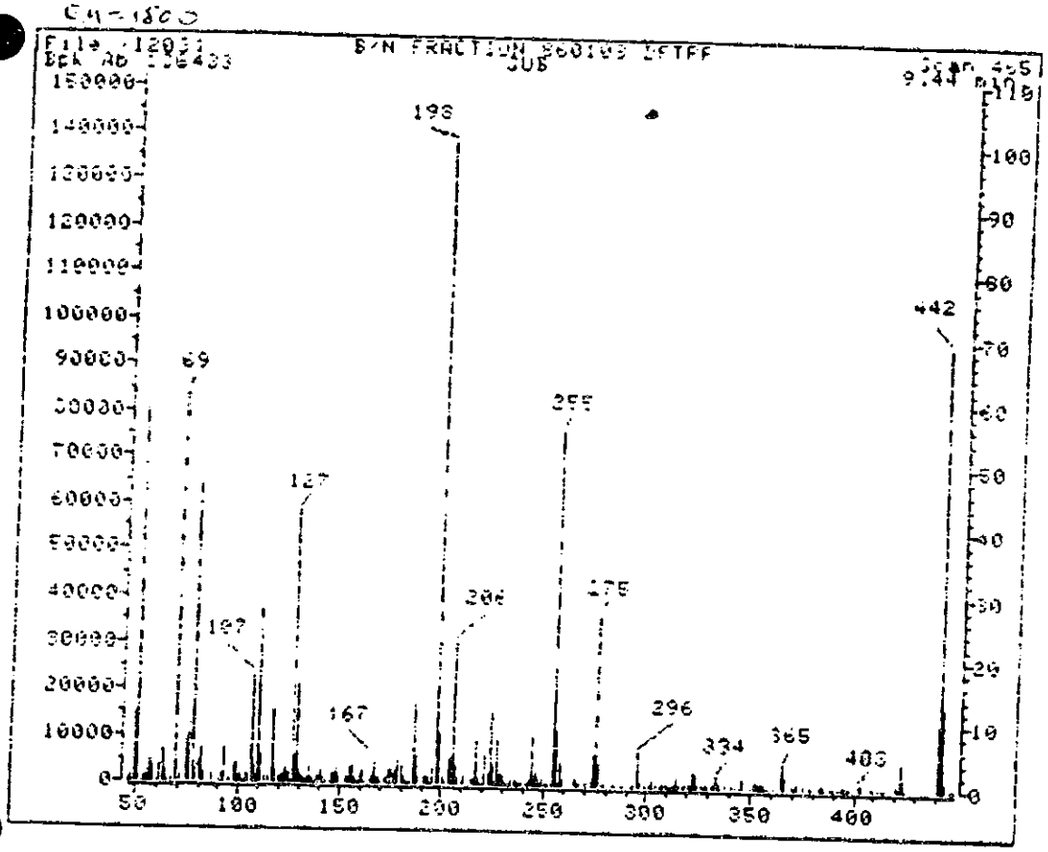

TABLE 2: METHOD PERFORMANCE DATA (QR23)

GC/MS Tuning Data - Decafluorotriphenylphospine (DFTPP) for Base/Neutral Analysis

m/z	Ion Abundance Criteria	% Relative Abundance Base Peak	% Relative Abundance Appropriate Peak	Status
51	30-60% of mass 198	58.00	58.00	Ok
68	Less than 2% of mass 69	0.00	0.00	Ok
69	(reference only)	60.38	60.38	Ok
70	Less than 2% of mass 69	0.00	0.00	Ok
127	40-60% of mass 198	42.20	42.20	Ok
197	Less than 1% of mass 198	0.00	0.00	Ok
198	Base peak, 100% relative abundance	100.00	100.00	Ok
199	5-9% of mass 198	7.65	7.65	Ok
275	10-30% of mass 198	26.44	26.44	Ok
365	Greater than 1% of mass 198	3.90	3.90	Ok
441	0-100% of mass 443	10.20	78.74	Ok
442	Greater than 40% of mass 198	69.01	69.01	Ok
443	17-23% of mass 442	12.96	18.78	Ok

Injection Date: 01/08/86
Injection Time: 18:27
Run No: >I2031
Spectrum No: 465

Analyst: Pearl Traut.
Processor: J. Hendel, D. Simons
QC Batch: QB4228
Samples: J8439B, K8484B, K8485B, K8171B, K8173B, K8174B, K8175B, K8176B, K3246B, S8204B-J2208B

1/25/86

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Methodology
for
GC/MS Analysis of Priority Pollutant Compounds

The methods employed in the GC/MS analysis for priority pollutants are established EPA methods. Rigid compliance with the instrument parameters and performance criteria of the published methods was achieved. In some cases, the precise amounts of sample used and the sample handling procedures vary with the complexity of the sample matrix. Qualitative identification of the priority pollutants was performed using the relative retention times, the relative abundance of three characteristic ions and the abundance ratios. The entire mass spectrum was reviewed to confirm each identification. Quantitative analysis of detected compounds was performed by using a response factor generated by a major characteristic ion of the specific compound and an internal standard.

Compounds, in addition to those on the priority pollutant list, were identified through a computer-aided search of the NBS-EPA spectra library. After review the identifications are included in a separate tabulation and labelled "tentatively identified".

Volatile Priority Pollutant Compounds

For the analysis of Volatile priority pollutants in a soil matrix, a modified version of EPA Method 624 was used. The modification can be be summarized as follows: 1-3 gm of the solid sample are weighed into a 15 ml Hypo vial. The vial is sealed immediately with a teflon-backed silicone septum. A solution containing 3 internal standards is injected through the septum onto the sample. The vial is attached to the Purge and Trap sampler in series with a 5 ml organic-free water trap. The sample vial is heated at 80 degrees Centigrade for 20 minutes. An inert gas sweeps the volatile organic compounds through the water trap onto a sorbent column where they are trapped. When the purge cycle is complete, the sorbent column is heated and backflushed with helium to desorb the purgeable organic compounds onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeable mixture. The separated purgeable components are then identified and quantitated using a computerized mass spectrometer.

Acid, Base/Neutral and Pesticide Priority Pollutant Compounds

For the analysis of the Acid, Base/Neutral and Pesticide priority pollutants in a soil matrix, a modification of EPA Method 625 was used. The method can be summarized as follows: A 30 gm semi-wet soil sample is soxhlet extracted with a 1:1 mixture of acetone and hexane. The acetone is thermally stripped. The remaining hexane extract is diluted to 200 ml with methylene chloride and twice extracted with an aqueous NaOH solution followed by an extraction with deionized water. The methylene chloride extract is dried and concentrated to a 1 ml final volume. This concentrate is injected into a GC/MS instrument configured for the analysis of Base/Neutral priority pollutant compounds. The remaining aqueous extracts are combined and the pH adjusted to a value less than 2. The aqueous phase is serially extracted with 3 aliquots of methylene chloride. The methylene chloride extracts are dried, concentrated to a 1 ml final volume. The concentrate is injected into a GC/MS instrument configured for the analysis of acid extractable priority pollutant compounds.

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

Summary of
Quality Assurance/Quality Control Procedures (QA/QC)

ETC bases its quality assurance protocols on the following government guidelines:

- "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", EPA-600/4-79-019, March 1979;
- National Enforcement Investigation Center Policies, and Procedures manual; EPA-330/9/79/001-R, October 1979;
- the recommended guidelines for EPA Methods 624 and 625. (Federal Register, December 3, 1979; updated on October 26, 1984);
- "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples," EPA 600/8-80-038, June 1980;
- "Determination of 2,3,7,8-TCDD in Soil and Sediment" EPA, Region VII, Kansas City, September 1983;
- Organic Analysis: Multi-media, Multi Concentration-IFB WA84-A267; and
- Dioxin Analysis:Soil/Sediment Matrix; Multi-Concentration; Selected Ion Monitoring with Jar Extration Procedure-IFB WA84-A002

However, we have modified our protocols to provide a higher level of QA/QC than the guidelines require. For example, we analyze a higher than required number of quality control samples and we pay especially careful attention to the certification of the "reference standard" compounds we use in analysis. Below are listed the key QA/QC elements for the methods we used.

Analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry

- Each batch of 13 samples consists of 9 customer samples (at a maximun), one blank sample, one spiked blank, one spiked sample and one replicate sample. This amounts to a 30% quality control factor.
- Three surrogate compounds are added to each sample in the batch of 13.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on bromofluorobenzene (BFB) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of Volatile Organic Priority Pollutant "standards" at a minimum of 3 different concentrations and using a mixture of 3 internal standards at a constant concentration.
- The calibration curve is verified with a mixture of priority pollutant standards every day. If the response factors vary greater than 25%, the instrument must be recalibrated.

Analysis of Organic Compounds Extracted in Acid or Base/Neutral Solutions by Gas Chromatography/Mass Spectrometry

- Each batch of 20 samples consists of 16 customer samples (at a maximum), one blank sample, one spiked blank (for water matrices), one sample spiked with the priority pollutant standard mixture and a duplicate customer sample. This amounts to a 20% quality control factor.

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- Three surrogate compounds are added to each sample in the batch for Base/Neutral analysis.
- Three surrogate compounds are added to each sample in the batch for Acid analysis.
- A blind quality control sample is introduced to the laboratory for analysis on a weekly basis.
- Each GC/MS is checked and retuned, if necessary, at the beginning of each day to ensure that its performance on decafluorotriphenylphosphine (DFTPP) meets the EPA criteria.
- A calibration curve for quantitation is prepared using a mixture of standards composed of either the Organic Acid or Base/Neutral Extractable Compounds at a minimum of 3 concentrations and using five internal standards for quantitation.

Analysis of Metals

All Samples

- New standards are prepared for each batch of samples.
- Normal calibration is performed using a blank sample and four standards that have been through the sample preparation procedure. A regression analysis is used to construct the calibration curve.
- All EP Toxicity samples and all samples determined by furnace atomic absorption are calculated by the "method of additions".
- For each sample analysis that requires the use of the "method of additions" technique, a three point calibration is performed using U.S. EPA "Methods for Chemical Analysis of Water and Wastes, 1979". Results are obtained using linear regression analysis. Any regression with a coefficient of correlation below 0.990 is considered suspect, necessitating review of calibration data or sample re-analysis.
- In constructing the normal calibration curves the lowest concentration levels we use are values greater than or equal to 5 times the Instrumental Detection Limit (IDL).
- All calibration standards are analyzed in duplicate, at a minimum.
- Independent reference standards are used to check the accuracy of calibration standards.
- A check standard is analyzed every ten samples to validate the normal calibration curve.
- One customer sample out of every ten is analyzed in triplicate.

Homogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are homogeneous, the QC program is a minimum of 25% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 independent reference standard;
- 4 Calibration standards (processed using the sample preparation method);
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Heterogeneous Samples (except for Mercury analysis)

Samples are analyzed in batches of 30 or less. For batches in which the sample matrices are heterogeneous, the QC program is a minimum of 35% and consists of analyzing:

- 3 sets of triplicate analyses;
- 2 Replicate spikes;
- 1 Replicate independent reference standards;
- 4 Calibration standards (processed using the sample preparation method);
- 1 Procedural Blank;
- 4 Calibration standards (without sample preparation); and
- 1 Reagent Blank.

Analysis of Mercury

To analyze samples for mercury we group them by matrix in batches of 30 or less. Our QC program is a minimum of 30% and consists of analyzing:

- each of the 30 customer samples in duplicate;
- 3 sets of triplicate anaylses;
- 2 Replicate spikes;
- 2 Replicate independent reference standards;
- 10 Calibration standards (processed using the sample preparation method); and
- 2 Procedural Blanks.

Analysis of Pesticides, Herbicides and PCB's by Gas Chromatography

Pesticide, herbicide and PCB samples are grouped in batches of 16 customer samples or less according to the type of analysis to be performed. The QC program for each of these three types of analyses is a minimum of 20% and consists of analyzing:

- 1 procedural blank sample(a reagent blank is analyzed in the case of non-water matrices);
- 1 spiked blank sample (the spiked blank is eliminated in the case of non-water matrices);
- 1 replicate sample;
- 1 replicate spiked sample; and
- 1 known refernece QC sample for at least each 100 samples analyzed.

The instrument is calibrated each run with three standards, and checked every 10 samples.

Analysis of Cyanides, Phenols, Fluoride, Chloride, Nitrate and Nitrite

- All parameters are analyzed using a Technicon Autoanalyzer II GT.
- 3 calibration standards are analyzed at the beginning and end of each batch.

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- Each batch (up to 80 samples) consists of analyzing one blank, one spiked blank, one duplicate and spiked sample every 20 samples, and an EPA known reference sample.

Analysis of Total Organic Carbon (TOC)

TOC samples are analyzed on a daily basis with the number of samples analyzed per day dependent on the request for duplicate or quadruplicate analyses. The quality control program is designed to maintain the appropriate amount of QC and consists of the following elements:

- Daily instrument calibration
- One blank
- Standard recalibration every 10 samples
- Spiked samples at a low and high level
- Every sample is run in duplicate at a minimum

Analysis of Total Organic Halide (TOX)

- Blank reagent water for absolute carbon backround must contain less than 5 ug/l of halide (as chloride).
- Using a trichlorophenol standard, the mean adsorption efficiency must be within +/- 15% of the standard value.
- Calibration standards are run every 10 samples.
- Every sample is run in duplicate at a minimum.

Analysis of 2,3,7,8-TCDD (Dioxin) by GC/MS (SIM)

- Each sample is dosed with a known quantity of $^{13}C_{12}$-2,3,7,8-TCDD as internal standard and $^{37}Cl_4$-TCDD as surogate standard. The action limits for surrogate standard results is +/- 40% of the true value. Samples showing surrogate standard results outside of these limits are reextracted and reanalyzed.
- Two laboratory "method blanks" are run along with each set of 24 or fewer samples. The method blank is also dosed with the internal standard and surrrogate standard.
- At least one per set of 24 samples is run in duplicate to determine intralaboratory precision.
- Qualitative Requirements. The following are met in order to confirm the presence of native 2,3,7,8-TCDD:

  a. Isomer specificity must be demonstrated initially and verified once per 8-hour work shift. The verification consists of injecting a mixture containing TCDD isomers which elute close to 2,3,7,8-TCDD. The 2,3,7,8-TCDD must be separated from interferring isomers, with no more than 25% valley relative to the 2,3,7,8-TCDD peak.

  b. The 320/322 ratio is within the range of 0.67 to 0.87.

  c. Ions 320, 322, and 257 are all present and maximize together the signal to mean noise ratio must be 2.5 to 1 or better for all 3 ions.

  d. The retention time is equal (within 3 seconds) the retention time for the isotopically labeled 2,3,7,8-TCDD.

  e. At least one of the positives can be confirmed by obtaining partial scan spectra from mass 150 to mass 350. The partial scan guidelines are as follows:

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. the 320/324 ratio should be 1.58 +/- 0.16

. the 257/259 ratio should be 1.03 +/- 0.10

. the 194/196 ratio should be 1.54 +/- 0.15

- One sample is spiked with native 2,3,7,8-TCDD at a level of 1.0 PPB (for soil) for each set of 24 or fewer samples.
- In cases where no native 2,3,7,8-TCDD is detected, the actual detection limit is estimated and reported based on a signal to noise ratio of 2.5 to 1 at ions 320 and 322.
- For each sample, the internal standard is present with at least a 10 to 1 signal to noise ratio for both mass 332 and mass 334. Also, the internal standard 332/334 ratio must be within the range of 0.67 to 0.87.

Subcontractor QA/QC

Each subcontractoer is required to maintain an appropriate level of quality control. To insure this, each subcontractor is required to submit to ETC the quality control data for all analyses it performs. This data is kept on file at ETC. In general, the amount of quality control required is one duplicate sample with one spiked sample for every ten analyses.

Chain-of-Custody

The chain-of-custody procedure is part of our quality assurance protocol. We believe our chain-of-custody record fully complies with the legal requirements of federal, state and local government agencies and of the courts of law. The record covers:

- labeling of sample bottles, packing the Sample Shuttle and transferring the Shuttle under seal to the custody of a shipper;
- outgoing shipping manifests;
- the chain-of-custody form completed by the person(s) breaking the Shuttle seal, taking the sample, resealing the Shuttle and transferring custody to a shipper;
- incoming shipping manifests;
- breaking the Shuttle's reseal;
- storing each labeled sample bottle in a secured area;
- disposition of each sample to an analyst or technician; and
- the use of the sample in each bottle in a testing procedure appropriate to the intended purpose of the sample.

The records show for each link in this process:

- the person with custody; and
- the time and date each person accepted or relinquished custody.

002681

Appendix A

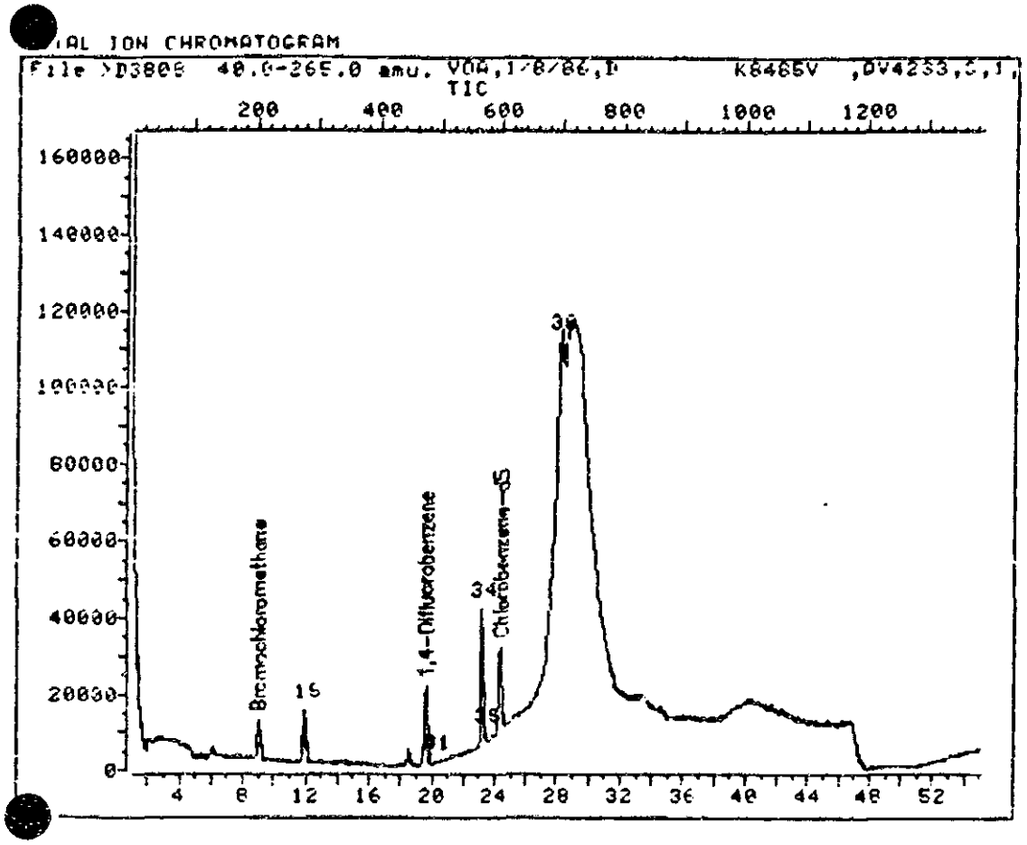
Mass Spectral Data for Quantitated Compounds

1) A total ion chromatogram for each sample analyzed by a GC/MS instrument.

2) A Quant. report used by the analyst to determine qualitative and quantitative results of the compounds present.

3) A mass spectrum and a reference spectrum for each priority pollutant compound detected in the sample.

002682



Data File: >D3808::U2
Name: VOA,1/8/86,D
Misc: K8485V ,QV4233,S,1,1

Id File: DVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860108 12:55

Operator ID: RR0835
Quant Time: 860108 23:16
Injected at: 860108 22:20

002683

QUANT REPORT

perator ID: RR0835
utput File: ^D3808::AQ
ata File: >D3808::U2
ame: VOA,1/8/86,D
isc: K8485V ,QV4233,S,1,1

Quant Rev: 5

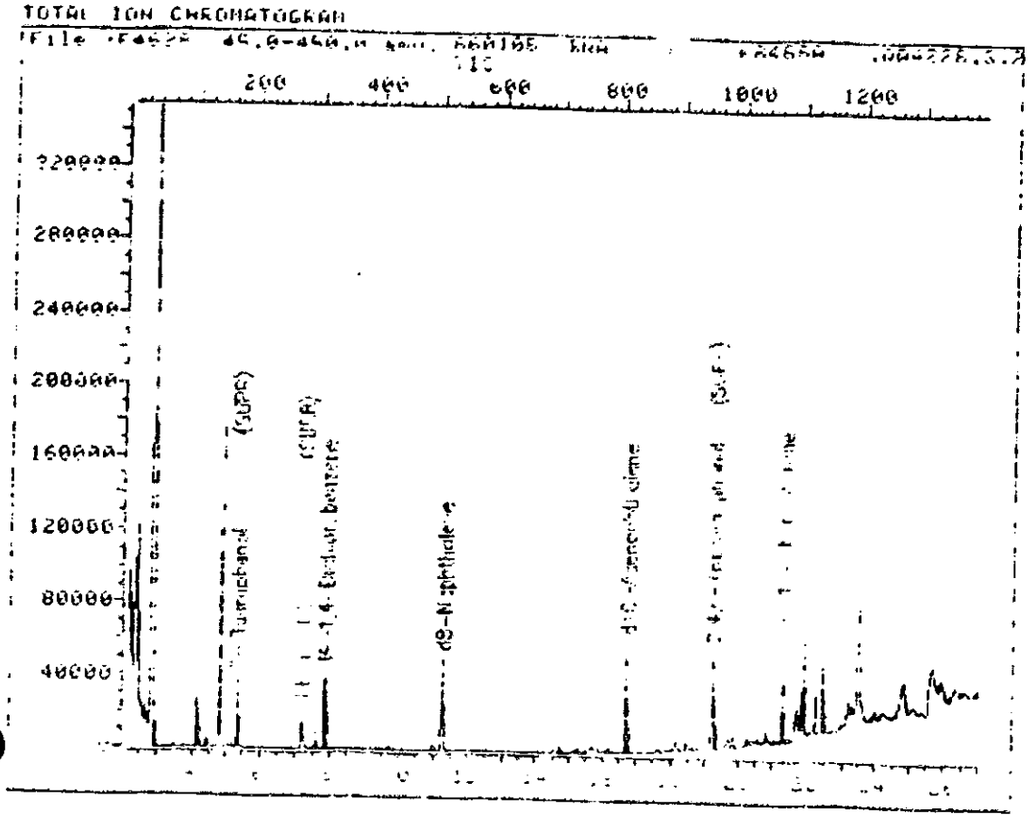
Quant Time: 860108 23:16
Injected at: 860108 22:20
Dilution Factor: 1.00

D File: DVOA::US
itle: Volatile Priority Pollutant ID FILE
ast Calibration: 860108 12:55

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		8.98	206	17455	250.00	NG	95
.5)	1,2-Dichloroethane-D4	(SURR)	11.94	282	26609	284.52	NG	84
.7)	*1,4-Difluorobenzene		19.56	478	83183	250.00	NG	99
50)	*Chlorobenzene-d5		24.34	601	73161	250.00	NG	96
51)	2-Chloroethylvinyl ether		20.06	491	212	~~571.19~~	~~NG~~	51
51)	2-Chloroethylvinyl ether		20.18	494	620	~~1678.47~~	~~NG~~	46
54)	Toluene-D8	(SURR)	23.14	570	141815	303.53	NG	91
55)	Toluene		23.33	575	2294	~~4.67~~	~~NG~~	93
58)	p-Bromofluorobenzene	(SURR)	28.04	696	78128	266.06	NG	100

* Compound is ISTD

002684



Data File: [illegible]
Name: 860105 BNA F
Misc: [illegible]

ETL#33

[illegible]
Title: FF ACID IDFILE...INST. [illegible]
Last Calibration: 860106 [illegible]

Operator ID: JH2180
Quant Time: 860106 1[illegible]:2[illegible]
Injected at: 860106 14:5[illegible]

002685

QUANT REPORT

Operator ID: 342190
Output File: F4628::AQ
Data File: >F4628::U3
Name: 860105 ENA F
Misc: K8485A ,OA4228,5,29.27,1

Quant Rev: 4
Quant Time: 860106 15:23
Injected at: 860106 14:53
Dilution Factor: 1.00

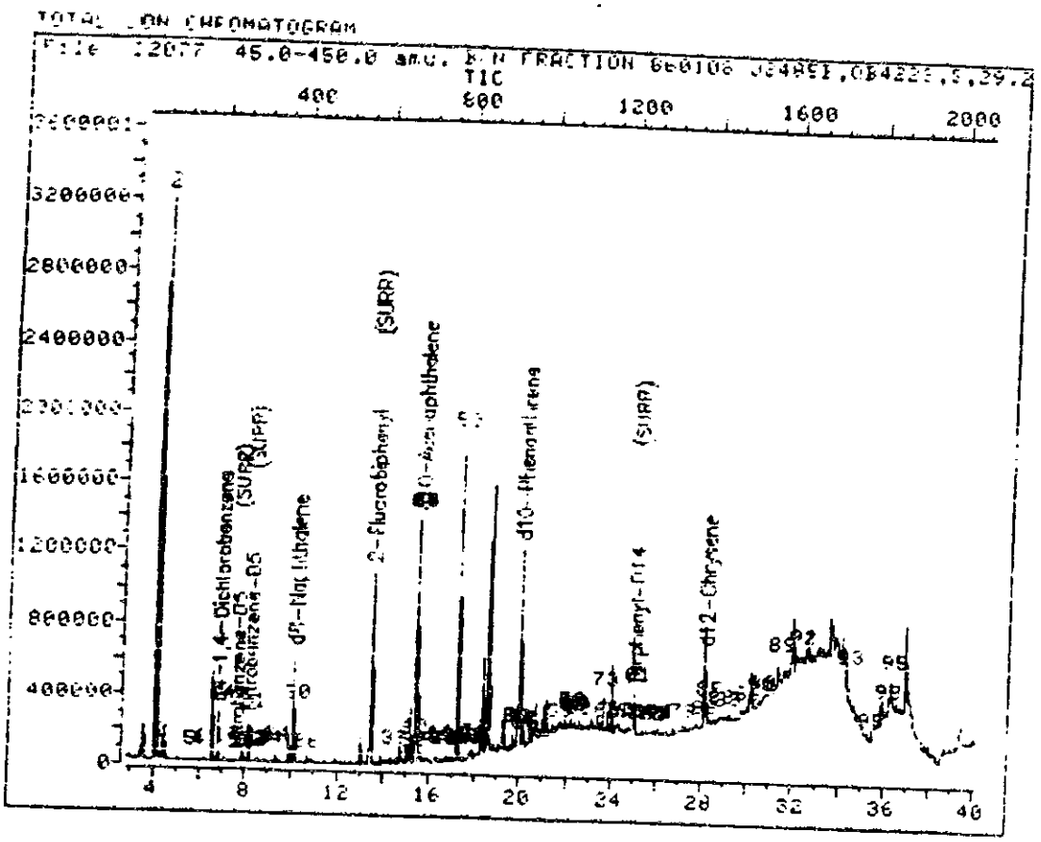
ETL#33

ID File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860105 11:37

	Compound		R.T.	Scan#	Area	Conc	Units	q
[illegible]	*d4-1,4-Dichlorobenzene		7.82	315	26870	40.00	UG/ML	88
[illegible]	2-Fluorophenol	(SURR)	5.32	174	29068	67.53	UG/ML	94
[illegible]	Phenol-[illegible]	(SURR)	[illegible].19	279	31600	65.56	UG/ML	93
10	*d8-Naphthalene		11.27	509	60118	40.00	UG/ML	96
18)	*d10-Acenaphthalene		16.71	816	37547	40.00	UG/ML	97
[illegible]	*d10-Phenanthrene		21.27	1072	86766	40.00	UG/ML	99
[illegible]	2,4,6-Tribromophenol	(SURR)	[illegible].20	[illegible]	[illegible]	[illegible]	UG/ML	94

* Compound is ISTD

002686



Data File: :12077::U5
Name: B/N FRACTION 860108
Mis:: J5485E,QS4228,S,29.27,1

Id File: IBNP::US
Title: B/N+PEST ID FILE .... FOR I 850326
Last Calibration: 860109 18:45

Operator ID: KU0786
Quant Time: 860110 17:54
Injected at: 860110 17:11

BTL#47

002687

QUANT REPORT

Operator ID: [illegible]
Quant File: [illegible]
Data File: [illegible]
Name: [illegible] ACTION 860109
Method: [illegible]

Quant Key: [illegible]
Quant time: 860109 17:54
Injected at: 860109 17:11
Dilution Factor: 1.000

ID File: [illegible]
Title: B/N-Acid ID FILE .... FOR 1 860326
Last Calibration 860109 [illegible]

DILE:7

Compound		R.T	Scan #	Area	Conc	Units	Q
1) *d4-1,4-Dichlorobenzene		6.79	216	70111	40.00	UG/ML	96
2) [illegible]		[illegible]	[illegible]	[illegible]	~~[illegible]~~	~~UG/ML~~	[illegible]
[illegible] Nitrobenzene		[illegible]	[illegible]	[illegible]	~~[illegible]~~	~~UG/ML~~	[illegible]
4) Benzaldehyde		4.38	62	1271	~~[illegible]~~	~~UG/ML~~	[illegible]
5) Bis(2-Chloroethyl) ether		5.89	166	1711	~~.01~~	~~UG/ML~~	[illegible]
6) Benzyl alcohol		5.47	146	1305	~~.60~~	~~UG/ML~~	51
7) Nitrobenzene-d5		6.00	172	957	~~.43~~	~~UG/ML~~	70
13) Nitrobenzene-d5	(SURR)	7.60	261	[illegible]	~~[illegible]~~	~~UG/ML~~	57
14) bis(2-Chloroisopropyl)ether	(SURR)	6.15	272	147555	53.75	UG/ML	[illegible]
11) bis(2-Chloroisopropyl)ether		6.79	216	4726	~~10.45~~	~~UG/ML~~	94
14) [illegible]-Chloroisopropyl)ether		7.08	232	1270	~~2.99~~	~~UG/ML~~	77
19) [illegible]		8.50	311	2920	~~0.70~~	~~UG/ML~~	[illegible]
20) [illegible]	(SURR)	10.06	[illegible]	640716	~~40.00~~	~~UG/ML~~	[illegible]
21) N-Nitrosodi-n-propylamine		10.44	386	762980	32.31	UG/ML	96
31) N-Nitrosodi-n-propylamine		8.15	292	32053	~~0.[illegible]~~	~~UG/ML~~	70
22) [illegible]		8.34	302	1764	~~.56~~	~~UG/ML~~	61
23) [illegible]		[illegible]	[illegible]	[illegible]	~~[illegible]~~	~~UG/ML~~	[illegible]
24) [illegible]		8.37	305	2274	~~[illegible]~~	~~UG/ML~~	[illegible]
24) Isophorone		8.38	301	10044	~~.75~~	~~UG/ML~~	62
26) o-Nitrotoluene		7.27	324	2610	~~.25~~	~~UG/ML~~	35
30) Naphthalene		10.[illegible]	426	1675	~~.41~~	~~UG/ML~~	70
34) *d10-Acenaphthalene		10.11	401	4423	~~.25~~	~~UG/ML~~	94
33) Dimethyl phthalate		15.42	670	666087	40.00	UG/ML	89
36) [illegible] phthalate		15.23	656	[illegible]	~~[illegible]~~	~~UG/ML~~	[illegible]
38) Dimethyl phthalate		15.42	670	117331	~~4.39~~	~~UG/ML~~	77
39) Acenaphthylene		15.76	715	21[illegible]	~~.00~~	~~UG/ML~~	99
40) 2,6 Dinitrotoluene		15.37	629	1531	~~.10~~	~~UG/ML~~	[illegible]
40) 2,6-Dinitrotoluene		15.18	663	7653	~~1.45~~	~~UG/ML~~	62
42) Acenaphthene		15.42	676	62403	~~15.38~~	~~UG/ML~~	54
44) 2,4-Dinitrotoluene		15.90	723	1600	~~.07~~	~~UG/ML~~	[illegible]
44) 2,4 Dinitrotoluene		15.42	676	63403	~~8.64~~	~~UG/ML~~	59
44) 2,4-Dinitrotoluene		16.26	745	2542	~~.24~~	~~UG/ML~~	13
45) Diethyl phthalate		17.07	786	2601	~~.20~~	~~UG/ML~~	79
45) Diethyl phthalate		16.46	754	1581	~~.04~~	~~UG/ML~~	30
45) Diethyl phthalate		16.53	758	1270	~~.03~~	~~UG/ML~~	87
46) Fluorene		17.11	790	15377	~~.40~~	~~UG/ML~~	80
46) Fluorene		17.68	822	1907	~~.06~~	~~UG/ML~~	[illegible]
50) N-Nitrosodiphenylamine		17.77	827	2216	~~.06~~	~~UG/ML~~	[illegible]
50) N-Nitrosodiphenylamine		17.16	793	12531	~~.47~~	~~UG/ML~~	84
51) 1,2-Diphenylhydrazine		17.56	815	1970	~~.07~~	~~UG/ML~~	61
51) 1,2-Diphenylhydrazine		17.02	783	2271	~~.05~~	~~UG/ML~~	62
51) 1,2-Diphenylhydrazine		17.79	828	2503	~~.05~~	~~UG/ML~~	70
53) *d10-Phenanthrene		18.05	842	2670	~~.06~~	~~UG/ML~~	69
52) Phenanthrene		19.93	947	1145281	40.00	UG/ML	97
52) Phenanthrene		19.76	938	47[illegible]	~~.61~~	~~UG/ML~~	[illegible]
52) Phenanthrene		19.99	950	7825	~~.03~~	~~UG/ML~~	78
56) Anthracene		20.12	957	1760	~~.09~~	~~UG/ML~~	51
56) Anthracene		19.70	934	4793	~~.20~~	~~UG/ML~~	90
56) Anthracene		19.99	950	7825	~~.02~~	~~UG/ML~~	[illegible]
		20.12	957	1760	~~.00~~	~~UG/ML~~	[illegible]

002688

[illegible]	[illegible] phthalate	[illegible]	[illegible]	[illegible]	[illegible] UG/ML	[illegible]
57)	[illegible] butyl phthalate	22.35	1031	2447	~~[illegible] UG/ML~~	70
58)	[illegible] anthene	23.67	1154	3274	~~[illegible] UG/ML~~	53
[illegible]	[illegible] anthene	24.32	1190	1672	~~[illegible] UG/ML~~	41
[illegible]	[illegible]	25.00	122[illegible]	4799	~~[illegible] UG/ML~~	100
62)	[illegible]	25.67	1154	3274	~~[illegible] UG/ML~~	53
[illegible]	[illegible]	24.3[illegible]	1190	1678	~~[illegible] UG/ML~~	41
[illegible]	[illegible]	22.17	1071	1587	~~[illegible] UG/ML~~	63
[illegible]	[illegible]	22.42	1085	1777	~~[illegible] UG/ML~~	45
70)	[illegible]	26.11	1400	148961	40.00 UG/ML	100
72)	Endosulfan I	25.57	1150	1424	~~[illegible] UG/ML~~	66
73)	Endosulfan I	24.62	1218	1496	~~[illegible] UG/ML~~	26
[illegible]	[illegible]	24.15	1181	1727	~~[illegible] UG/ML~~	62
[illegible]	Endrin	25.13	1235	1865	~~[illegible] UG/ML~~	42
76)	Endrin	25.18	1238	3084	~~[illegible] UG/ML~~	47
76)	Endrin	25.69	1266	2567	~~[illegible] UG/ML~~	35
[illegible]	Endrin aldehyde	25.53	125[illegible]	2619	~~[illegible] UG/ML~~	56
[illegible]	[illegible]	25.82	1273	3035	~~[illegible] UG/ML~~	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	~~[illegible] UG/ML~~	[illegible]
82)	[illegible] (SURR)	25.00	1228	190210	17.70 UG/ML	71
[illegible]	Butyl benzyl phthalate	25.92	1279	2503	~~[illegible] UG/ML~~	51
[illegible]	Butyl benzyl phthalate	26.01	1284	1781	~~[illegible] UG/ML~~	84
[illegible]	[illegible] anthracene	28.16	1405	2394	~~[illegible] UG/ML~~	[illegible]
[illegible]	[illegible]	28.16	1405	2394	~~[illegible] UG/ML~~	64
[illegible]	[illegible] phthalate	27.97	1392	2125	~~[illegible] UG/ML~~	62
[illegible]	[illegible] phthalate	[illegible]	[illegible]	11021	3.09 UG/ML	97
[illegible]	[illegible] phthalate	[illegible]	1450	1681	~~[illegible] UG/ML~~	54
[illegible]	[illegible] phthalate	[illegible]	1477	[illegible]	~~[illegible] UG/ML~~	93
[illegible]	[illegible] phthalate	[illegible]	[illegible]	[illegible]	[illegible] UG/ML	93
[illegible]	[illegible] phthalate	[illegible]	1580	9827	~~[illegible] UG/ML~~	50
[illegible]	[illegible]	30.44	1529	1670	~~[illegible] UG/ML~~	94
[illegible]	[illegible]	30.44	[illegible]	[illegible]	~~[illegible] UG/ML~~	93
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	~~[illegible] UG/ML~~	[illegible]
[illegible]	[illegible]	32.27	1630	4205	~~[illegible] UG/ML~~	86
[illegible]	[illegible]	[illegible]	1742	1560	~~[illegible] UG/ML~~	38
[illegible]	[illegible]	[illegible]	[illegible]	1662	~~[illegible] UG/ML~~	[illegible]
[illegible]	[illegible]	36.04	1863	1429	~~[illegible] UG/ML~~	98
[illegible]	[illegible]	[illegible]	[illegible]	1662	~~[illegible] UG/ML~~	39
[illegible]	[illegible]	[illegible]	[illegible]	1429	~~[illegible] UG/ML~~	80
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	~~[illegible] UG/ML~~	[illegible]

[illegible]

No PCB's Found. 1/17/86

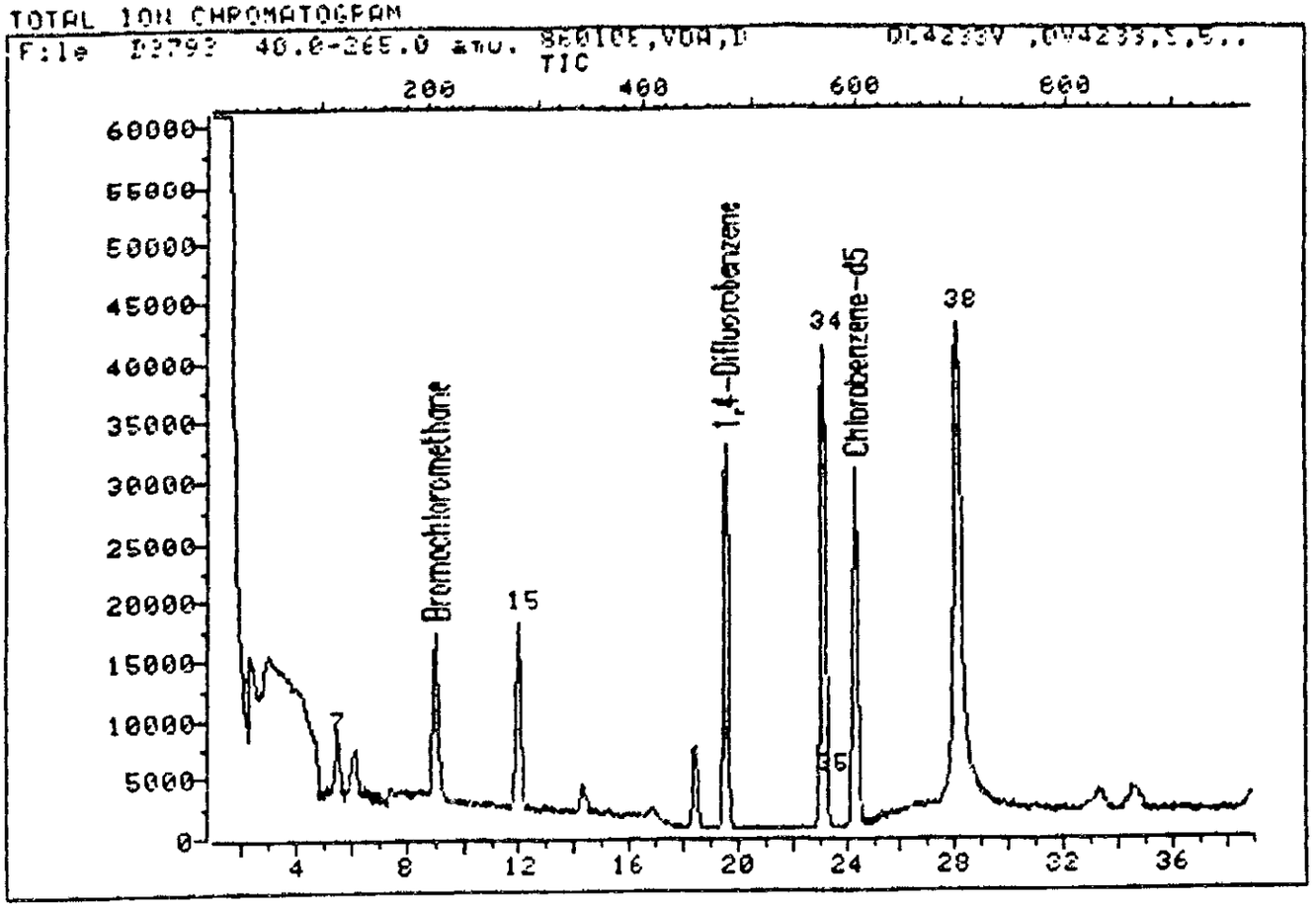
002680

Appendix C1

GC/MS Subsidiary Data

002690

TOTAL ION CHROMATOGRAM



002691

Data File:)D3793::U2
Name: 860108,VOA,D
Misc: QC4233V ,QV4233,S,S,,

Id File: DVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860108 12:55

Operator ID: SJ3562
Quant Time: 860108 14:16
Injected at: 860108 09 03

QUANT REPORT

Operator ID: SJ3562
Output File: ^D3793::AQ
Data File >D3793::U2
Name: 860108,VOA,D
Misc: QC4233V ,QV4233,S,S.,

Quant Rev. 5
Quant Time: 860108 14 16
Injected at 860108 09:03
Dilution Factor 1.00

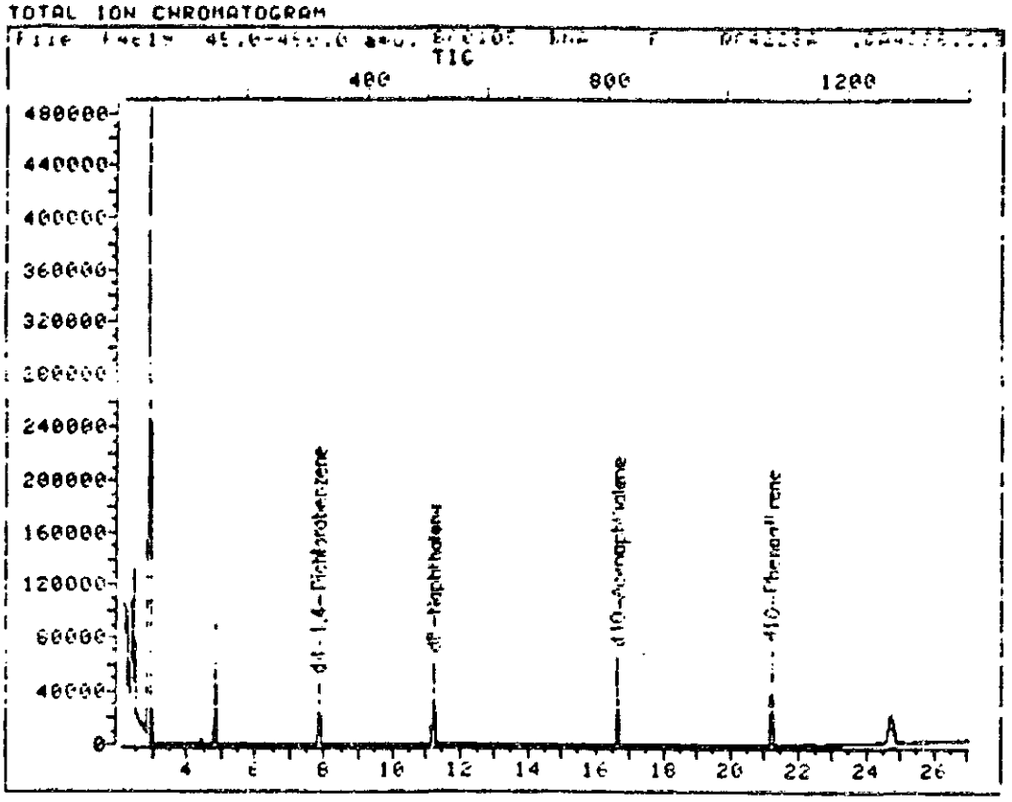
ID File: DVOA::US
Title: Volatile Priority Pollutant ID FILE
Last Calibration: 860108 12:55

	Compound		R.T.	Scan#	Area	Conc	Units	q
1)	*Bromochloromethane		9.00	206	28110	250.00	NG	94
7)	Methylene chloride		5.46	115	10573	65.16	NG	92
15)	1,2-Dichloroethane-D4	(SURR)	11.95	282	31393	208.44	NG	81
17)	*1,4-Difluorobenzene		19.53	477	129322	250.00	NG	99
30)	*Chlorobenzene-d5		24.32	600	103350	250.00	NG	97
34)	Toluene-D8	(SURR)	23.11	569	163927	248.37	NG	90
35)	Toluene		23.31	574	2048	~~8.95~~	~~NG~~	97
38)	p-Bromofluorobenzene	(SURR)	28.05	696	94278	227.27	NG	100

* Compound is ISTD

002692

TOTAL ION CHROMATOGRAM



Data File: >F4619::U3
Name: 860105 BNA F
Misc: QC4225A ,QA4228,S,30.00,1

ETL#24

Id File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:33

Operator ID: JH2180
Quant Time: 860106 14:02
Injected at: 860106 08:40

002693

QUANT REPORT

Operator ID: JH2180
Output File: >F4619::AQ
Data File: >F4619::U3
Name: 860105 BNA F
Misc: QC4228A ,QA4228,S,30.00,1

Quant Rev: 4
Quant Time: 860106 14:02
Injected at: 860106 08:40
Dilution Factor: 1.00

BTL#24

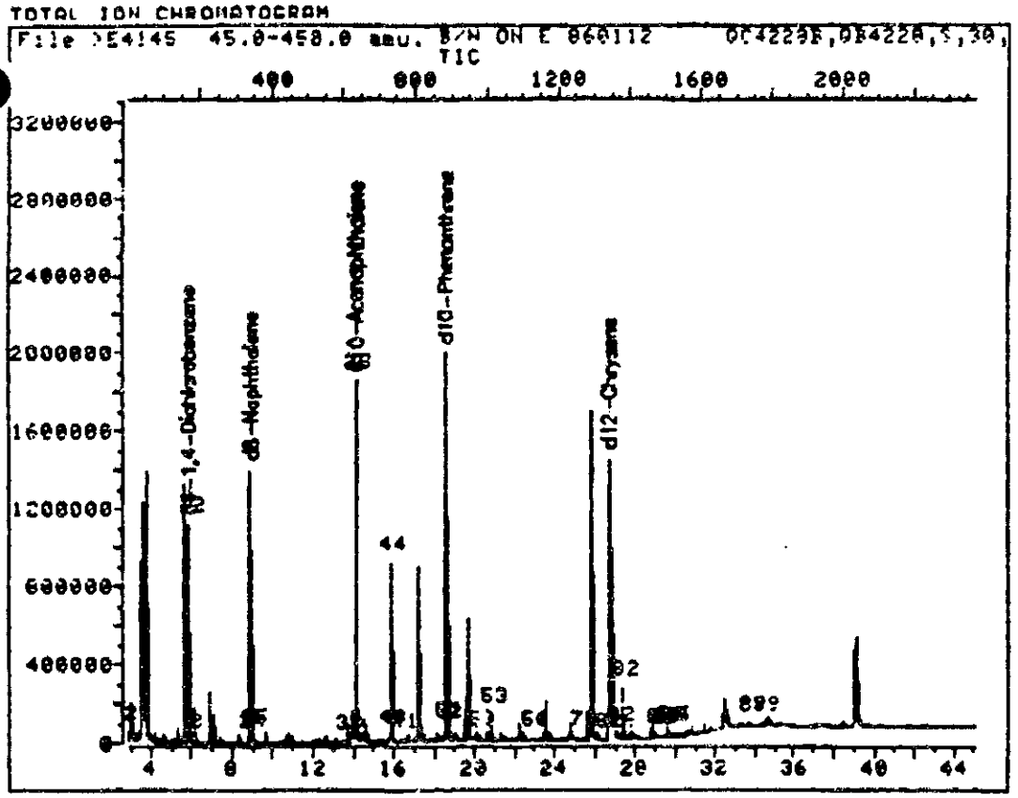
ID File: FACID::US
Title: PP/ACID IDFILE...INST. F
Last Calibration: 860106 11:37

	Compound	R.T.	Scan#	Area	Conc	Units	Q
1)	*d4-1,4-Dichlorobenzene	7.80	319	33041	40.00	UG/ML	88
10)	*d8-Naphthalene	11.22	512	74465	40.00	UG/ML	95
18)	*d10-Acenaphthalene	16.63	817	45053	40.00	UG/ML	96
24)	*d10-Phenanthrene	21.21	1075	99903	40.00	UG/ML	99

* Compound is ISTD

002694

TOTAL ION CHROMATOGRAM



Data File: >E4145::U5
Name: B/N ON E 860112
Misc: QC4228B,QB4228,5,30,1 BTL# 6

Id File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

Operator ID: WW9928
Quant Time: 860113 11:38
Injected at: 860113 03:14

002695

QUANT REPORT

Operator ID: WW9928 Quant Rev: 5 Quant Time: 860113 11:38
Output File: ^E4145::AQ Injected at: 860113 03:14
Data File: >E4145::US Dilution Factor: 1.00
Name: B/N ON E 860112
Misc: QC42288,QB4228,S,30,1 BTL# 6

ID File: EBNP::US
Title: B/N+PEST ID FILE .... FOR E 850326
Last Calibration: 860113 11:36

	Compound	R.T.	Scan#	Area	Conc	Units	q
1)	*d4-1,4-Dichlorobenzene	5.85	169	368447	40.00	UG/ML	99
2)	~~N-Nitrosodimethylamine~~	~~2.93~~	~~4~~	~~2426~~	~~474.52~~	~~UG/ML~~	100
3)	~~Benzyl alcohol~~	~~6.26~~	~~192~~	~~8613~~	~~.51~~	~~UG/ML~~	87
12)	~~bis(2-Chloroisopropyl)ether~~	~~5.89~~	~~169~~	~~13740~~	~~5.07~~	~~UG/ML~~	99
17)	*d8-Naphthalene	8.88	340	1775324	40.00	UG/ML	93
~~24)~~	~~1,2,4-Trichlorobenzene~~	~~8.81~~	~~338~~	~~7674~~	~~.28~~	~~UG/ML~~	99
~~29)~~	~~Naphthalene~~	~~8.95~~	~~343~~	~~4687~~	~~.13~~	~~UG/ML~~	93
29)	*'10-Acenaphthalene	14.09	634	1378682	40.00	UG/ML	94
~~33)~~	~~Dimethyl phthalate~~	~~13.61~~	~~607~~	~~3385~~	~~.09~~	~~UG/ML~~	71
~~33)~~	~~Dimethyl phthalate~~	~~14.09~~	~~634~~	~~243961~~	~~6.17~~	~~UG/ML~~	66
~~35)~~	~~2,6-Dinitrotoluene~~	~~14.09~~	~~634~~	~~172607~~	~~16.52~~	~~UG/ML~~	54
~~40)~~	~~Diethyl phthalate~~	~~15.79~~	~~730~~	~~22463~~	~~.97~~	~~UG/ML~~	93
~~41)~~	~~Fluorene~~	~~16.43~~	~~766~~	~~1269~~	~~.05~~	~~UG/ML~~	81
~~44)~~	~~N-Nitrosodiphenylamine~~	~~19.85~~	~~933~~	~~5786~~	~~.25~~	~~UG/ML~~	90
47)	*d10-Phenanthrene	18.55	885	2866028	40.00	UG/ML	98
~~51)~~	~~Phenanthrene~~	~~18.60~~	~~888~~	~~10194~~	~~.18~~	~~UG/ML~~	94
~~52)~~	~~Anthracene~~	~~18.60~~	~~888~~	~~10194~~	~~.18~~	~~UG/ML~~	92
~~53)~~	~~Di-n-butyl phthalate~~	~~20.23~~	~~980~~	~~9854~~	~~.16~~	~~UG/ML~~	92
~~53)~~	~~Di-n-butyl phthalate~~	~~20.84~~	~~1014~~	~~182206~~	~~2.99~~	~~UG/ML~~	97
~~54)~~	~~Fluoranthene~~	~~22.90~~	~~1130~~	~~5422~~	~~.06~~	~~UG/ML~~	93
~~56)~~	~~Pyrene~~	~~22.90~~	~~1130~~	~~3422~~	~~.06~~	~~UG/ML~~	93
64)	*d12-Chrysene	26.68	1343	1855287	40.00	UG/ML	100
~~78)~~	~~Butyl benzyl phthalate~~	~~25.35~~	~~1268~~	~~4469~~	~~.14~~	~~UG/ML~~	79
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~26.50~~	~~1337~~	~~1391~~	~~.03~~	~~UG/ML~~	94
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~27.15~~	~~1369~~	~~4589~~	~~.10~~	~~UG/ML~~	87
~~82)~~	~~bis(2-Ethylhexyl)phthalate~~	~~27.33~~	~~1379~~	~~234144~~	~~5.34~~	~~UG/ML~~	93
~~83)~~	~~Di-n-octyl phthalate~~	~~29.12~~	~~1480~~	~~7817~~	~~.14~~	~~UG/ML~~	94
~~85)~~	~~Di-n-octyl phthalate~~	~~29.41~~	~~1496~~	~~1286~~	~~.02~~	~~UG/ML~~	88
~~85)~~	~~Di-n-octyl phthalate~~	~~29.64~~	~~1509~~	~~4568~~	~~.08~~	~~UG/ML~~	60
84)	~~Benzo(b)fluoranthene~~	~~29.89~~	~~1523~~	~~3362~~	~~.10~~	~~UG/ML~~	82
~~85)~~	~~Benzo(k)fluoranthene~~	~~29.89~~	~~1523~~	~~3362~~	~~.11~~	~~UG/ML~~	81
~~86)~~	~~Benzo(a)pyrene~~	~~29.89~~	~~1523~~	~~3362~~	~~.11~~	~~UG/ML~~	82
~~87)~~	~~Indeno(1,2,3-c,d)pyrene~~	~~33.67~~	~~1735~~	~~8825~~	~~.29~~	~~UG/ML~~	92
~~88)~~	~~Dibenzo(a,h)anthracene~~	~~33.71~~	~~1737~~	~~2886~~	~~.31~~	~~UG/ML~~	91
~~89)~~	~~Benzo(ghi)perylene~~	~~33.67~~	~~1735~~	~~8825~~	~~.35~~	~~UG/ML~~	94
~~89)~~	~~Benzo(ghi)perylene~~	~~34.40~~	~~1776~~	~~8380~~	~~.33~~	~~UG/ML~~	92

* Compound is ISTD

NO PCB'S Found.

DMS 1/16/86

002696

Appendix E

Chain-of Custody Forms

1) A field Chain-of-Custody form (CC1) is included for all samples shipped by ETC shuttle.

2) An in-house sample Chain-of Custody form is included for all samples not shipped by ETC shuttle.

3) Any additional Chain-of-Custody material provided by a client or by a client's sampling agent is also included.

4) A subcontractor's Chain-of-Custody form is included for any analytical work not performed within ETC's laboratory.

5) Analysis and Extraction Custody forms are included for the period the sample was in ETC's possession.

002697

ETC ENVIRONMENTAL TESTING and CERTIFICATION

CHAIN OF CUSTODY FORM (CC1)

Seal No. 47011 ETC Job # K8485

Date Sealed 12/10/85 By: R. Rivera

Company: Resource Eng.

Facility/Site:

Address: 3000 Richmond Ave.
Houston Tx 77098

Attn.: Chis Itin

Phone: (713) 520-9900

SAMPLE IDENTIFICATION

Facility: RES 2881-014 | CLARKE LAKE SEDIMENT

Facility/Site Code (Optional Sample Point Descriptions)

Sample Point: 616 | B-L3 | 85 12 19

Source Code (from below) | Your Sample Point ID (left justify) | Start Date (YY/MM/DD) | Start Time (2400 hr clock) | Elapsed Hours (composite)

Source Codes: 0.

Well (W) Outfall (O) Bottom Sediment (B) Surface Impoundment (I) Leachate Collection Sys. (C) Other (X)

Soil (S) River/Stream (R) Generation Point (G) Treatment Facility (T) Lake/Ocean (L) Specify

SHUTTLE CONTENTS

BOTTLE				ANALYSIS	SAMPLER		LAB
No	Type	Size	Preserv.		Filt. (Y/N)	Observations	Observations
1	A	1 l	Baked	ExTbl			½ EMPTY
2	F	40 ml	Baked	VOA			

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) JOHN BINS Date: 12/11/85 Time: 6:00 PM
Signature: John Bins Seal #: 047011 Intact: Y

2. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

3. I have received these materials in good condition from the above person.
Name: Signature:
Date: Time: Remarks:

4. Shuttle Sealed By: (print) JOHN BINS Date: 12/19/85 Time: 6:30 PM
Signature: John Bins Seal #: 0047012 Intact: YES

ETC USE ONLY Opened By: [signature] Date: 12 20 85 Time: 400

ORIGINAL Seal #: 47012 Condition: INTACT

002698

ETC ENVIRONMENTAL TESTING and CERTIFICATION

FIELD PARAMETER FORM (CC2)

ETC JOB # K 84/85

Sample Point B (Source Code) L3 (Sample Point I.D)

FIELD PROCEDURES

PURGE DATE (XX MM DD) | START PURGE (2400 Hr Clock) | ELAPSED HRS | WATER VOL. IN CASING (Gallons) | VOLUME PURGED (Gallons)

SAMPLING METHOD: PETERSON DREDGE

Sampler Type: A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other _____ (SPECIFY OTHER)

Sampler Material: A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other _____ (SPECIFY OTHER)

Tubing Material: A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other _____ (SPECIFY OTHER)

Sample Composited Y/N _____ Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl) | Well Depth (ft)

Depth to Ground water (ft) | Sample Depth (non-well) (ft)

Groundwater Elevation (ft msl)

1st	ph (STD)	1st	spec. cond. um/cm at 25° C	(other parameter)	value	units
2nd	ph (STD)	2nd	spec. cond. um/cm at 25°C	(other parameter)	value	units
3rd	ph (STD)	3rd	spec. cond. um/cm at 25°C	(other parameter)	value	units
4th	ph (STD)	4th	spec. cond. um/cm at 25°C	(other parameter)	value	units

Sample Temp (°C) | Turbidity NTU

FIELD COMMENTS

Sample Appearance:

Weather Conditions:

Other:

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: JOHN BINS (Print) Employer: RESOURCE ENGINEERING INC

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

12/19/85 (Date) John Bins (Signature)

ORIGINAL

002600

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: Sample Preparation Department

Sample Number	Log Link	Sample Weight (gm)	Extract Vol. (ml) BN	Extract Vol. (ml) ACID	Comments
* ~~K4174~~	~~12865~~	~~29.95~~			~~PP/ORG/PST/PCB~~
+ J8439	12825	30.02	5.0	1.0	
K8484	12847	29.51	1.0	1.0	
K8485	↓	29.27	1.0	1.0	↓
K8171	12847	30.00	1.0	1.0	PP/ORG/PST/PCB CMPD/BN
* ~~K8172~~		~~30.01~~			RESOXHLET AT 3.0 grams. MG 12/30
K8173		30.00	1.0	1.0	
K8174		30.01	1.0	1.0	
K8175		29.95	1.0	1.0	
K8176	↓	28.15	1.0	1.0	↓
K3246	11759	30.60	1.0		PP/BN
J2204	12890	31.01	1.0		BN+15
J2205		30.16	1.0		
J2206		30.79	1.0		
J2207		30.24	1.0		
J2208	↓	30.10	1.0		↓ ↓
QC 4228			1.0	1.0	
~~K8173~~ ~~K 81 7[illegible]3~~ S		22.72	1.0	1.0	
K 8174 R		~~20.38~~ 24.84	D.V. 12137 1.0	1.0	

QC Batch # 4228

Analysis PP/ACID

1-2 PP/BN

Matrix Soil

Turnaround Normal

Date 12/24/87

Extraction Method:

Sep. Funnel

Continuous

Soxhlet ✓

Other

COMMENTS

Log 12847 Cmpd/BN:
Benzyl Aldehyde
Benzoic Acid
Catechol (O-Hydroxybenzene)
- Spec Sheet #930
Benzyl Alcohol

*K 4174 } RESOXHLET AT 3.0 grams. MG 12/30
*K 8172 }

+ F.V 5.0 ml a 1 ml Aliquot was packaged

FRACTION	SPIKE Amt (ml)	Conc.	Lot #
BN	1.0	100 ug/ml	12,098
ACID	1.0	100 ug/ml	11,825
Arochlor 1260	1.0	100 ug/ml	12,097
Pest	1.0	100/200 ug/ml	12,059
Spec #930 BN Spike	1.0	100 ug/ml	12,137
Semi-VOA			

SURROGATE Amt. (ml)	Conc.	Lot #
1.0	BN: 50 ug/ml ACID: 100 ug/ml	12,093

Set-up: L.M. Zok 12/27/85 J. Vajda 12-27-85 UPD/Supervisor: Mara Gualon 1/2/88

BN Conc.: Judie C 12/30/85 Acid Conc.: L.M. Zok 1/2/86 Spike/Surr. Verified: Mina Gandhi 12/27/85

ETC FORM 6110

002700

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/5/86 SHIFT
FRACTION Acid; BNA
INSTRUMENT F
TUNE FILE MTF001
SEQUENCE FILE JHF
METHOD FILE AcidF; BNPF
ID FILE FAcid; FBNA
ANALYST(S) J. Hendl
SUPERVISOR
BATCH #'s QC4159, QA4228

STANDARD	CONC PPM	LOT NO.	LOT VOL.
Int Std	400	12,008	100 ml
B/N Cal std		12,110	1 ml
B/N Cal std II		12,111	
B/N Cal std III		11,906	
Acid cal std I		12,020	
Acid cal std II		12,021	
Acid cal std III		12,022	
Spec #930	60	12,140	
Spec #930	100	12,139	
Spec #930	300	12,138	
DFTPP	25	11,972	

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACO	JH 1/5	DATE	1/6
WIP		BY	

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP-60ng std.	>F4595					OK	
B/N Cal std III	F4596		1				
B/N Cal std II	F4597		2				
B/N Cal std I	F4598		3				
Acid cal std III	F4599		4				
Acid cal std II	F4600		5				
Acid cal std I	F4601		6				
Spec #930; 300ppm	F4602		7				
Spec #930; 100ppm	F4603		8				
Spec #930; 60ppm	F4604		9				
DFTPP-50ng std.	F4605		10			OK	
K8322CS	F4606		11				
QC4159C	F4607		12			BNHSAc+1	Y
K8323C	F4608		13			BNHS Ac+1	Y
K8323CR	F4609		14				
K8320C	F4610		15			BNHS Ac+1	Y
K8322C	F4611		16			Ac+1	Y
K8321C	F4612		17			Ac+1	Y
K8325C	F4613		18			Ac+1	Y
K8324C	F4614		19			Ac+1	Y
GPC BLANK	F4615		20				
K8173AS	F4616		21				
DFTPP-50ng std.	F4617		22			OK	
Acid cal std II	F4618		23			CBCHK-OK	
QC4228A	F4619		24				

ETC FORM #102

002701

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE _____
METHOD FILE _____
ID FILE _____
ANALYST(S) J. Hewette-RH
SUPERVISOR [signature]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8174A	>F4620		25				
K8174AR	F4621		26				
K8173A	F4622		27				
K8175A ~~K8176A~~	F4623		28				
K8171A	F4624		29				
J8439A	F4625		30				
K8176A	F4626		31				
K8484A	F4627		32				
K8485A	F4628		33				

002702

ETC FORM #102

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1-7-86 SHIFT
FRACTION VOA
INSTRUMENT D
TUNE FILE APEI02
SEQUENCE FILE RRD/SJD
METHOD FILE VOAD
ID FILE DVOA
ANALYST(S) Rodger M. Reed

SUPERVISOR [illegible]
BATCH #'s QX4233

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	1/8/86
WIP		BY	SJ

STANDARD	CONC PPM	LOT NO.	LOT VOL.
P-BFB	50	12151	1ul
Surrogate	25ppm	12019	10ul
Internal	25	12166	10ul
ABC/SCVOA	18	12141-B	5,10,30
O,M+P Chlorotoluene	18		5,10,30

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
P-BFB	>D3789	1ul			E00298	NG	
P-BFB	>D3790	1ul			E00299	N/G	
P-BFB	>D3791	1ul				Tuned	
P-BFB	>D3792	1ul			OK	0757	
QC4233V	>D3793	5ml	3		OK	0903	Y
QC4233VS	>D3794		4			5UL ABC/Chlorotoluene	
QC4233VS	>D3795		5			10	
QC4233VS	>D3796		6			30	
P-BFB	>D3797	1				13:17	
K8560VS	>D3798	1.0	1		OK	5UL ABC/Citoluene	
K8560V	>D3799	1.0	2		OK	Cmpd/VOA	
K8559V	>D3800	0.1	3		OK	Cmpd/VOA	
K8559VR	>D3801	0.1	4		OK		
K8485V	>D3802	0.1	5		Too Dilute	Run at 1.0 (Extend Run time)	
K8558V	>D3803	0.1	6		OK	Cmpd/VOA	
J2205V	>D3804	0.1	7		OK	VO+15	Y
J2204V	>D3805	0.1	8		Too dilute	Rerun 1.0 (Extend Run time)	
J2203V	>D3806	0.1	9		Too dilute	Rerun 1.0	
J2202V	>D3807	0.1	10		Too dilute	Rerun 1.0 grace	
(R) K8485V	>D3808	1g	1		OK		
(R) J2204V	>D3809	1g	2		OK		Y
QC4233VS	>D3810	5ml	3		OK	5ul ABC + chlorotoluene	0 13
P-BFB	>D3811	1ul				1:25	
J2202	>D3812	1g	1		OK		Y
J2203	>D3813	1g	2		OK		Y

ETC FORM #102

002703

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1-9-86 SHIFT
FRACTION VOA
INSTRUMENT D
TUNE FILE APE I02
SEQUENCE FILE 220
METHOD FILE VOAD
ID FILE DVOA
ANALYST(S)
SUPERVISOR
BATCH #'s

STANDARD	CONC PPM	LOT NO.	LOT VOL
See Page #1			

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACO		DATE	
WIP		BY	

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
J2206V	>D3814	.1g	3		NG	Rerun 1gram Leave Extended run time	
J2207V	>D3815		4		NG	Rerun 1gram "	"
J2208V	>D3816		5		NG	Rerun 1gram	
K8407V	>D3817	.1g	6		OK		Y
GC4233V	>D3818	1gm	7		OK		
® J2206V	>D3819		8		NG	Rerun in new batch	Y
® J2207V	>D3820		9		OK		Y
® J2208V	>D3821		10		OK		Y

ETC FORM 6102

002704

TESTING and CERTIFICATION

LABORATORY CHRONICLE: Sample Preparation Department

Sample Number	Log Link	Sample Weight (gm)	Extract Vol. (ml) BN	Extract Vol. (ml) ACID	Comments
* ~~K4174~~	~~12865~~	~~29.95~~			~~PP/ORG/PST/PCB~~ RESOXHLET AT 3.0 gram MG 12/30
J8439	12825	30.02	5.0	1.0	
K8484	12847	29.51	1.0	1.0	
K8485		29.27	1.0	1.0	
K8171	12847	30.00	1.0	1.0	PP/ORG/PST/PCB CMPD/BN
* ~~K8172~~		30.01			RESOXHLET AT 3.0 gram MG 12/30
K8173		30.00	1.0	1.0	
K8174		30.01	1.0	1.0	
K8175		29.95	1.0	1.0	
K8176		28.15	1.0	1.0	
K3246	11759	30.60	1.0		PP/BN
J2204	12890	31.01	1.0		BN+15
J2205		30.16	1.0		
J2206		30.19	1.0		
J2207		30.24	1.0		
J2208		30.15	1.0		
QC 4228			1.0	1.0	
~~K8173~~ ~~K8173~~ S		22.72	1.0	1.0	
K8174 R		~~20.38~~ 24.84	1.0	1.0	

QC Batch # 4228

Analysis PP/ACID

1-2 PP/BN

Matrix Soil

Turnaround Normal

Date 12/24/85

Extraction Method:

Sep. Funnel

Continuous

Soxhlet ✓

Other

COMMENTS

Log 12847 Cmpd/BN:
Benzyl Aldehyde
Benzoic Acid
Catechol (O-Hydroxybenzene)
- Spec Sheet #930
Benzyl Alcohol

*K4174 } RESOXHLET AT 3.0 grams. MG 12/30
*K8172 }

+ F.V 5.0 ml a 1 ml Aliquot was packaged

MT 8501

FRACTION	SPIKE Amt (ml)	Conc.	Lot #
BN	1.0	100 ug/ml	12,098
ACID	1.0	100 ug/ml	11,825
Aroclor 1260	1.0	100 ug/ml	12,097
Pest	1.0	100/250 ug/ml	12,059
Spec #930 BN spike	1.0	100 ug/ml	12,137
Semi-VOA			

SURROGATE Amt. (ml)	Conc.	Lot #
1.0	BN: 50 ug/ml ACID: 100 ug/ml	12,093

Set-up: L.M. Zyk 12/24/85 J. Vejda 12-27-85 UPD/Supervisor: Marc Quaglia 1/2/86

BN Conc.: Giulio C 12/30/85 Acid Conc.: L.M. Zyk 12/30/85 Spike/Surr. Verified: Mina Gandhi 12/27/85

ETC FORM #110

002705

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE 1/8/86 SHIFT
FRACTION B/N
INSTRUMENT "I"
TUNE FILE MTI001
SEQUENCE FILE MBI
METHOD FILE BNPI.
ID FILE IBNP, ISPPJ*
ANALYST(S) M Barkley

SUPERVISOR [signature]
BATCH #'s QB4228, QP0002, QP0007

*ID File for QCP0002 and QCP0007.
PLEASE INITIAL

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	Jan. 9th 1986
WIP		BY	KV

to ISTPJ, CB-file: CBISPJ

STANDARD	CONC PPM	LOT NO.	LOT VOL.
INT. STD	400	12008	
DFTPP	25	11972	
BN IV	150	12112	
BN III	200	11906	
BN II	100	12111	
BN I	60	12110	
HSLPP/BN III	300	11837	
" II	100	11838	
" I	30	11839	
SPEC. 930 III	300	12138	
930 II	100	12139	
930 I	60	12140	
o,m,p-nitrotoluene III	500	11244	
II	~~100~~ 300	11245	
I	100	11246	

U5, U6, U7, U8.

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
DFTPP-50ng	>I2031		1	OW		-Lowered EMV ↓ to 1600.	
BN IV - 150ppm	>I2032		2		I00373		
BN III - 200ppm	>I2033		3				
BN II - 100ppm	>I2034		4			AR1260	
BN I - 60ppm	>I2035		5				
HSLPP/BN - 300ppm	>I2036		6				
HSLPP/BN - 100ppm	>I2037		7		for 2-Methylnaphthalene in IS00J		
HSLPP/BN - 30ppm	>I2038		8			ID File:	
SPEC. 930 - 300ppm	>I2039		9				
SPEC. 930 - ~~300ppm~~ 100ppm	>I2040		10				
SPEC. 930 - 60ppm	>I2041		11				
o,m,p-nitrotoluene 500ppm	>I2042		12		↓		
o,m,p-nitrotoluene 300ppm	>I2043		13		I00374		
o,m,p-nitrotoluene 100ppm	>I2044		14				
DFTPP-50ng	>I2045		15	OK			
QC4183B	>I2046		16			QB4183	
QCP0002B	>I2047		17				
QCP0002BS	>I2048		18				
Lt. #2-3	>I2049		19			Lt. #2-3	
QCP0007B	>I2050		20				
QCP0007BS	>I2051		21		"		
Lt. #1	>I2052		22				
QCP0007B1	>I2053		23			QC1	
K4572B	>I2054		24	X10		QB4241	
K4583B	>I2055		25	X10	↓	QB4241	

002706

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE see
METHOD FILE _____
ID FILE _____
ANALYST(S) [signature]
SUPERVISOR [signature]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.
see page			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K4585B	>I2056		26	X20	I00374	QB4241	
K4585BS	>I2057		27	X20		QB4241	
DFTPP-50ng	>I2058		28				
BN II - 100ppm	>I2059		29				
K7562B	>I2060		30	X5	I00375	QB4243	
K7559B	>I2061		31	X5		QB4243	
K7561B	>I2062		32	X5		QB4243	
K7551B	>I2063		33			QB4242	
K7553B	>I2064		34				
K7554B	>I2065		35				
K7545B	>I2066		36				
K7544B	>I2067		37				
K7550B	>I2068		38				
K7557B	>I2069		39				
K7556B	>I2070		40				
DFTPP-50ng	>I2071		41				
BN II - 100ppm	>I2072		42				
QC4228B	>I2073		43			PCBSCR	PB
K8173BS	>I2074		44			AR1260	
J8439B	>I2075		45			PCBSCR	
K8484B	>I2076		46				
K8485B	>I2077		47		I00376		
K8171B	>I2078		48				
K8173B	>I2079		49				
K8174B	>I2080		50				

002707

ETC FORM 8102

ETC ENVIRONMENTAL TESTING and CERTIFICATION

LABORATORY CHRONICLE: GC-MS Department

DATE _____ SHIFT _____
FRACTION _____
INSTRUMENT _____
TUNE FILE _____
SEQUENCE FILE per
METHOD FILE per
ID FILE _____
ANALYST(S) [illegible]
SUPERVISOR [illegible]
BATCH #'s _____

(PLEASE INITIAL)

CURRENT CS05 STATUS		STANDARDS UPDATED	
ACQ		DATE	
WIP		BY	

STANDARD	CONC PPM	LOT NO.	LOT VOL.
per page			

NAME	DATA FILE	uL INJ	ALS #	DIL	TAPE #	SPECIALS (WRITE A-TYPE)	PLUS Y/N
K8174BR	>I2081		51		I00376	pcB55R	
K8175B	>I2082		52				
K8176B	>I2083		53				
DFTPP-50ng	>I2084		54				
BN II - 100ppm	>I2085		55				
K3246B	>I2086		56				
J2204B	>I2087		57				PB
J2205B	>I2088		58				
J2206B	>I2089		59				
J2207B	>I2090		60				
J2208B	>I2091		61				

002708

Technical Report

for

RESOURCE ENGINEERING

11 GREENWAY PLAZA

HOUSTON, TX 77406

002709

BRAZOS RIVER - UPSTREAM

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No	Company	Facility	Sample Point	Date	Time
E9434	RESOURCE ENGINEERING	RESSHER	RUPSTREAM	840628	153

Denis C. K. Lin, Ph.D

Vice President
Research and Operations

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 20, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l *	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1V	Acrolein	ND	100	ND	ND	ND	1600	96	ND	1600	100
2V	Acrylonitrile	ND	100	ND	ND	ND	160	53.	ND	160	70.
3V	Benzene	ND	10	ND	ND	ND	36	96	ND	36	111
4V	bis(Chloromethyl)ether	ND	10	ND	ND	ND	0	-	ND	0	-
5V	Bromoform	ND	10	ND	ND	ND	36	97	ND	36	118
6V	Carbon tetrachloride	ND	10	ND	ND	ND	36	100	ND	36	115
7V	Chlorobenzene	ND	10	ND	ND	ND	36	95	ND	36	109
8V	Chlorodibromomethane	ND	10	ND	ND	ND	36	99	ND	36	126
9V	Chloroethane	ND	10	ND	ND	ND	36	97	ND	36	111
10V	2-Chloroethylvinyl ether	ND	10	ND	ND	ND	36	78	ND	36	87
11V	Chloroform	ND	10	ND	ND	BMDL	36	88	ND	36	190
12V	Dichlorobromomethane	ND	10	ND	ND	ND	36	98	ND	36	161
13V	Dichlorodifluoromethane	ND	10	ND	ND	ND	0	-	ND	0	-
14V	1,1-Dichloroethane	ND	10	ND	ND	ND	36	96	ND	36	111
15V	1,2-Dichloroethane	ND	10	ND	ND	ND	36	94	ND	36	110
16V	1,1-Dichloroethylene	ND	10	ND	ND	ND	36	93	ND	36	98
17V	1,2-Dichloropropane	ND	10	ND	ND	ND	36	96	ND	36	111
18V	cis-1,3-Dichloropropylene	ND	10	ND	ND	ND	36	97	ND	36	108
19V	Ethylbenzene	ND	10	ND	ND	ND	36	95	ND	36	109
20V	Methyl bromide	ND	10	ND	ND	ND	36	108	ND	36	115
21V	Methyl chloride	ND	10	ND	ND	ND	36	97	ND	36	107
22V	Methylene chloride	ND	10	ND	ND	BMDL	36	56	ND	36	74
23V	1,1,2,2-Tetrachloroethane	ND	10	ND	ND	ND	36	91	ND	36	115
24V	Tetrachloroethylene	ND	10	ND	ND	ND	36	96	ND	36	103
25V	Toluene	ND	10	ND	ND	BMDL	36	83	ND	36	103
26V	1,2-Trans-dichloroethylene	ND	10	ND	ND	ND	36	99	ND	36	110
27V	1,1,1-Trichloroethane	ND	10	ND	ND	ND	36	97	ND	36	112
28V	1,1,2-Trichloroethane	ND	10	ND	ND	ND	36	95	ND	36	111
29V	Trichloroethylene	ND	10	ND	ND	ND	36	96	ND	36	107
30V	Trichlorofluoromethane	ND	10	ND	ND	ND	36	96	ND	36	112
31V	Vinyl chloride	ND	10	ND	ND	ND	36	100	ND	36	114

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 21, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l *	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
	trans-1,3-Dichloropropylene	ND	10	ND	ND	ND	36	100	ND	36	107

* EPA published Method Detection Limit.

B Recovery normally variable using EPA Protocol Method 624.

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Acid Compounds - GC/MS Analysis Data (QR02)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l [a]	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1A	2-Chlorophenol	ND	25	ND	ND	ND	150	78	ND	150	57
2A	2,4-Dichlorophenol	ND	25	ND	ND	ND	150	95	ND	150	53
3A	2,4-Dimethylphenol	ND	25	ND	ND	ND	150	2[b]	ND	150	0[b]
4A	4,6-Dinitro-o-cresol	ND	250	ND	ND	ND	250	88	ND	250	75
5A	2,4-Dinitrophenol	ND	250	ND	ND	ND	250	110	ND	250	130
6A	2-Nitrophenol	ND	25	ND	ND	ND	150	78	ND	150	70
7A	4-Nitrophenol	ND	25	ND	ND	ND	150	71	ND	150	86
8A	p-Chloro-m-cresol	ND	25	ND	ND	ND	150	67	ND	150	25[c]
9A	Pentachlorophenol	ND	25	ND	ND	ND	150	106	ND	150	86
10A	Phenol	ND	25	ND	ND	ND	150	77	ND	150	45
11A	2,4,6-Trichlorophenol	ND	25	ND	ND	ND	150	101	ND	150	76

[a] EPA published Method Detection Limit

[b] Recovery normally low using EPA Protocol Method 625.

[c] Recovery low due to sample matrix interference

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen ug/l	MDL ug/l a	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1B	Acenaphthene	ND	10	ND	ND	ND	100	104	ND	105	100
2B	Acenaphthylene	ND	10	ND	ND	ND	100	101	ND	105	100
3B	Anthracene	ND	10	ND	ND	ND	100	67	ND	105	81
4B	Benzidine	ND	10	ND	ND	ND	100	0a	ND	105	0a
5B	Benzo(a)anthracene	ND	10	ND	ND	ND	100	133	ND	105	126
6B	Benzo(a)pyrene	ND	10	ND	ND	ND	100	128	ND	105	133
7B	Benzo(b)fluoroanthene	ND	10	ND	ND	ND	100	160	ND	105	153
8B	Benzo(ghi)perylene	ND	10	ND	ND	ND	0	-	ND	0	-
9B	Benzo(k)fluoranthene	ND	10	ND	ND	ND	100	124	ND	105	114
10B	bis(2-Chloroethoxy)methane	ND	10	ND	ND	ND	100	65	ND	105	87
11B	bis([illegible] Chloroethyl) ether	ND	10	ND	ND	ND	100	100	ND	105	246a
12B	bis([illegible]-Chloro isopropyl)ether	ND	10	ND	ND	ND	100	306a	ND	105	107a
13B	bis(2-Ethyl[illegible]yl)phthalate	BMDL	10	135	44	BMDL	100	103	ND	105	230a
14B	4-Bromophen[illegible] phenyl ether	ND	10	ND	ND	ND	100	65	ND	105	81
15B	Butyl benzyl phthalate	ND	10	ND	ND	ND	100	110	ND	105	94
16B	2-Chloronaphthalene	ND	10	ND	ND	ND	100	80	ND	105	87
17B	4-Chlorophenyl phenyl ether	ND	10	ND	ND	ND	100	105	ND	105	95
18B	Chrysene	ND	10	ND	ND	ND	100	102	ND	105	86
19B	Dibenzo(a,h)anthracene	ND	10	ND	ND	ND	0	-	ND	0	-
20B	1,2-Dichlorobenzene	ND	10	ND	ND	ND	100	33a	ND	105	52a
21B	1,3-Dichlorobenzene	ND	10	ND	ND	ND	100	30a	ND	105	45a
22B	1,4-Dichlorobenzene	ND	10	ND	ND	ND	100	33a	ND	105	47a
23B	3,3'-Dichlorobenzidine	ND	10	ND	ND	ND	100	17a	ND	105	21a
24B	Diethyl phthalate	[illegible]	10	ND	ND	ND	100	6a	ND	105	44a
25B	Dimethyl phthalate	ND	10	ND	ND	ND	100	1	ND	105	12
26B	Di-n-butyl phthalate	ND	10	ND	ND	BMDL	100	60	ND	105	80
27B	2,4-Dinitr[illegible]	ND	10	ND	ND	ND	100	74	ND	105	88
28B	2,6-Dinitr[illegible]	[illegible]	10	ND	ND	ND	100	98	ND	105	100
29B	[illegible]	[illegible]	10	ND	ND	ND	100	137	ND	105	117
30B	[illegible]	[illegible]	10	ND	ND	ND	100	92	ND	105	90
31B	[illegible]	[illegible]	10	ND	ND	ND	100	62	ND	105	90

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l A	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
32B	Fluorene	ND	10	ND	ND	ND	100	95	ND	105	94
33B	Hexachlorobenzene	ND	10	ND	ND	ND	100	107	ND	105	87
34B	Hexachlorobutadiene	ND	10	ND	ND	ND	100	14B	ND	105	43B
35B	Hexachlorocyclopentadiene	ND	10	ND	ND	ND	0	-	ND	0	-
36B	Hexachloroethane	ND	10	ND	ND	ND	100	16B	ND	105	32B
37B	Indeno(1,2,3-c,d)pyrene	ND	10	ND	ND	ND	0	-	ND	0	-
38B	Isophorone	ND	10	ND	ND	ND	100	83	ND	105	88
39B	Naphthalene	ND	10	ND	ND	ND	100	44	ND	105	54
40B	Nitrobenzene	ND	10	ND	ND	ND	100	83	ND	105	198
41B	N-Nitrosodimethylamine	ND	10	ND	ND	ND	0	-	ND	0	-
42B	N-Nitrosodi-n-propylamine	ND	10	ND	ND	ND	100	74	ND	105	77
43B	N-Nitrosodiphenylamine	ND	10	ND	ND	ND	100	127	ND	105	129
44B	Phenanthrene	ND	10	ND	ND	ND	100	81	ND	105	83
45B	Pyrene	ND	10	ND	ND	ND	100	108	ND	105	96
46B	1,2,4-Trichlorobenzene	ND	10	ND	ND	ND	100	209C	ND	105	197C

A EPA published Method Detection Limit

B Recovery normally low using EPA Protocol Method 625

D Recovery variable due to sample matrix interference

C Recovery normally variable using EPA Protocol Method 625

ETC ENVIRONMENTAL TESTING and CERTIFICATION

July 27, 1984

TABLE 1: QUALITATIVE RESULTS

Tentatively Identified Organic Compounds - GC/MS Analysis Data - Acid Fraction (QR07)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

Compound Name	Data			Identifiers				
	Scan Number	Retention Time (Min)	M.W.	CAS Number	Empirical Formula	Estimated Concen. ug/l		
1 Pentanoic Acid, 2,2,-Dimethyl-, Ethenyl ester	46	4 6	156	44970050	$C_9H_{16}O_2$	18		

ETC ENVIRONMENTAL TESTING and CERTIFICATION

July 27, 1984

TABLE 1: QUALITATIVE RESULTS

Tentatively Identified Organic Compounds – GC/MS Analysis Data – Base/Neutral Fraction (QR08)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9434	RESOURCE ENGINEERING	RES28801	RUPSTREAM	840628	1530	

Compound Name	Data			Identifiers				
	Scan Number	Retention Time (Min)	M.W.	CAS Number	Empirical Formula			
None Found								

Technical Report

for

RESOURCE ENGINEERING

11 GREENWAY PLAZA

HOUSTON, TX 77406

002717

BRAZOS RIVER - DOWNSTREAM

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RESSHER	RDOWNSTREAM	840628	1630	

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ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 24, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1V	Acrolein	ND	100	ND	ND	ND	1600	4.	ND	1600	14.
2V	Acrylonitrile	ND	100	ND	ND	ND	160	77.	ND	160	89.
3V	Benzene	ND	10	ND	ND	ND	36	95	ND	36	97
4V	bis(Chloromethyl)ether	ND	10	ND	ND	ND	0	-	ND	0	-
5V	Bromoform	ND	10	ND	ND	ND	36	92	ND	36	108
6V	Carbon tetrachloride	ND	10	ND	ND	ND	36	93	ND	36	96
7V	Chlorobenzene	ND	10	ND	ND	ND	36	103	ND	36	110
8V	Chlorodibromomethane	ND	10	1	ND	ND	36	100	ND	36	103
9V	Chloroethane	ND	10	ND	ND	ND	36	88	ND	36	89
10V	2-Chloroethylvinyl ether	ND	10	ND	ND	ND	36	62	ND	36	61
11V	Chloroform	ND	10	ND	ND	BMDL	36	91	ND	36	96
12V	Dichlorobromomethane	ND	10	ND	ND	ND	36	93	ND	36	96
13V	Dichlorodifluoromethane	ND	10	ND	ND	ND	0	-	ND	0	-
14V	1,1-Dichloroethane	ND	10	ND	ND	ND	36	97	ND	36	101
15V	1,2-Dichloroethane	ND	10	ND	ND	ND	36	98	ND	36	98
16V	1,1-Dichloroethylene	ND	10	ND	ND	ND	36	87	ND	36	91
17V	1,2-Dichloropropane	ND	10	ND	ND	ND	36	92	ND	36	96
18V	cis-1,3-Dichloropropylene	ND	10	ND	ND	ND	36	85	ND	36	93
19V	Ethylbenzene	ND	10	ND	ND	ND	36	99	2	36	101
20V	Methyl bromide	ND	10	ND	ND	ND	36	122	ND	36	104
21V	Methyl chloride	ND	10	ND	ND	ND	36	89	ND	36	94
22V	Methylene chloride	BMDL	10	6	1	BMDL	36	58	4	36	56
23V	1,1,2,2-Tetrachloroethane	ND	10	ND	ND	ND	36	77	ND	36	102
24V	Tetrachloroethylene	ND	10	1	ND	ND	36	85	1	36	88
25V	Toluene	ND	10	ND	ND	BMDL	36	86	ND	36	115
26V	1,2-Trans-dichloroethylene	ND	10	ND	ND	ND	36	87	ND	36	87
27V	1,1,1-Trichloroethane	ND	10	2	ND	ND	36	93	ND	36	97
28V	1,1,2-Trichloroethane	ND	10	ND	ND	ND	36	109	ND	36	116
29V	Trichloroethylene	ND	10	ND	ND	ND	36	113	ND	36	114
30V	Trichlorofluoromethane	ND	10	ND	ND	ND	36	89	ND	36	90
31V	Vinyl chloride	ND	10	ND	ND	ND	36	84	ND	36	93

002718

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 24, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Volatile Compounds - GC/MS Analysis Data (QR01)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES2880I	RDOWNSTREAM	840628	1630	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l *	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
	trans-1,3-Dichloropropylene	ND	10	ND	ND	ND	36	90	ND	36	90

* EPA published Method Detection Limit.

Recovery normally variable using EPA Protocol Method 624.

002719

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

Acid Compounds - GC/MS Analysis Data (QR02)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l A	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1A	2-Chlorophenol	ND	25	ND	ND	ND	150	78	ND	150	57
2A	2,4-Dichlorophenol	ND	25	ND	ND	ND	150	95	ND	150	53
3A	2,4-Dimethylphenol	ND	25	ND	ND	ND	150	2B	ND	150	0B
4A	4,6-Dinitro-o-cresol	ND	250	ND	ND	ND	250	88	ND	250	75
5A	2,4-Dinitrophenol	ND	250	ND	ND	ND	250	110	ND	250	130
6A	2-Nitrophenol	ND	25	ND	ND	ND	150	78	ND	150	70
7A	4-Nitrophenol	ND	25	ND	ND	ND	150	71	ND	150	86
8A	p-Chloro-m-cresol	ND	25	ND	ND	ND	150	67	ND	150	25C
9A	Pentachlorophenol	ND	25	ND	ND	ND	150	106	ND	150	86
10A	Phenol	ND	25	ND	ND	ND	150	77	ND	150	45
11A	2,4,6-Trichlorophenol	ND	25	ND	ND	ND	150	101	ND	150	76

A EPA published Method Detection Limit.

B Recovery normally low using EPA Protocol Method 625.

C Recovery low due to sample matrix interference.

002720

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l *	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
1B	Acenaphthene	ND	10	ND	ND	ND	100	104	ND	105	100
2B	Acenaphthylene	ND	10	ND	ND	ND	100	101	ND	105	100
3B	Anthracene	ND	10	ND	ND	ND	100	67	ND	105	81
4B	Benzidine	ND	10	ND	ND	ND	100	0[a]	ND	105	0[c]
5B	Benzo(a)anthracene	ND	10	ND	ND	ND	100	133	ND	105	126
6B	Benzo(a)pyrene	ND	10	ND	ND	ND	100	128	ND	105	133
7B	Benzo(b)fluoroanthene	ND	10	ND	ND	ND	100	160	ND	105	153
8B	Benzo(ghi)perylene	ND	10	ND	ND	ND	0	-	ND	0	-
9B	Benzo(k)fluoranthene	ND	10	ND	ND	ND	100	124	ND	105	114
10B	bis(2-Chloroethoxy)methane	ND	10	ND	ND	ND	100	65	ND	105	87
11B	bis(2-Chloroethyl) ether	ND	10	ND	ND	ND	100	100	ND	105	246[b]
12B	bis(2-Chloroisopropyl)ether	ND	10	ND	ND	ND	100	306[c]	ND	105	107[c]
13B	bis(2-Ethylhexyl)phthalate	BMDL	10	135	44	BMDL	100	103	ND	105	230[b]
14B	4-Bromophenyl phenyl ether	ND	10	ND	ND	ND	100	65	ND	105	81
15B	Butyl benzyl phthalate	ND	10	ND	ND	ND	100	110	ND	105	94
16B	2-Chloronaphthalene	ND	10	ND	ND	ND	100	80	ND	105	87
17B	4-Chlorophenyl phenyl ether	ND	10	ND	ND	ND	100	105	ND	105	95
18B	Chrysene	ND	10	ND	ND	ND	100	102	ND	105	85
19B	Dibenzo(a,h)anthracene	ND	10	ND	ND	ND	0	-	ND	0	-
20B	1,2-Dichlorobenzene	ND	10	ND	ND	ND	100	33[a]	ND	105	52[a]
21B	1,3-Dichlorobenzene	ND	10	ND	ND	ND	100	30[a]	ND	105	45[a]
22B	1,4-Dichlorobenzene	ND	10	ND	ND	ND	100	33[a]	ND	105	47[a]
23B	3,3'-Dichlorobenzidine	ND	10	ND	ND	ND	100	17[a]	ND	105	21[a]
24B	Diethyl phthalate	ND	10	ND	ND	ND	100	6[a]	ND	105	44[a]
25B	Dimethyl phthalate	ND	10	ND	ND	ND	100	1	ND	105	12
26B	Di-n-butyl phthalate	ND	10	ND	ND	BMDL	100	60	ND	105	80
27B	2,4-Dinitrotoluene	ND	10	ND	ND	ND	100	74	ND	105	88
28B	2,6-Dinitrotoluene	ND	10	ND	ND	ND	100	98	ND	105	100
29B	Di-n-octyl phthalate	ND	10	ND	ND	ND	100	137	ND	105	117
30B	1,2-Diphenylhydrazine	ND	10	ND	ND	ND	100	92	ND	105	90
31B	Fluoranthene	ND	10	ND	ND	ND	100	62	ND	105	90

002721

ETC ENVIRONMENTAL TESTING and CERTIFICATION

JUL 25, 1984

TABLE 1: QUANTITATIVE RESULTS and QUALITY ASSURANCE DATA

BASE/NEUTRAL COMPOUNDS - GC/MS ANALYSIS DATA (QR03)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

NPDES Number	Compound	Results		QC Replicate		QC Blank and Spiked Blank			QC Matrix Spike		
		Sample Concen. ug/l	MDL ug/l A	First ug/l	Second ug/l	Blank Data ug/l	Concen. Added ug/l	% Recov	Unspiked Sample ug/l	Concen. Added ug/l	% Recov
32B	Fluorene	ND	10	ND	ND	ND	100	95	ND	105	94
33B	Hexachlorobenzene	ND	10	ND	ND	ND	100	107	ND	105	87
34B	Hexachlorobutadiene	ND	10	ND	ND	ND	100	14B	ND	105	43B
35B	Hexachlorocyclopentadiene	ND	10	ND	ND	ND	0	-	ND	0	-
36B	Hexachloroethane	ND	10	ND	ND	ND	100	16B	ND	105	32B
37B	Indeno(1,2,3-c,d)pyrene	ND	10	ND	ND	ND	0	-	ND	0	-
38B	Isophorone	ND	10	ND	ND	ND	100	83	ND	105	88
39B	Naphthalene	ND	10	ND	ND	ND	100	44	ND	105	54
40B	Nitrobenzene	ND	10	ND	ND	ND	100	83	ND	105	198
41B	N-Nitrosodimethylamine	ND	10	ND	ND	ND	0	-	ND	0	-
42B	N-Nitrosodi-n-propylamine	ND	10	ND	ND	ND	100	74	ND	105	77
43B	N-Nitrosodiphenylamine	ND	10	ND	ND	ND	100	127	ND	105	129
44B	Phenanthrene	ND	10	ND	ND	ND	100	81	ND	105	83
45B	Pyrene	ND	10	ND	ND	ND	100	108	ND	105	96
46B	1,2,4-Trichlorobenzene	ND	10	ND	ND	ND	100	209C	ND	105	197C

A EPA published Method Detection Limit.

B Recovery normally low using EPA Protocol Method 625.

D Recovery variable due to sample matrix interference

C Recovery normally variable using EPA Protocol Method 625.

002722

ETC ENVIRONMENTAL TESTING and CERTIFICATION

July 27, 1984

TABLE 1: QUALITATIVE RESULTS

Tentatively Identified Organic Compounds – GC/MS Analysis Data – Base/Neutral Fraction (QR08)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

Compound Name	Data			Identifiers				
	Scan Number	Retention Time (Min)	M.W.	CAS Number	Empirical Formula			
None Found								

002723

ETC ENVIRONMENTAL TESTING and CERTIFICATION

July 27, 1984

TABLE 1: QUALITATIVE RESULTS

Tentatively Identified Organic Compounds – GC/MS Analysis Data – Acid Fraction (QR07)

Chain of Custody Data Required for ETC Data Management Summary Reports

ETC Sample No.	Company	Facility	Sample Point	Date	Time	Elapsed Hours
E9442	RESOURCE ENGINEERING	RES28801	RDOWNSTREAM	840628	1630	

Compound Name	Data			Identifiers				
	Scan Number	Retention Time (Min)	M.W.	CAS Number	Empirical Formula			
None Found								

002724

APPENDIX 5B

U.S. CORP OF ENGINEERS

FLOOD PLAIN DATA

002725

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102

REPLY TO ATTENTION OF:

April 2, 1984

Hydrology & Hydraulics Branch
Engineering Division

Mr. Charles D. Oliver, P.E.
Resource Engineering
11 Greenway Plaza
Suite 1724
Houston, Texas 77046

Dear Mr. Oliver:

Thank you for your letter dated March 20, 1984 requesting floodwater data on the Brazos River at a site in Waller County, Texas.

The site location shown on your attached map substantiates your description given earlier by telephone to Mr. Dennis Barabas of this office. This location is at about River Mile 207.9.

A recent backwater study was made by this office on the reach of the Brazos River in the area of your concern in preparation of the Design Memorandum No. 2 of the proposed Millican Lake which is located in the Brazos River Basin on the Navasota River. Although this is our best available data, this Design Memorandum has not been finalized for publication; therefore, you should consider this information we are sending as preliminary.

The water surface elevation and respective discharges of the range of flood frequencies requested are as follows:

Flood Frequency	Discharge (CFS)	Elevation in Feet (approx.)
25 year	140,000	171.5
50 year	171,000	173.5
100 year	224,000	175.0
Standard Project Flood (SPF)	364,000	179.0

The river cross section used in our study at this location (River Mile 207.9) has not been plotted; therefore, we are enclosing a listing of the cross section coordinates (stations and elevations) along with a copy of our layout map showing the cross section location (Enclosures 1 and 2).

002726

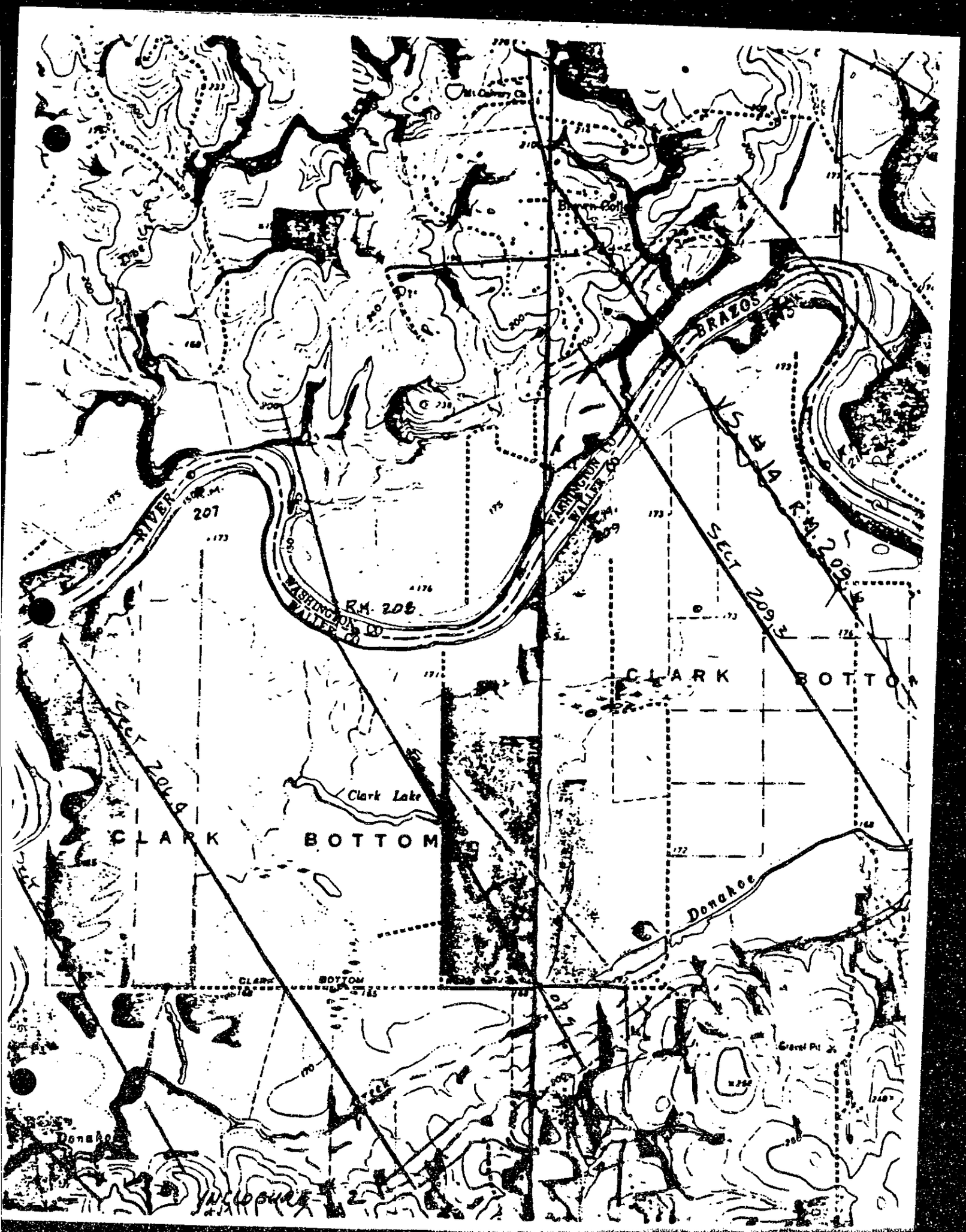
Hopefully this information will satisfy your requirements.

Sincerely,

Enclosures

for Jimmy D. Baggett, P.E.
Chief, Hydrology and Hydraulics
Branch

002727



BRAZOS
RIVER
207
R.M. 208
WASHINGTON CO
WALLER CO
R.M. 209
VS #14 R.M. 209
SECT 209.3
CLARK BOTTOM
Clark Lake
CLARK BOTTOM
Donahoe
CLARK BOTTOM
Gravel Pit
Donahoe

CROSS SECTION LISTING

BRAZ4:

```
1490 14700 200
1500 "A" 206.4  1 22 1 5 5*0
1510 "B" 6300 12100 12900 15200 16900 4*0 12900
1520 "C" 3300 2900 5300 2600 2000 16*0
1530 "D" 2*165 0 7*165
1540 "E" 1 .07 169 .11 165 6*0
1550 "E" 2 .07 174 .11 170 6*0
1560 "E" 3 .028 165 .020 151 .02 122 4*0
1570 "E" 4 .06 174 .10 170 6*0
1580 "E" 5 .06 179 .10 175 6*0
1590 "G" 0 200 200 190 500 180 1100 170 2900 170
1600 3100 165 8700 165 11000 170 12100 169 12300 162
1610 12370 151 12450 141 12700 128 12780 126 12820 122
1620 12850 126 12880 137 12900 172 15000 170 16200 175
1630 16600 180 16900 200
1640 "A" [redacted] 1 37 1 5 5*0
1650 "B" 4700 9000 9630 11500 13300 4*0 9630
1660 "C" 3900 4100 7900 6000 6900 4*0 16*0
1670 "D" 2*170 0 7*170
1680 "E" 1 .06 169 .10 165 6*0
1690 "E" 2 .06 174 .10 170 6*0
1700 "E" 3 .028 165 .020 151 .02 125 4*0
1710 "E" 4 .07 179 .11 175 6*0
1720 "E" 5 .07 179 .11 175 6*0
1730 "G" 0 200 [redacted] 190 [redacted] 180 [redacted] 170 [redacted] 165
1740 [redacted] 165 [redacted] 170 [redacted] 170 [redacted] 176 [redacted] 175
1750 [redacted] 144 [redacted] 138 [redacted] 132.5 [redacted] 128.5 [redacted] 125
1760 [redacted] 125 [redacted] 128.5 [redacted] 128 [redacted] 126.5 [redacted] 127.5
1770 [redacted] 131 [redacted] 132.5 [redacted] 136 [redacted] 143.5 [redacted] 155
1780 [redacted] 161 [redacted] 167.5 [redacted] 168.5 [redacted] 168 [redacted] 172
1790 [redacted] 174 [redacted] 175 [redacted] 175 [redacted] 175 [redacted] 180
1800 [redacted] 190 [redacted] 200
1810 "A" 209.3 1 20 1 5 5*0
1820 "B" 5600 9700 10550 11200 12000 4*0 10550
1830 "C" 6900 6500 7400 6000 5500 16*0
1840 "D" 2*170 0 7*170
1850 "E" 1 .07 174 .11 170 .028 126 4*0
1860 "E" 2 .07 174 .11 170 .028 126 4*0
1870 "E" 3 .028 168 .020 153 .02 126 4*0
1880 "E" 4 .07 179 .11 175 6*0
1890 "E" 5 .07 179 .11 175 6*0
1900 "G" 0 210 100 200 250 190 400 180 550 170
1910 3000 170 9700 174 9780 153 9900 158 9910 153
1920 9990 152 10280 133 10400 126 10470 126 10500 133
1930 10550 175 11450 175 11500 180 11600 190 12000 200
1940 "A" 212.0 1 37 1 5 4*0 1
1941 "0" 143000 172000 206000 7*0
1950 "B" 2800 5200 6075 9400 14200 4*0 6075
1960 "C" 6100 5500 14300 4800 4300 16*0
1970 "D" 2*170 0 7*170
```

02729

= STATIONS (IN FEET)

= ELEVATIONS (IN FEET)

= RIVER MILE

NOTE:
THE CROSS SECTION STATIONING
FROM LEFT OVERBANK & RIGH
OVERBANK (VIEWING DOWNSTREA
STATION 8000 IS THE LEFT R
BANK & STATION 9630 IS TH
RIGHT RIVER BANK.
(℄ of STREAM SHOULD BE ±9

CALCULATIONS AND COMPUTATIONS

SHEET ___ OF ___

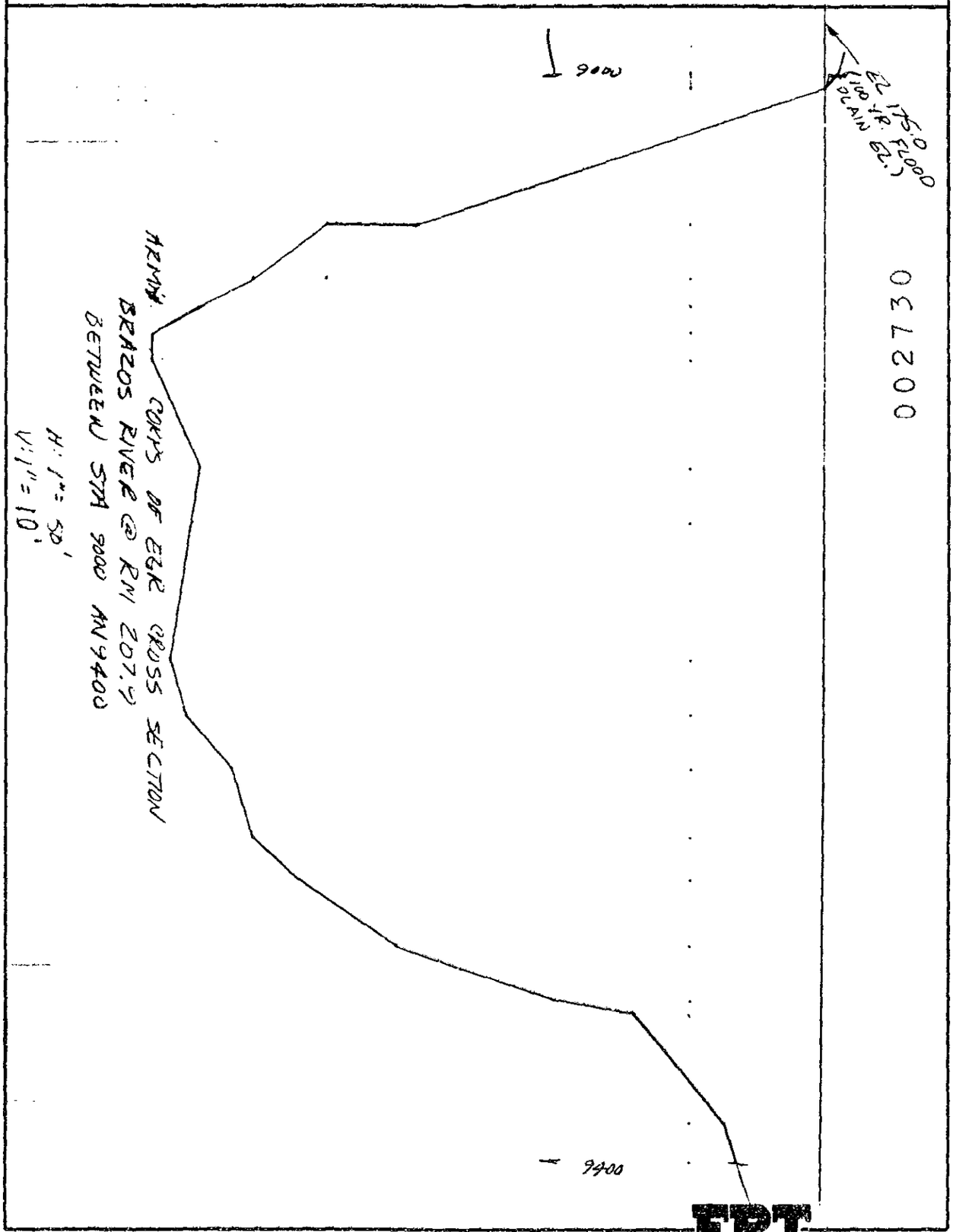
PROJECT: SHERIDAN

JOB NO.: 288-07-03

SUBJECT: AVG FLOW VELOCITY OF BRAZOS RIVER DURING A 100YR. STORM

COMPUTED BY: SD DATE: 12/4/85

CHECKED BY: ___ DATE: ___



002730

ERT

CALCULATIONS AND COMPUTATIONS

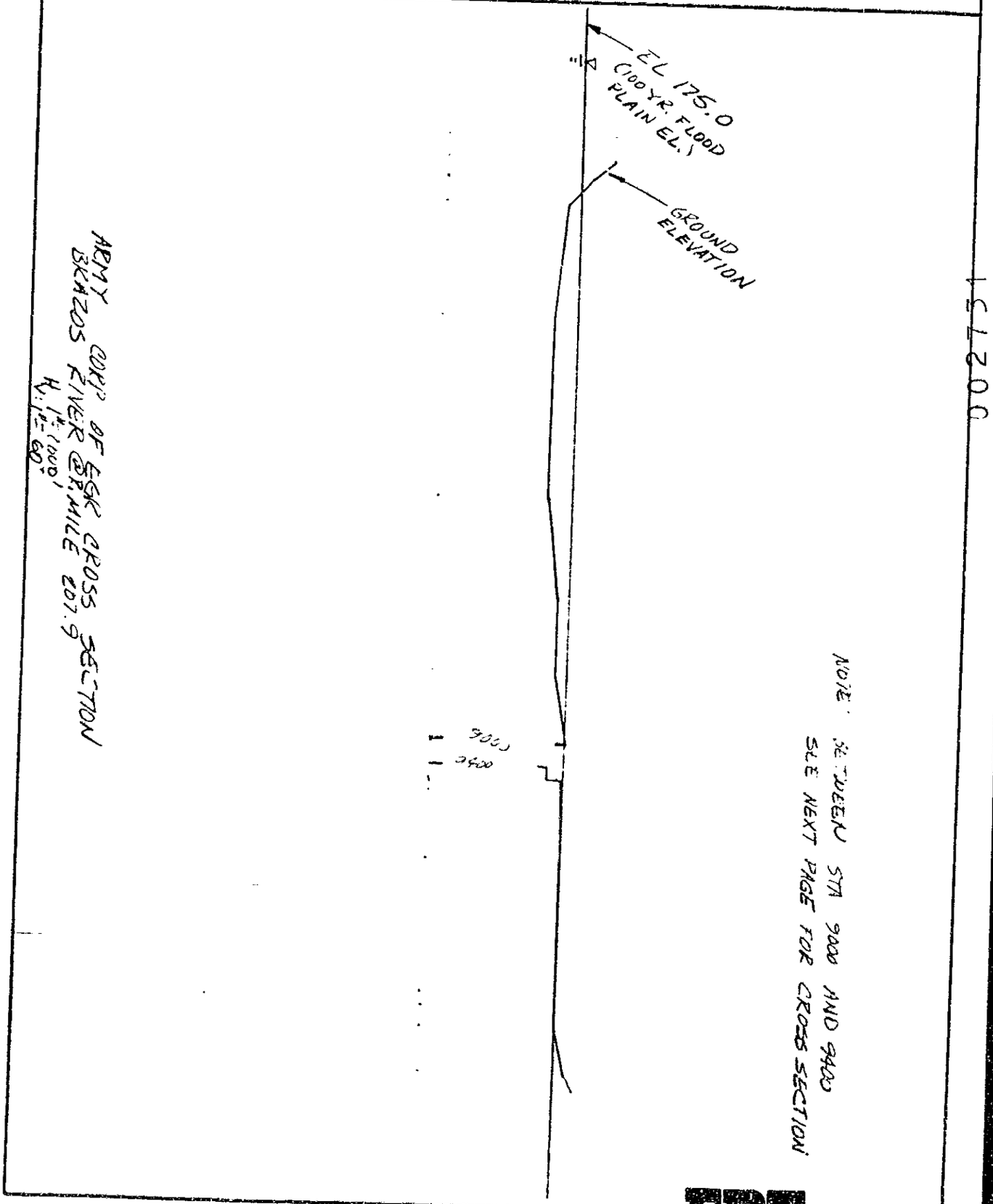
PROJECT: _____ SHEET ___ OF ___

JOB NO.: _____

SUBJECT: _____

COMPUTED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____



ARMY CORP OF ENG. CROSS SECTION
BRAZOS RIVER @ R. MILE 207.9
H. 1" = 1000'
V. 1" = 60'

ERT

CALCULATIONS AND COMPUTATIONS

PROJECT: SHERIDAN

SHEET ___ OF ___

JOB NO.: 28-07-03

SUBJECT: AVG FLOW VELOCITY OF BRAZOS RIVER DURING A 100 YR. STORM (EL 175.0)

COMPUTED BY: SD DATE: 12/18/86

CHECKED BY: ___ DATE: ___

FROM STA	TO STA	AVG EL.	WIDTH (FT)	DEPTH (FT)	AVG. X-SECT AREA
600 (180)	1000 (170)	175	400	—	0
1000 (170)	2700 (165)	167.5	1700	7.5	12,750
2700 (165)	5400 (165)	165	2700	10	27,000
5400 (165)	6900 (170)	167.5	1500	7.5	11,250
6900 (170)	8000 (170)	170	1100	5.0	5,500
8000 (170)	9000 (176)	173	1000	2.0	2,000
9000 (176)	9005 (175)	175.5	5	—	0
9005 (175)	9055 (144)	159.5	50	15.5	775
9055 (144)	9055 (138)	141	0	34	0
9055 (138)	9075 (132.5)	135.25	20	39.75	795
9075 (132.5)	9085 (128.5)	130.5	10	44.5	445
9085 (128.5)	9095 (125)	126.75	10	48.25	482.5
9095 (125)	9105 (144)	134.5	10	40.5	405
9105 (144)	9145 (128.5)	136.25	40	38.75	1550
9145 (128.5)	9165 (128)	128.25	20	46.75	935
9165 (128)	9215 (126.5)	127.25	50	47.75	2387.5
9215 (126.5)	9235 (127.5)	127	20	48	960
9235 (127.5)	9255 (131)	129.25	20	45.75	915
9255 (131)	9280 (132.5)	131.75	25	43.25	1081.25
9280 (132.5)	9296 (136)	134.25	16	40.75	652
9296 (136)	9320 (143.5)	139.75	24	35.25	846
9320 (143.5)	9340 (155)	149.25	20	25.75	515

002732

ERT

CALCULATIONS AND COMPUTATIONS

PROJECT: _____ SHEET ___ OF ___

JOB NO. _____

SUBJECT: _____

COMPUTED BY _____ DATE _____

CHECKED BY _____ DATE _____

FROM STA	TO STA	AVG EL.	WIDTH (FT)	AVG DEPTH (FT)	AVG X SECT AREA
9340(155)	9345(161)	158	5	17	85
9345(161)	9385(167.5)	164.25	40	10.75	430
9385(167.5)	9400(168.5)	168	15	7	105
9400(168.5)	9600(168)	168.25	200	6.75	1350
9600(168)	9625(172)	170	25	5	125
9625(172)	9630(174)	173	5	2	10
9630(174)	9800(175)	174.5	170	0.5	85
			TOTAL		73,434.50 SF

100 YR FLOW = 224,000 CFS (ARMY CORPS OF ENGINEERS)

AVG. FLOW VELOCITY ACROSS SECTION

$$\frac{224{,}000 \text{ CFS}}{73{,}434.50 \text{ SF}} = 3.05 \text{ FEET PER SECOND}$$

ACTUAL FLOW WILL BE HIGHER IN THE MAIN STREAM AND LOWER ACROSS THE OVERBANK FLOW.

NO EROSION OF DIKES LOCATED ON THE OVERBANK WILL OCCUR

002755

ERT

APPENDIX 5C

STORMWATER RUNOFF CALCULATIONS

002734

CALCULATIONS AND COMPUTATIONS

SHEET 1 OF 7

PROJECT: SHERIDAN

JOB NO. 28[illegible]-04-04

SUBJECT: EXISTING STORMWATER RUNOFF

COMPUTED BY: SDD DATE: [illegible]

CHECKED BY: ____ DATE: ____

USE THE SOIL CONSERVATION SERVICE CHART METHOD TO (TR-55) DETERMINE PEAK RUNOFF AND TOTAL RUNOFF VOLUME
REF: "A GUIDE TO HYDROLOGIC ANALYSIS USING SCS METHODS" BY RICHARD McCUEN

A 24 HR 100 YR. STORM IS USED FOR THE RUNOFF CALCULATIONS. THE PEAK FLOWS AND VOLUMES CALCULATED ARE ASSUMING THAT THE STORM IS A LOCAL STORM SINCE A BROAD BASED STORM, COVERING THE RIVER BASIN, WOULD RAISE THE RIVER ELEVATION TO APPROX 1750 AND CONSEQUENTLY FLOOD THE UNCULTIVATED PORTION OF THE SITE.

DRAINAGE AREAS (BY PLANIMETER)

I.	Ac	18.82 Ac
II	Ac	19.20 Ac
III	Ac	34.84 Ac
IV	Ac	4.12 Ac
V	Ac	4.43 Ac.

100 YR - 24 HR STORM 11.9 IN

AS A BACKUP, THE RUNOFF WAS CALCULATED ON A COMPUTER PROGRAM WRITTEN BY DODSON & ASSOC. BASED ON THE SCS TR-55 GRAPH METHOD.

0027-3-5

REI

PT. ① FROM AREAS I & II

TABLE 5. COMPUTATION SHEET FOR CHART METHOD

PROJECT SHERIDAN Computed By SDD Date 1/24/86
Checked By _____ Date _____

1. Required Input

A = 38.02 Acres : Drainage Area
T = 100 Years : Design Frequency (return period)
P = 11.9 Inches: Rainfall depth for 24-hour, T-year event
Y = 0.174 % : Average watershed slope
CN = 81 : Runoff Curve Number

$S = \frac{1000}{CN} - 10 = 2.35$

2. Compute Volume of Runoff, Q

Q = 9.48 Inches: Use CN and P as input to ~~Fig. 5~~ $Q = \frac{(P-0.2S)^2}{P+0.8S}$

3. Watershed Shape Adjustment (Optional: if adjustment is not made, set EA = A)

HL = 2875 feet : Hydraulic Length
EA = 78.94 Acres : Equivalent Drainage Area (~~use Fig. 10~~) $EA = 0.0001356\ HL^{5/3}$
HF = 0.48 : HF = A/EA

4. Obtain Unit Peak Discharge, QU

QU = 36 cfs/inch Q : Use EA with Fig. 11 (Sheet 1, 2, and 3 for flat, moderate, and steep slopes, respectively)

5. Watershed Slope Interpolation Factor, SF (Optional: if adjustment is not made, set SF = 1.0)

SF = 0.59 : Use Y and EA with Table 7

6. Ponding and Swamp Storage Adjustment Factor, PF (Optional: if adjustment is not made, set PF = 1.0)

PPS = 1.0 % : % of Ponds and Swampy Area (Based on actual drainage area A)

Location in watershed (check one):
Design Point (6-a)___; Center or Spread out (6-b)___; Upper Reaches (6-c)___

PF = 1.0 : Use PPS and T with Table 6-a, 6-b, or 6-c.

7. Peak Discharge QP, Calculation with Adjustments

QP = QU x Q x HF x SF x PF
= 36 x 9.48 x 0.48 x 0.59 x 1.0
= 97 cfs

8. Modifications for Urbanization

IMP = _____ % : Percentage of Impervious Area (based on actual drainage area A)
IMPF = _____ : Impervious Area Adjustment Factor (Fig. 12)
HLM = _____ % : Percentage of Hydraulic Length Modified
HLMF = _____ : Hydraulic Length Modified Factor (Fig. 13)

QPU = QP x IMPF x HLMF
= _____ x _____ x _____
= _____ cfs

002736

PT (3) AREA 3

TABLE 5. COMPUTATION SHEET FOR CHART METHOD

PROJECT SHERIDAN Computed By SDD Date 1/27/76
Checked By _____ Date _____

1. Required Input

A = 34.64 Acres : Drainage Area
T = 100 Years : Design Frequency (return period)
P = 4.3 Inches: Rainfall depth for 24-hour, T-year event
Y = 0.27 % : Average watershed slope
CN = 81 : Runoff Curve Number

S = 2.35

2. Compute Volume of Runoff, Q

Q = 3.48 Inches: Use CN and P as input to ~~Fig. 8~~ $Q = \frac{(P-0.2S)^2}{P+0.8S}$

3. Watershed Shape Adjustment (Optional: if adjustment is not made, set EA = A)

HL = 4125 feet : Hydraulic Length
EA = 144 Acres : Equivalent Drainage Area (use Fig. 10)
HF = 0.24 : HF = A/EA

4. Obtain Unit Peak Discharge, QU

QU = 50 cfs/inch Q : Use EA with Fig. 11 (Sheet 1, 2, and 3 for flat, moderate, and steep slopes, respectively)

5. Watershed Slope Interpolation Factor, SF (Optional: if adjustment is not made, set SF = 1.0)

SF = 0.64 : Use Y and EA with Table 7

6. Ponding and Swamp Storage Adjustment Factor, PF (Optional: if adjustment is not made, set PF = 1.0)

PPS = _____ % : % of Ponds and Swampy Area (Based on actual drainage area A)

Location in watershed (check one):
Design Point (6-a)___; Center or Spread out (6-b)___; Upper Reaches (6-c)___

PF = 1.0 : Use PPS and T with Table 6-a, 6-b, or 6-c.

7. Peak Discharge QP, Calculation with Adjustments

QP = QU x Q x HF x SF x PF
= 50 x 3.48 x 0.24 x 0.64 x —
= 23 cfs

8. Modifications for Urbanization

IMP = _____ % : Percentage of Impervious Area (based on actual drainage area A)
IMPF = _____ : Impervious Area Adjustment Factor (Fig. 12)
HLM = _____ % : Percentage of Hydraulic Length Modified
HLMF = _____ : Hydraulic Length Modified Factor (Fig. 13)

QPU = QP x IMPF x HLMF
= _____ x _____ x _____
= _____ cfs

002737

PT (2) FLOW OFF SITE FROM AREAS I, II & V

TABLE 5. COMPUTATION SHEET FOR CHART METHOD

PROJECT SHERIDAN Computed By SDD Date 1/22/86
Checked By _____ Date _____

1. Required Input

A = 42.45 Acres : Drainage Area
T = 100 Years : Design Frequency (return period)
P = 11.9 Inches: Rainfall depth for 24-hour, T-year event
Y = 0.215 % : Average watershed slope
CN = 81 : Runoff Curve Number
S = 2.35

2. Compute Volume of Runoff, Q

Q = 9.48 Inches: Use CN and P as input to Fig. 5

3. Watershed Shape Adjustment (Optional: if adjustment is not made, set EA = A)

HL = 3250 feet : Hydraulic Length
EA = 96.29 Acres : Equivalent Drainage Area (use Fig. 10)
HF = 0.44 : HF = A/EA

4. Obtain Unit Peak Discharge, QU

QU = 40 cfs/inch Q : Use EA with Fig. 11 (Sheet 1, 2, and 3 for flat, moderate, and steep slopes, respectively)

5. Watershed Slope Interpolation Factor, SF (Optional: if adjustment is not made, set SF = 1.0)

SF = 0.55 : Use Y and EA with Table 7

6. Ponding and Swamp Storage Adjustment Factor, PF (Optional: if adjustment is not made, set PF = 1.0)

PPS = _____ % : % of Ponds and Swampy Area (Based on actual drainage area A)
Location in watershed (check one):
Design Point (6-a)___; Center or Spread out (6-b)___; Upper Reaches (6-c)___
PF = 1.0 : Use PPS and T with Table 6-a, 6-b, or 6-c.

7. Peak Discharge QP, Calculation with Adjustments

QP = QU x Q x HF x SF x PF
= 40 x 9.48 x 0.44 x 0.55 x 1.0
= 91.8 cfs

8. Modifications for Urbanization

IMP = _____ % : Percentage of Impervious Area (based on actual drainage area A)
IMPF = _____ : Impervious Area Adjustment Factor (Fig. 12)
HLM = _____ % : Percentage of Hydraulic Length Modified
HLMF = _____ : Hydraulic Length Modified Factor (Fig. 13)

QPU = QP x IMPF x HLMF
= _____ x _____ x _____
= _____ cfs

002738

FLOW OFFSITE @ PT (4) FROM AREAS III + IV

TABLE 5. COMPUTATION SHEET FOR CHART METHOD

PROJECT SHERIDAN Computed By SDD Date 1/22/86
Checked By _____ Date _____

1. Required Input

A = 38.96 Acres : Drainage Area
T = 100 Years : Design Frequency (return period)
P = 11.9 Inches: Rainfall depth for 24-hour, T-year event
Y = 0.22 % : Average watershed slope
CN = 81 : Runoff Curve Number

S=2.35

2. Compute Volume of Runoff, Q

Q = 9.48 Inches: Use CN and P as input to Fig. 5

3. Watershed Shape Adjustment (Optional: if adjustment is not made, set EA = A)

HL = 5313 feet : Hydraulic Length
EA = 220 Acres : Equivalent Drainage Area (use Fig. 10)
HF = 0.18 : HF = A/EA

4. Obtain Unit Peak Discharge, QU

QU = 68 cfs/inch Q : Use EA with Fig. 11 (Sheet 1, 2, and 3 for flat, moderate, and steep slopes, respectively)

5. Watershed Slope Interpolation Factor, SF (Optional: if adjustment is not made, set SF = 1.0)

SF = 0.54 : Use Y and EA with Table 7

6. Ponding and Swamp Storage Adjustment Factor, PF (Optional: if adjustment is not made, set PF = 1.0)

PPS = _____ % : % of Ponds and Swampy Area (Based on actual drainage area A)

Location in watershed (check one):
Design Point (6-a)___; Center or Spread out (6-b)___; Upper Reaches (6-c)___

PF = 1.0 : Use PPS and T with Table 6-a, 6-b, or 6-c.

7. Peak Discharge QP, Calculation with Adjustments

QP = QU x Q x HF x SF x PF
= 68 x 9.48 x 0.18 x 0.54 x 1.0
= 62.7 cfs

8. Modifications for Urbanization

IMP = _____ % : Percentage of Impervious Area (based on actual drainage area A)
IMPF = _____ : Impervious Area Adjustment Factor (Fig. 12)
HLM = _____ % : Percentage of Hydraulic Length Modified
HLMF = _____ : Hydraulic Length Modified Factor (Fig. 13)

QPU = QP x IMPF x HLMF
= _____ x _____ x _____
= _____ cfs

002739

Table 7 .--Slope adjustment factors by drainage areas

Slope (per-cent)	10 acres	20 acres	50 acres	100 acres	200 acres	500 acres	1,000 acres	2,000 acres
FLAT SLOPES								
0.1	0.49	0.47	0.44	0.43	0.42	0.41	0.41	0.40
0.2	.61	.59	.56	.55	.54	.53	.53	.52
0.3	.69	.67	.65	.64	.63	.62	.62	.61
0.4	.76	.74	.72	.71	.70	.69	.69	.69
0.5	.82	.80	.78	.77	.77	.76	.76	.76
0.7	.90	.89	.88	.87	.87	.87	.87	.87
1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	1.13	1.14	1.14	1.15	1.16	1.17	1.17	1.17
2.0	1.21	1.24	1.26	1.28	1.29	1.30	1.31	1.31
MODERATE SLOPES								
3	.93	.92	.91	.90	.90	.90	.89	.89
4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.04	1.05	1.07	1.08	1.08	1.08	1.09	1.09
6	1.07	1.10	1.12	1.14	1.15	1.16	1.17	1.17
7	1.09	1.13	1.18	1.21	1.22	1.23	1.23	1.24
STEEP SLOPES								
8	.92	.88	.84	.81	.80	.78	.78	.77
9	.94	.90	.86	.84	.83	.82	.81	.81
10	.96	.92	.88	.87	.86	.85	.84	.84
11	.96	.94	.91	.90	.89	.88	.87	.87
12	.97	.95	.93	.92	.91	.90	.90	.90
13	.97	.97	.95	.94	.94	.93	.93	.92
14	.98	.98	.97	.96	.96	.96	.95	.95
15	.99	.99	.99	.98	.98	.98	.98	.98
16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10
25	1.06	1.08	1.12	1.14	1.15	1.16	1.17	1.19
30	1.09	1.11	1.14	1.17	1.20	1.22	1.23	1.24
40	1.12	1.16	1.20	1.24	1.29	1.31	1.33	1.35
50	1.17	1.21	1.25	1.29	1.34	1.37	1.40	1.43

002740

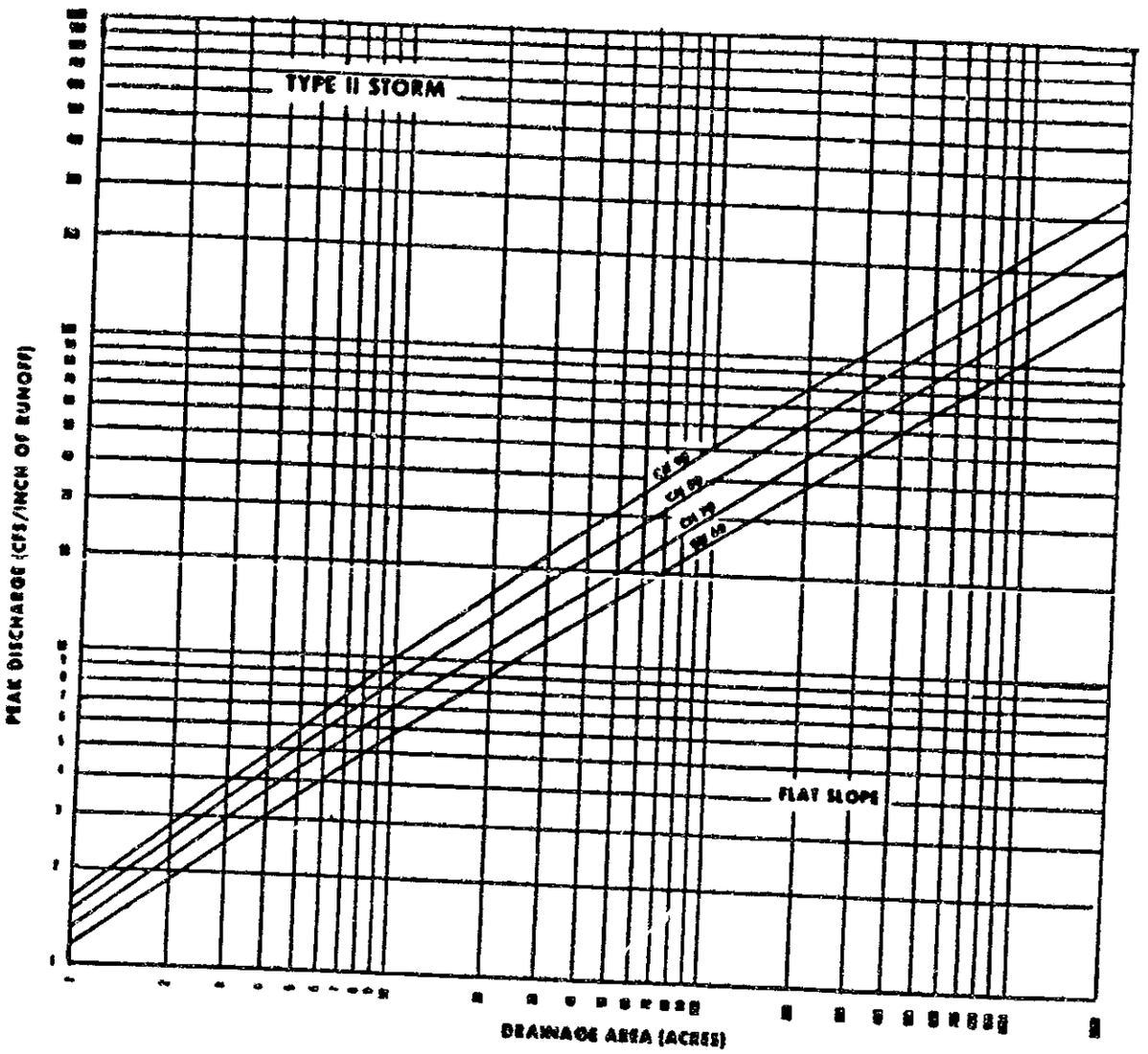


Figure 11.--Peak rates of discharge for small watersheds (24-hour, type-II storm distribution). Sheet 1 of 3

002741

COMPUTING THE CHARACTERISTICS OF RUNOFF

In order to determine the required size of a detention basin, the peak flow rate and volume of runoff entering the basin must be determined. This program includes a procedure to compute the runoff volume using the widely-accepted SCS Graphical method. The following items of input data are required:

TOTAL RAINFALL AMOUNT: The total volume of rainfall in the drainage area, as given by publications such as the Weather Bureau TP 40 or HMR 35.

SCS CURVE NUMBER: A measure of the runoff potential of the soil in the drainage area, adjusted for factors such as land use.

DRAINAGE AREA: The area draining to the basin.

WATERSHED SLOPE: The average slope of the watershed above the detention basin, expressed as a percentage. For example, 50 ft of drop in 10,000 feet is 0.5%.

HYDRAULIC LENGTH: The distance a drop of water must travel from the remotest point in the watershed.

002742

<<< Please press any key to cont . >>>

PT ① (AREAS I & II)

DETENTION BASIN SIZING

RUNOFF CHARACTERISTICS BY SCS METHODS

Total Rainfall Amount (inches)	11.9
Soil Conservation Service Curve Number	81
Drainage Area (acres)	38.02
Watershed Slope (percent)	0.174
Hydraulic Length of Watershed (feet)	2875

*** RESULTS ***

Runoff Amount (inches)	9.48
RUNOFF VOLUME (ACRE-FEET)	30.05
	OR 1,308,978 CF
Watershed Lag Value (hours)	1.72
Time of Concentration (hours)	2.86
Unit Peak Discharge (cfs/sqmi/in)	147
PEAK DISCHARGE (CFS)	83

002743

Press Return to repeat this operation, or Esc to return to Main Menu

PT ③ (AREA III)

DETENTION BASIN SIZING

RUNOFF CHARACTERISTICS BY SCS METHODS

Total Rainfall Amount (inches)	11.9
Soil Conservation Service Curve Number	81
Drainage Area (acres)	34.84
Watershed Slope (percent)	0.27
Hydraulic Length of Watershed (feet)	4125

*** RESULTS ***

Runoff Amount (inches)	9.48
RUNOFF VOLUME (ACRE-FEET)	27.54
	OR 1,199,642 C.F.
Watershed Lag Value (hours)	1.84
Time of Concentration (hours)	3.07
Unit Peak Discharge (cfs/sqmi/in)	140
PEAK DISCHARGE (CFS)	72

Press Return to repeat this operation, or Esc to return to Main Menu

PT ② (AREAS I II & V)

DETENTION BASIN SIZING
RUNOFF CHARACTERISTICS BY SCS METHODS

Total Rainfall Amount (inches)	11.9
Soil Conservation Service Curve Number	81
Drainage Area (acres)	42.45
Watershed Slope (percent)	0.215
Hydraulic Length of Watershed (feet)	3250

*** RESULTS ***

Runoff Amount (inches)	9.48
RUNOFF VOLUME (ACRE-FEET)	33.55 OR 1,461,438 CF
Watershed Lag Value (hours)	1.70
Time of Concentration (hours)	2.84
Unit Peak Discharge (cfs/sqmi/in)	148
PEAK DISCHARGE (CFS)	93

Press Return to repeat this operation, or Esc to return to Main Menu

PT ④ (AREAS III + IV)

DETENTION BASIN SIZING
RUNOFF CHARACTERISTICS BY SCS METHODS

Total Rainfall Amount (inches)	11.9
Soil Conservation Service Curve Number	81
Drainage Area (acres)	38.96
Watershed Slope (percent)	0.22
Hydraulic Length of Watershed (feet)	5313

*** RESULTS ***

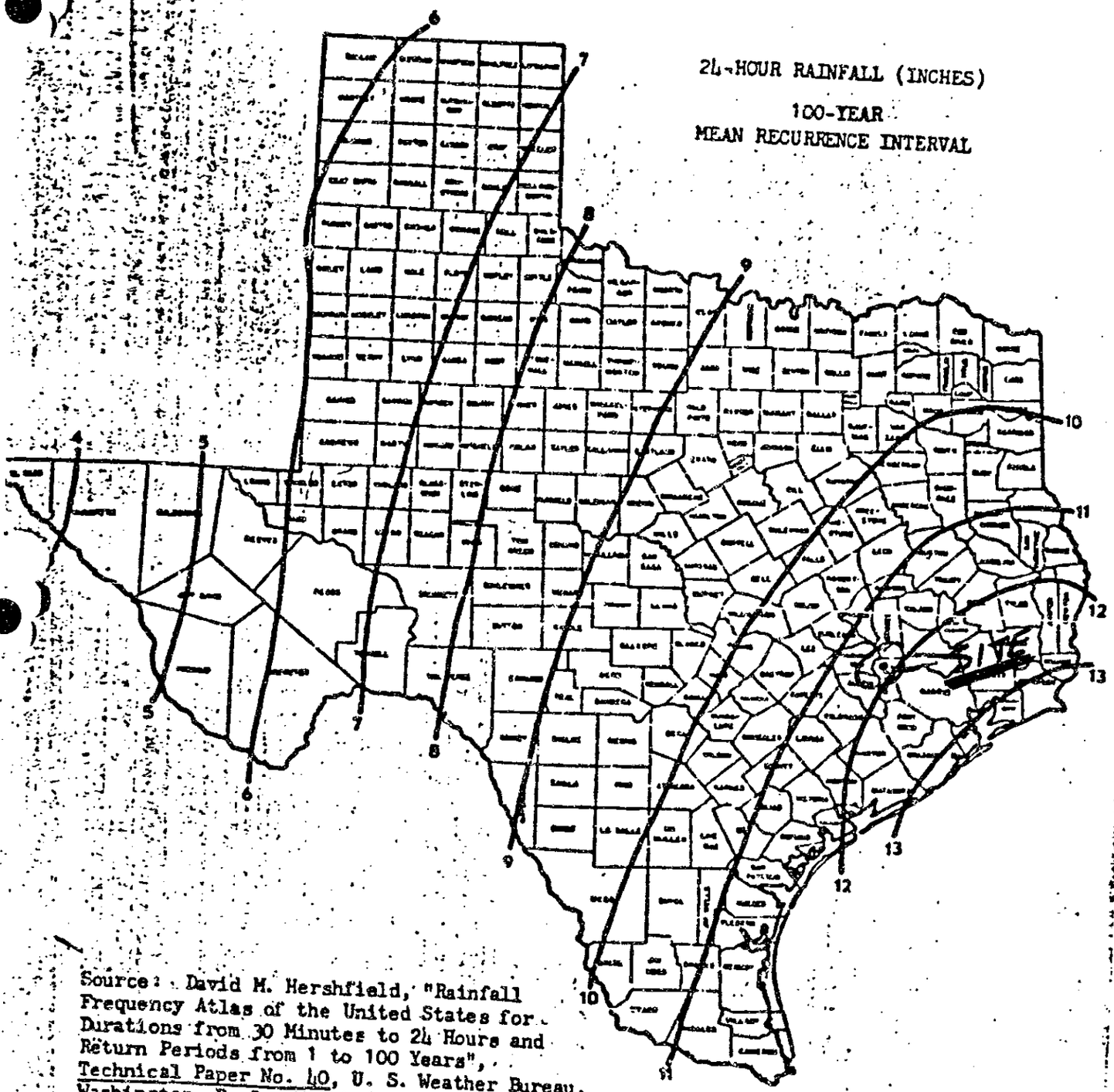
Runoff Amount (inches)	9.48
RUNOFF VOLUME (ACRE-FEET)	30.79 OR 1,341,212 CF
Watershed Lag Value (hours)	2.50
Time of Concentration (hours)	4.16
Unit Peak Discharge (cfs/sqmi/in)	112
PEAK DISCHARGE (CFS)	65

Press Return to repeat this operation, or Esc to return to Main Menu

002744

NOVEMBER 1970

577.36.17



Source: David M. Hershfield, "Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years", Technical Paper No. 40, U. S. Weather Bureau, Washington, D. C., May 1961, 115 pp.

002745

CALCULATIONS AND COMPUTATIONS

PROJECT: SHERIDAN

SHEET 1 OF 4

JOB NO.: 288-04-04

SUBJECT: AVG WATER ADDED TO POND & LAND FARM AREAS

COMPUTED BY: S.D. DATE: 1/23/86

CHECKED BY: ____ DATE: ____

SINCE THE AREAS ARE BUILT UP, ONLY RAINFALL THAT FALLS INTO THE AREAS WILL CONTRIBUTE WATER.

AVG RAINFALL ADDED TO LAGOON
USE DATA FROM NATIONAL WEATER SERVICE. (SEE ATTACHED TABLE 1) USE EVAPORATION DATA FROM TEXAS WATER DEVELOPMENT BOARD

LAGOON AREA = 22 Ac (PLANIMETER

LANDFARM AREA = 39.6 Ac (PLANIMETER)
ASSUME NO WATER IS LEAKING FROM POND OR LAND FARM

WATER ACCUMULATED IN THE AREAS IS EQUAL TO THE RAINFALL - EVAPORATION

RAINFALL - EVAPORATION = NET RESERVIOR EVAPORATION
AREA IS LOCATED BETWEEN LAT 30° TO 31°N
AND LONG 96° TO 97°W

YEARLY AVG PRECIPITATION = 40.40 INCHES
YEARLY AVG EVAPORATION = 57 INCHES

SINCE AN OIL SHEEN COVERS THE TOP OF THE POND, REDUCE EVAPORATION BY 50% EVAP = 29 INCHES

NET YEARLY RAINFALL = 11.4 INCHES POND
= - 16.6 INCHED LANDFARM

THIS WILL ADD APPROX 910,404 CF OR 6,810,000 GAL/YR TO THE POND

THE VOLUME OF WATER IN THE LANDFARM WILL BE REDUCED BY APPROX. 2,386,217 CF OR 17,849,000 GAL/YR.

002746

REI

CALCULATIONS AND COMPUTATIONS

PROJECT: _____ SHEET 2 OF 4

JOB NO.: _____

SUBJECT: _____

COMPUTED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

CHECK MONTHLY AVERAGES FOR WORST MONTH CONDITIONS

	J	F	M	A	M	J	J	A	S	O	N	D
PRECIP (AVG)	2.56	3.23	2.08	3.36	4.75	4.29	2.23	2.84	4.38	4.11	2.93	3.64
EVAP (AVG)	2.5	2.4	3.1	3.5	4.7	6.2	7.4	7.8	6.7	6.0	4.0	2.9
NET RAIN	0.06	0.83	-1.02	-0.14	0.05	-1.91	-5.17	-4.96	-2.32	-1.89	-1.07	0.74

HIGHEST NET RAINFALL IS IN FEB. (0.83 IN.)

- POND (USE 50% EVAP = 1.2

  NET RAINFALL POND = 2.03 IN.

  VOLUME ADDED TO POND = 162,116 CF OR 1,212,626 GAL.

- LANDFARM

  (USE 100% EVAP = 2.4)

  NET RAINFALL LAND FARM = 0.83 IN

  VOLUME ADDED TO LANDFARM = 119,311 CF OR 892,445 GAL

002747

REI

QUADRANGLE G - 11

Lat. 30° to 31° N. Long. 96° to 97° W.

GROSS LAKE SURFACE EVAPORATION RATES IN INCHES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1940	1.8	2.1	3.3	3.2	4.1	4.8	6.4	7.3	7.1	4.9	3.4	3.5	52.0
1941	2.6	2.3	2.6	2.7	4.0	4.5	5.8	8.2	5.2	3.8	3.2	3.1	48.0
1942	2.8	2.3	3.1	2.5	3.9	5.5	5.7	6.7	5.2	4.6	4.1	2.6	49.0
1943	2.0	2.6	2.4	3.7	4.6	5.2	7.0	7.0	5.4	4.7	3.3	2.1	50.0
1944	1.6	1.8	2.3	3.2	3.4	5.5	7.2	7.5	6.1	5.1	2.5	1.8	48.0
1945	1.9	2.0	2.2	3.1	4.8	5.5	6.5	6.6	5.5	3.8	3.7	2.4	48.0
1946	2.2	2.0	2.8	3.5	3.6	5.0	7.2	8.0	4.6	4.5	3.1	2.5	49.0
1947	1.3	2.5	2.2	2.9	4.7	5.3	6.6	6.5	6.3	5.1	3.5	2.0	49.0
1948	1.9	1.4	2.8	3.7	4.8	6.8	7.0	7.3	6.7	5.4	4.1	3.1	55.0
1949	1.8	1.9	2.8	2.7	4.9	5.4	6.1	7.2	6.4	4.5	5.0	3.3	52.0
1950	2.5	2.1	3.6	3.0	4.6	5.4	7.0	8.6	6.2	5.6	4.9	3.5	57.0
1951	2.7	2.0	4.1	4.2	4.9	6.1	9.9	7.4	6.8	7.3	5.8	3.8	65.0
1952	2.4	2.9	3.6	3.4	4.7	6.8	7.6	9.8	8.4	7.3	4.6	2.5	64.0
1953	4.0	2.8	3.3	5.0	3.7	9.7	7.1	6.9	6.0	6.2	4.7	3.6	63.0
1954	1.9	3.3	3.7	4.0	6.0	7.9	10.1	9.3	9.1	6.9	4.7	5.1	72.0
1955	3.2	2.8	3.2	3.9	5.2	8.2	7.6	7.3	6.4	7.6	4.8	2.8	63.0
1956	4.4	2.7	2.1	2.6	6.6	7.7	10.6	10.3	10.4	6.0	3.8	3.8	71.0
1957	2.7	2.2	4.2	2.6	4.1	4.2	6.4	7.1	8.8	5.3	3.5	2.9	54.0
1958	2.1	1.9	2.4	2.9	4.3	5.8	6.4	6.9	4.4	3.1	2.7	2.1	45.0
1959	2.1	1.7	3.2	3.2	4.0	5.3	5.6	5.3	5.6	5.6	3.9	2.5	48.0
1960	1.9	2.1	2.1	3.4	4.1	5.4	5.7	4.9	5.3	3.6	2.7	1.8	43.0
1961	1.7	1.8	2.7	3.8	4.7	5.1	5.4	5.9	5.7	4.7	3.1	2.4	47.0
1962	2.6	2.6	3.1	3.3	5.0	4.9	6.6	8.2	5.9	5.6	3.8	2.4	54.0
1963	1.8	2.4	3.3	4.3	5.2	6.4	7.3	8.5	7.3	6.0	4.7	2.8	60.0
1964	2.6	2.4	3.2	3.8	4.6	6.7	7.3	8.5	6.0	6.1	4.0	2.8	58.0
1965	2.8	2.6	3.0	3.4	3.9	5.4	6.1	7.7	7.0	5.4	3.9	2.4	55.0
AVG	2.5	2.4	3.1	3.5	4.7	6.2	7.4	7.8	6.7	6.0	4.0	2.9	57.0

NET RESERVOIR EVAPORATION RATES IN FEET

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1940	.03	-.09	.22	-.04	.00	-.16	.32	.52	.45	.23	-.58	-.17	0.78
1941	.08	-.05	-.12	-.07	.09	-.12	.11	.55	.24	-.10	.12	.12	0.85
1942	.18	.10	.19	.30	.10	.17	.26	.38	.22	.23	.08	.02	1.63
1943	.00	.20	.03	.23	-.12	.32	.17	.53	.27	.28	.10	.00	2.01
1944	-.34	-.12	-.09	.18	-.28	.33	.50	.23	.38	.40	-.27	-.23	0.59
1945	-.06	-.08	-.14	.03	.17	.14	.35	-.01	.29	.03	.24	.02	0.98
1946	-.16	-.03	-.23	.02	-.20	.07	.54	.43	.14	.14	-.20	.02	0.54
1947	-.17	.13	-.10	.11	-.01	.25	.46	-.02	.48	.39	.04	-.11	1.45
1948	-.02	-.14	.11	.12	.14	.47	.36	.53	.50	.43	.17	.17	2.84
1949	-.33	-.14	.02	-.26	.33	.14	.37	.48	.29	-.20	.41	-.17	0.94
1950	.04	-.14	.17	-.21	.00	.02	.43	.59	.17	.43	.39	.22	2.11
1951	.17	-.03	.03	.25	.19	.30	.75	.58	.17	.49	.28	.21	3.39
1952	.08	.01	.13	-.13	.00	.53	.49	.80	.55	.61	-.12	-.13	2.82
1953	.19	-.03	.12	.06	-.13	.63	.48	.22	.33	.13	.20	-.13	2.07
1954	.05	.22	.26	.08	.18	.63	.63	.70	.67	.31	.21	.31	4.25
1955	.08	-.17	.19	.09	.22	.42	.56	.37	.42	.60	.35	.07	3.20
1956	.16	-.03	.10	.02	.32	.54	.83	.76	.81	.40	.15	.10	4.16
1957	.13	.01	-.02	-.58	.16	.08	.46	.52	.29	-.18	-.09	.09	0.87
1958	-.05	-.07	.08	-.08	.18	.33	.29	.45	-.27	.04	.09	.03	1.02
1959	.15	-.12	.20	-.25	.01	.25	.31	.16	.30	.10	.19	-.07	1.23
1960	.03	-.08	.11	.03	.28	-.07	.29	.14	.39	-.28	-.14	-.18	0.52
1961	-.04	-.18	.12	.18	.29	.02	.17	.42	-.06	.28	.00	-.01	1.09
1962	.03	.14	.18	.01	.34	-.03	.53	.63	.08	.20	.01	-.13	1.99
1963	.08	-.03	.22	.11	.27	.38	.55	.66	.40	.40	.05	.00	3.09
1964	-.03	.04	.04	.14	.23	.36	.53	.56	-.08	.33	.08	.08	2.28
1965	.01	-.20	.15	.13	-.27	.33	.63	.52	.37	.28	-.06	-.20	1.69

NOTE: Negative values indicate effective rainfall exceeds gross lake surface evaporation rate.

"MONTHLY RESERVIOR EVAPORATION RATES FOR TEXAS 1940 THROUGH 1965"

BY TEXAS WATER DEVELOPMENT BOARD, OCTOBER 1967

REPORT 64

002748

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-78 at Sealy, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	64.4	42.7	53.6	82	18	201	2.56	1.10	3.80	5	0.0
February---	67.0	44.8	55.9	84	23	210	3.23	1.37	4.80	6	.0
March------	73.9	50.3	62.1	89	28	386	2.08	.45	3.35	4	.0
April------	81.2	59.5	70.4	91	39	612	3.36	1.43	4.99	4	.0
May--------	86.7	65.1	75.9	95	48	803	4.75	1.82	7.19	6	.0
June-------	92.6	70.0	81.3	100	59	939	4.29	1.19	6.77	5	.0
July-------	96.0	71.7	83.9	104	66	1,051	2.23	.60	3.53	4	.0
August-----	96.3	71.2	83.8	105	63	1,048	2.84	.78	4.50	4	.0
September--	91.1	67.4	79.2	101	53	876	4.38	.91	7.08	5	.0
October----	83.5	58.4	71.0	95	40	651	4.11	.96	6.61	4	.0
November---	73.3	49.6	61.5	88	27	345	2.93	.87	4.60	5	.0
December---	66.3	44.7	55.5	83	22	221	3.64	1.70	5.31	6	.0
Yearly---	81.0	58.0	69.5	106	17	7,343	40.40	29.90	49.89	58	.0

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

0027749

CALCULATIONS AND COMPUTATIONS

PROJECT: SHERIDAN

SHEET ___ OF ___

JOB NO.: 288-04

SUBJECT: LAGOON STORAGE VOLUMES

COMPUTED BY: SDD DATE: 2/13/86

CHECKED BY: ___ DATE: ___

AREAS BY PLANIMETER

DESCRIPTION (ELEVATION)	SURFACE AREA (SQ. FT)	AVG SURFACE AREA (SQ. FT)	DEPTH (FT.)	VOLUME (CU FT)	VOLUME (GAL.)
WATER SURFACE (170.5)	517,546			—	
170.5-175	675,171	596,363	4.5	2683,634	2×10^7
175-176.4	747102	711,142	1.4	995,600	7.5×10^6

AFTER EL 176.4 WATER WILL TOP DIKE ON NORTH END SO EL 176.4 IS HIGHEST WATER STORAGE EL.

TOTAL VOLUME = 3,679,234 CF OR 2.8×10^7 GALLONS

002750

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APPENDIX 5D

LAGOON DIKE SLOPE

STABILITY ANALYSIS

002751

Existing Dikes

GENERAL

The existing dikes which form the lagoon were built in stages. The lagoon was created by pushing up a small dike around a natural depression which was probably the remnants of an old slough. The soils from the dikes were taken from the area immediately adjacent to, and outside of, the lagoon. The lagoon capacity was increased periodically by raising the dikes; in the latter stages of dike construction various other materials such as drums and construction debris were mixed with the soils. The elevation of the top of the dikes varies from approximately 177 to 185 feet above mean sea level.

In order to evaluate the dike construction, soil borings, cone penetrometer tests, and in-situ density tests were performed. The locations of these borings and tests are shown on Figure 6-1. The boring logs and cone penetrometer data are enclosed with this Attachment.

SOIL TESTING

Two Standard Proctor compaction curves were developed from bulk samples taken at opposite ends of the lagoon at locations CD-1 and CD-4. These curves are shown on Figures 6-2 and 6-3. The average maximum dry density of these curves is 102.6 pounds per cubic foot.

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Five in-situ density tests were performed at locations shown on Figure 6-1. The results of these tests are shown in Table 6-1 below.

TABLE 6-1

Dike Density Tests

Location	Dry Density lb/ft^3	Moisture Content %	Percent Compaction
CD1	88.3	23.7	86
CD2	99.9	12.7	97
CD3	95.6	10.9	93
CD4	91.3	12.3	89
CD6	90.6	17.9	88

These results indicate that the dikes are fairly well compacted with an average compaction of approximately 91 percent.

The results of Atterberg limit tests performed on the samples are presented in Figure 6-4.

CONE PENETROMETER TESTS

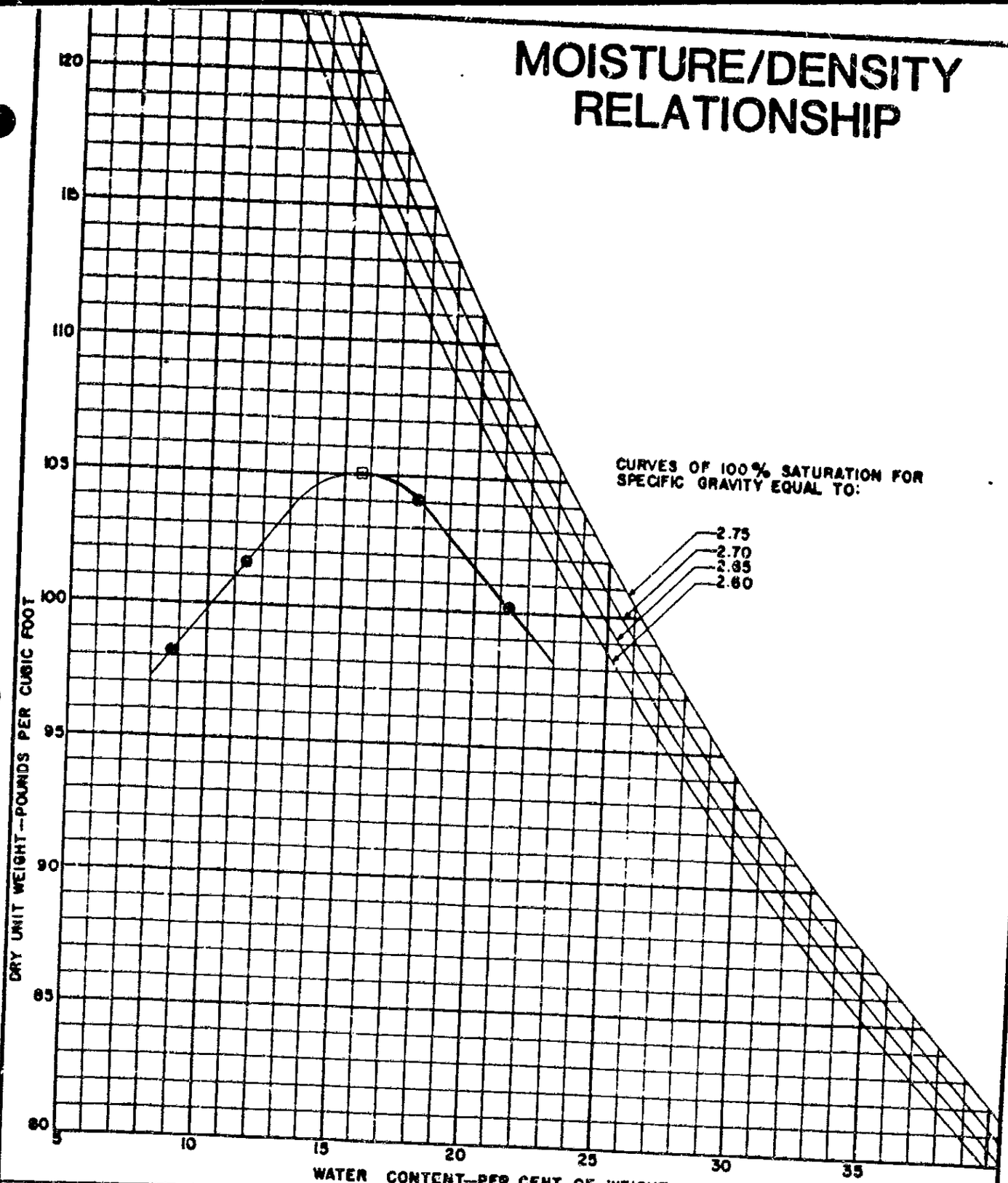
Six shallow cone penetrometer tests were performed through the dikes and into the underlying soils. The cone soundings extended approximately 33 feet beneath the surface. These tests

002753

indicate that the dike soils have a minimum shear strength of approximately 1,000 pounds per square foot. In several soundings a sludge layer varying in thickness from six inches to several feet was encountered. Clays and silty clay strata were found immediately beneath the dikes in all penetrometer tests.

002754

MOISTURE/DENSITY RELATIONSHIP



MOISTURE DENSITY RELATION	METHOD OF TEST	MAX. DRY DENSITY PCF	OPTIMUM MOISTURE CONTENT%	SOIL DESCRIPTION OR CLASSIFICATION AND SAMPLE LOCATION
II	ASTM D 698	105	15.8	Reddish Brown Sandy Clay Location CD-1

RESOURCE ENGINEERING

FIGURE 6-2

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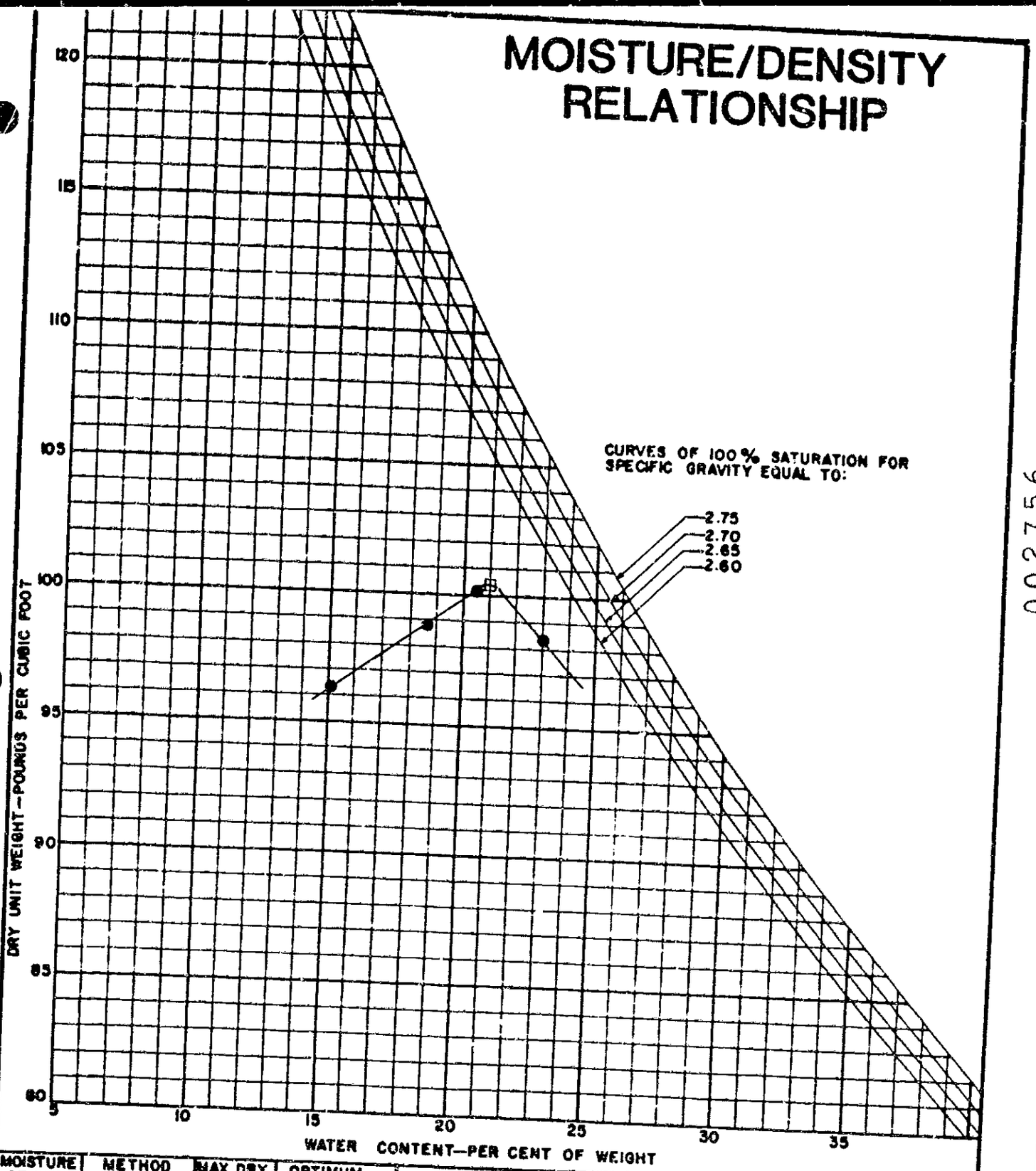
MOISTURE/DENSITY RELATIONSHIP



MOISTURE DENSITY RELATION	METHOD OF TEST	MAX. DRY DENSITY PCF	OPTIMUM MOISTURE CONTENT %	SOIL DESCRIPTION OR CLASSIFICATION AND SAMPLE LOCATION
I	ASTM D 698	100.3	21.0	Reddish Brown Silty Clay Location CD-4

RESOURCE ENGINEERING

FIGURE 6-3

002756

EXISTING DIKE MATERIAL
Atterberg Limits

SAMPLE Location	Liquid Limit	Plastic Limit	Plasticity Index
CD-1	58	25	33
CD-2	27	19	8
CD-3	37	15	22
CD-4	41	20	21
CD-5	35	13	22
CD-6	34	17	17

FIGURE 6-4

002757

APPENDIX 5 0

Slope stability safety factors were evaluated using a computer model or the simplified Bishop method of slope stability analysis. Several levee cross sections were evaluated using available topographic information. Strength of material values were assumed based on soil property data from soil borings. All safety factors were significantly above a worst case acceptable value of 2.0 which indicates the levee slope stability is secure.

002758

TABLE 5-1. RECOMMENDED MINIMUM VALUES OF FACTOR OF SAFETY FOR SLOPE STABILITY ANALYSES

Consequences of Slope Failure	Uncertainty of Strength Measurements	
	Small[1]	Large[2]
No imminent danger to human life or major environmental impact if slope fails.	1.25 (1.2)[3]	1.5 (1.3)
Imminent danger to human life or major environmental impact if slope fails.	1.5 (1.3)	2.0 or greater (1.7 or greater)

1 The uncertainty of the strength measurements is smallest when the soil conditions are uniform and high quality strength test data provide a consistent, complete, and logical picture of the strength characteristics.

2 The uncertainty of the strength measurements is greatest when the soil conditions are complex and when the avialable strength data do not provide a consistent, complete, or logical picture of the strength characteristics.

3 Numbers without parentheses apply for static conditions and those within the parentheses apply to seismic conditions.

Source: "Permit Applicant's Guidance Manual for Hazardous Waste Land Treatment, Storage and Disposal Facilities" EPA 530 SW-84-004

002759

CHAPTER 9

TECHNICAL DOCUMENTATION

The Simplified Bishop Method of Slope Stability Analysis is a technique to determine the relative stability of earth slopes. It employs limit equilibrium force resolutions based on soil strength parameters and density to arrive at a factor of safety for a given circular failure surface. A factor of safety is defined as a ratio of the strength available to resist movement to the forces tending to create movement of a mass of earth. A rigorous application af theoretical soil mechanics and classical engineering statics was used by Alan W. Bishop to derive the equations necessary to solve an analysis for the factor of safety with acceptable accuracy. This chapter presents the way his equations are used in SB-SLOPE.

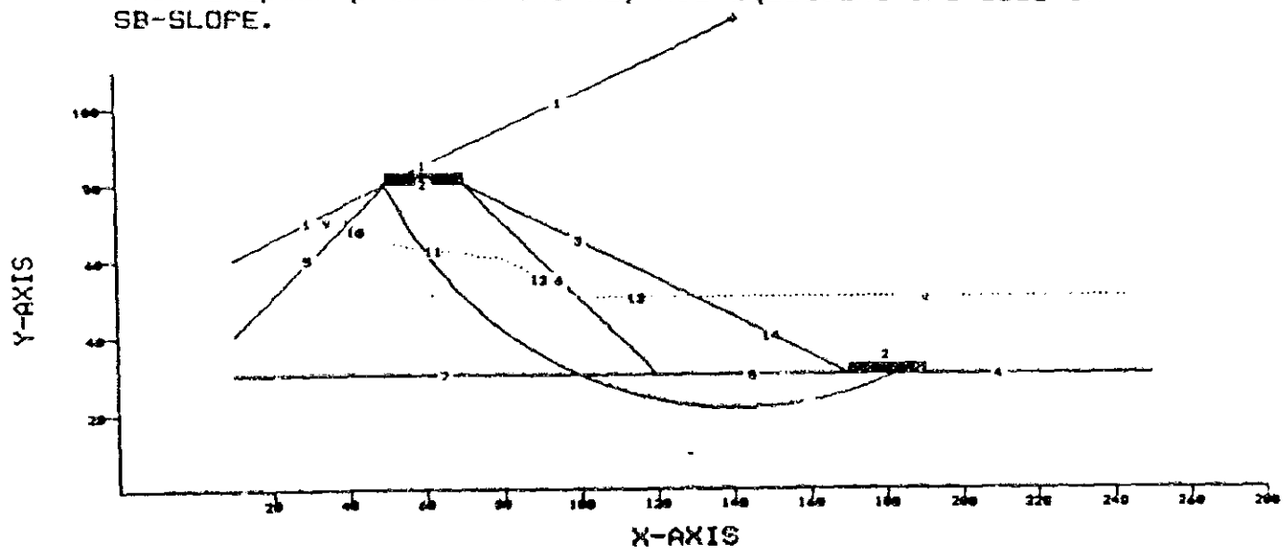
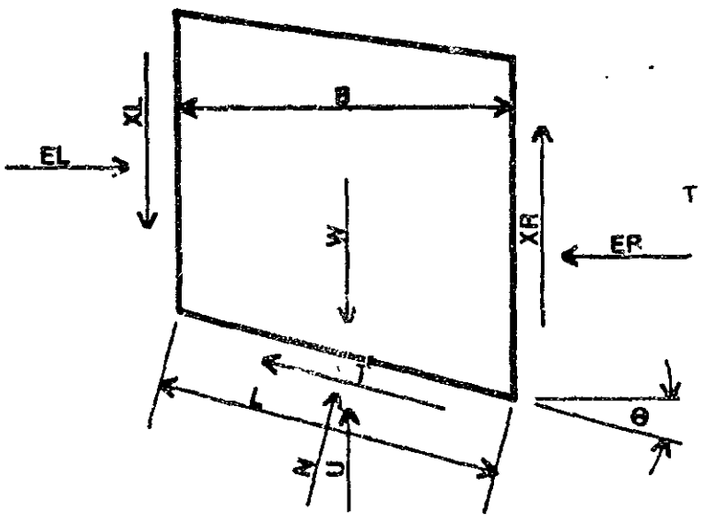


Figure 5.

An example slope and failure surface is shown in Figure 5. In order to determine the factor of safety, the overall resisting ability and overall driving tendency must be determined. Due to the interaction between strengths and forces in the Mohr-Coloumb soil strength equation, and the complexity of multi-layered soils cases, the geometry is broken into vertical slices to solve. The resisting and driving contributions of each slice are individually determined and are summed to get the overall factor of safety. Throughout this chapter the methods of finding these single slice contributions will be discussed.

002760

If a slice is taken as a free body, the forces acting on it are defined as follows:



$$T = \frac{c*L + N*\tan(\Phi)}{FS}$$

W - the weight of the slice
U - the pore water force acting normal to the base of the slice
T - the tangential component of the force on the base of the slice
N - the normal component of the force on the base of the slice
X - the vertical component of the inter-slice force
E - the horizontal component of the inter-slice force
L - the length of the bottom of the slice
B - the width of the slice
θ - the angle from a vertical through the circle center to the radius bisecting the slice base
c - the soil cohesion, or shear intercept
Φ - the soil friction angle
FS - the factor of safety

By resolving forces in the vertical direction, to solve for N, then substituting into the equation for T, the basic Bishop resisting term is derived:

$$R = \frac{c*B + \tan(\Phi)*((W-U) + (XL-XR))}{\cos(\theta)*\left(1 + \frac{\tan(\Phi)*\tan(\theta)}{FS}\right)}$$

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The basic equation becomes the simplified equation by taking XL-XR=0. The simplified equation, as used in this program, is:

$$R = \frac{c*B + \tan(\theta)*(W-U)}{Ma}$$

Where:

$$Ma = \cos(\theta)*\left(1 + \frac{\tan(\theta)*\tan(\theta)}{FS}\right)$$

The driving term is:

$$D = W*\sin(\theta)$$

9.1 CALCULATIONS USING THE PORE PRESSURE RATIO

When the pore pressure ratio option is used the pore water force, U, is calculated as:

$$U=W*Ru$$

If there is a free water surface the weight of the water above the slice is included in the slice weight at the time that U is calculated.

Unlike the free water weight, if there are distributed loads, their contribution to the weight of the slice is not included at the time U is calculated.

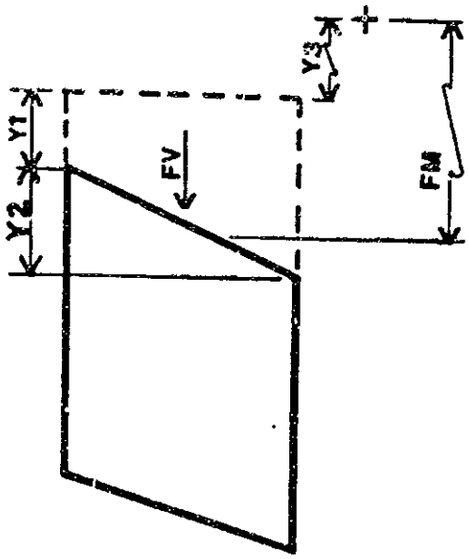
9.2 CALCULATIONS USING A PHREATIC LINE

Pore water forces are calculated as the weight of water occupying the area of the slice between the phreatic surface and the base of the slice. The density of water used is 62.4 pcf. If a free water surface is present over a slice it is considered to be the phreatic surface.

9.3 CALCULATIONS USING A FREE WATER SURFACE

When a free water surface is present over a slice it adds to the slice weight W. If the top of a slice beneath the free water surface slopes, a horizontal component, FD, is subtracted from the driving term. The term is calculated as:

002762



$$FD = \frac{FV*LS*FM}{RC}$$

$$FM = Y3 + Y1 + \frac{Y2*(2*Y2 + 3*Y1)}{3*(Y2 + 2*Y1)}$$

Where terms are defined as :

FV - the weight of the water above the slice
FM - the vertical distance between the circle center and the resultant force
LS - the absolute value of the slope of the slice top line
RC - the radius of the circle
Y1, Y2, and Y3 - dimensions as shown

When using a phreatic surface, the free water line is considered to be a phreatic line. The weight of the water is not included in the calculation of the pore pressure using the pore pressure ratio U, or the horizontal earthquake force. To have its weight included, specify the free water line as 2 soils lines without strength. Assign a density of 62.4 to the line over the failure surface and assign a density of 0 to the line beyond the failure surface. When using this method to input a free water line, the contribution to the driving term is not included.

9.4 CALCULATIONS USING EARTHQUAKE COEFFICIENTS

Earthquake coefficients are considered to affect the slice weight, the driving term and pore water forces. The convention followed is that a + horizontal coefficient is an acceleration away from the slope. A + vertical coefficient is an acceleration up.

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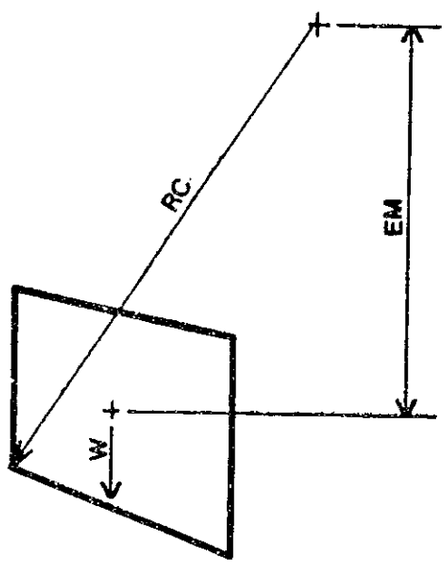
The effect on slice weight is that a + vertical coefficient reduces the slice weight. It is calculated by:

$$WA = W*(1-VEC)$$

Where the terms are defined as:

WA - the accelerated weight
W - the weight of the soil in the slice
VEC - the vertical earthquake coefficient

A horizontal earthquake coefficient adds a component to the driving term which is calculated as follows:



$$ED = \frac{EM*W*HEC}{RC}$$

Where the terms are defined as:

EM - the vertical distance between the center of the slice (not the center of gravity exactly) and the circle center
ED - the contribution to the driving term
W - the weight of the slice not including the components added by distributed loads and the free water surface
HEC - the horizontal earthquake coefficient defined as + away from the slope
RC - the circle radius

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9.5 CALCULATIONS USING A TENSION CRACK

When a tension crack is present, the depth specified is used to calculate a crack bottom elevation. The elevation is found by subtracting the depth from the elevation of the highest point on the failure surface. Slices with a base elevation above the tension crack bottom elevation are assigned a resisting term value of 0, and a pore water pressure of 0. To simulate a water filled crack do not specify a tension crack option. Rather, define a soil stratum above the elevation desired for the tension crack as being under a phreatic line and with no strength.

9.6 CALCULATIONS USING DISTRIBUTED LOADS

The contribution of a uniform distributed load over a slice is added to the weight of the slice. The uniform load weight is increased or reduced by vertical seismic accelerations, but is not a part of the slice weight used in the horizontal acceleration driving force contribution. It is not incorporated into the weight before the pore pressure is found using the pore pressure ratio. However, a distributed load may be simulated by using geometry lines and an appropriate density, in which case its weight would be included in all calculations.

9.7 SOLUTION FOR THE FACTOR OF SAFETY

Examination of the factor of safety equation reveals that the FS term appears in the function. This makes an iterative solution, using successive approximations for the factor of safety necessary. Using an initial estimate for the FS of 1.5 the slice parameters are summed, and a FS is calculated. The calculated value is substituted for the initial guess, and the FS is recalculated. When the difference between the estimated and the calculated factors of safety are less than +/- .005 the solution is considered complete. 10 iterations are allowed before an error message is printed and the solution is ended.

If the value for Ma, (page 26), is less than 0.2 or if the value of the normal force becomes less than or equal to 0 their values will be printed during the diagnostic slice data printout. Printing the diagnostics is the only way to check for these conditions. For more information on the Ma and negative normal force errors inherent in the Simplified Bishop method please refer to slope stability literature.

002765

9.8 EXAMPLE CALCULATION USING A DRY SLOPE WITH NO OPTIONS

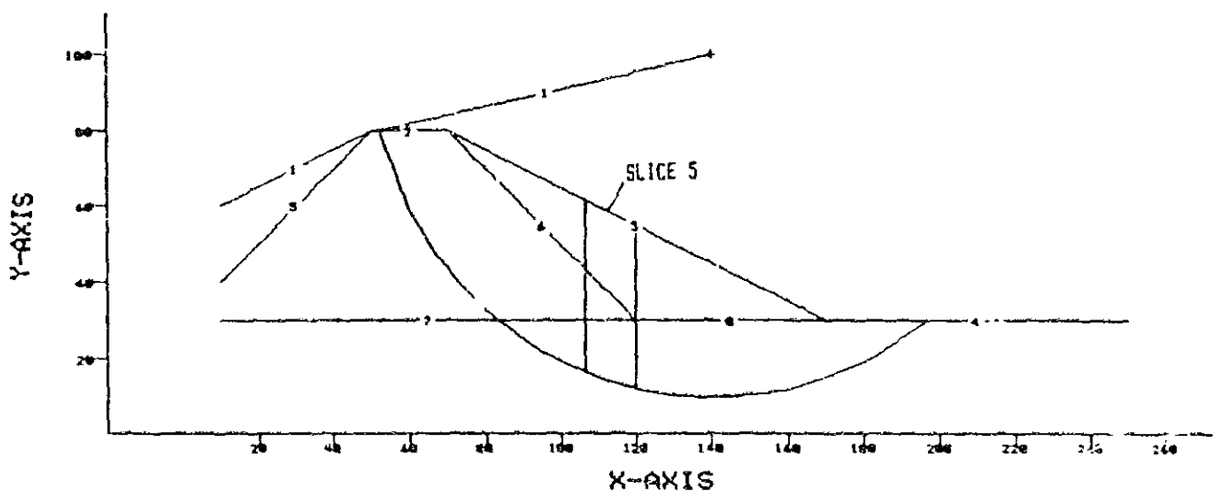
Consider the following case:

SB-SLOPE

PROJECT DATA
Project: Heather Lake Dam
Location: Getaway, Colorado
Filename: DD12 Description: Final checkout

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density PCF	Cohesion PSF	Phi Deg
1	10.0	60.0	50.0	80.0	130.0	250	30
2	50.0	80.0	70.0	80.0	115.0	750	15
3	70.0	80.0	170.0	30.0	130.0	250	30
4	170.0	30.0	250.0	30.0	120.0	59	20
5	10.0	40.0	50.0	80.0	115.0	750	15
6	70.0	80.0	120.0	30.0	115.0	750	15
7	10.0	30.0	120.0	30.0	120.0	50	20
8	120.0	30.0	170.0	30.0	120.0	50	20



X= 140.0 Y= 100.0 R= 90.0

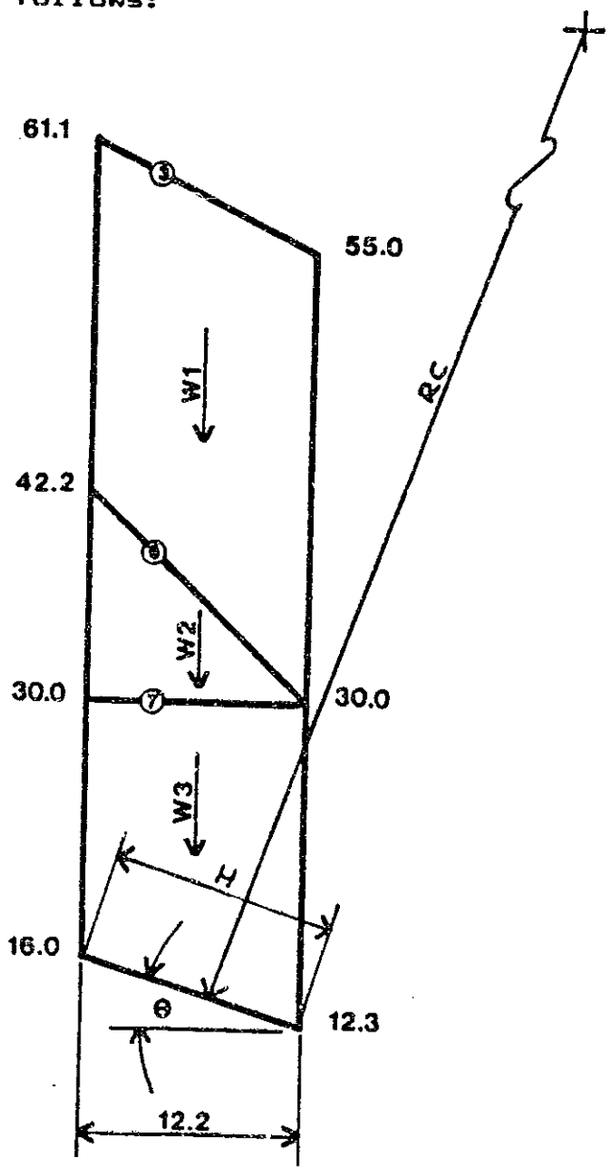
SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	RESISTING TERM	DRIVING TERM
1	52.3	17.8	1.820	0.268	750.0	37321	37012	32706
2	70.0	15.4	0.989	0.268	750.0	62345	32264	43839
3	83.4	12.2	0.677	0.364	50.0	64258	25001	36038
4	95.6	12.2	0.470	0.364	50.0	67102	24964	28544
5	107.8	12.2	0.303	0.364	50.0	66586	24270	19306
6	120.0	10.0	0.169	0.364	50.0	51565	18811	8594
7	130.0	10.0	0.056	0.364	50.0	46416	17281	2579
8	140.0	10.0	-0.055	0.364	50.0	39916	15246	-2218
9	150.0	10.0	-0.169	0.364	50.0	32065	12842	-5344
10	160.0	10.0	-0.289	0.364	50.0	22811	9816	-6337
11	170.0	13.3	-0.445	0.364	50.0	18939	9219	-7711
12	183.3	13.3	-0.666	0.364	50.0	7100	4613	-3939

DD12 - Final checkout
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 140.0, Y= 100.0
FS= 1.584 at R= 90.0

002766

The resisting and driving moment for slice 5 are found as follows:



① Indicates line number

W1 = 267.8*130 = 34813
W2 = 74.4*115 = 8558
W3 = 193.4*120 = 23204
WT = 66575

c = 50

B = 12.2

$\tan(\phi) = .364$

$H = \left[(16-12.3)^2 + 12.2^2\right]^{1/2} = 12.7$

$\sin(\theta) = \dfrac{16 - 12.3}{12.7} = .291$

$\cos(\theta) = .957$

$\tan(\theta) = .304$

FS = 1.589

$$R = \frac{50*12.2 + .364*66575}{.957*\left[1 + \dfrac{.364*.304}{1.589}\right]}$$

R = 24269

D = 66575 * .291 = 19373

002767

9.9 EXAMPLE CALCULATION USING A DRY SLOPE WITH ALL OPTIONS

Consider the following example:

SB-SLOPE

PROJECT DATA
Project: Heather Lake Dam
Location: Getaway, Colorado
Filename: DD12A Description: Final checkout w/all options (dry)

ANALYSIS DATA

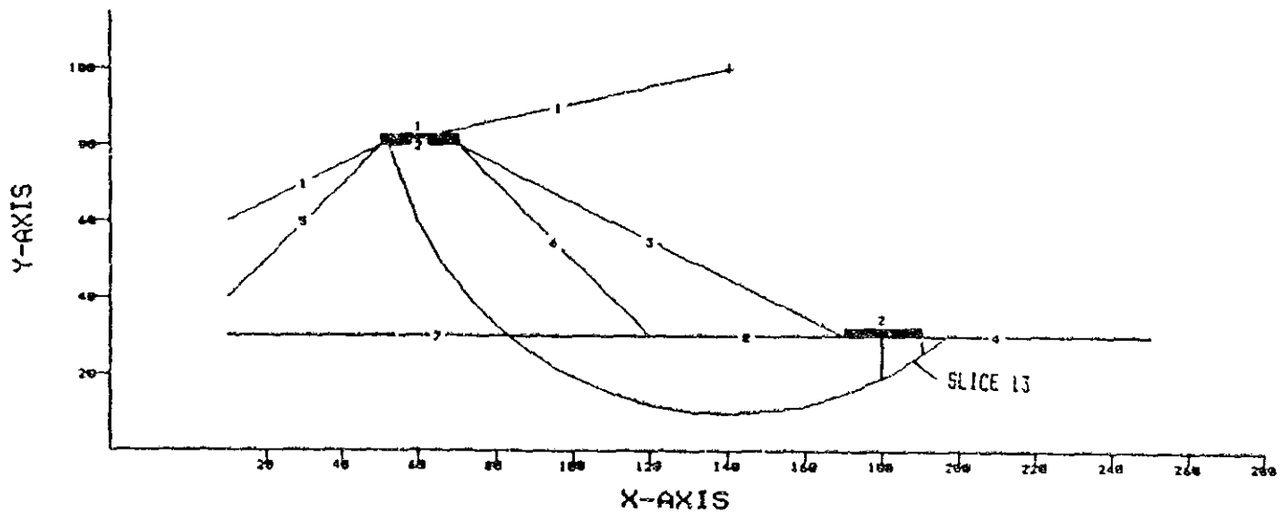
Line No.	Left X	Left Y	Right X	Right Y	Density #	Cohesion PSF	Phi Deg
1	10.0	60.0	50.0	80.0	130.0	250	30
2	50.0	80.0	70.0	60.0	115.0	750	15
3	70.0	80.0	170.0	30.0	130.0	250	30
4	170.0	30.0	250.0	30.0	120.0	50	20
5	10.0	40.0	50.0	80.0	115.0	750	15
6	70.0	80.0	120.0	30.0	115.0	750	15
7	10.0	30.0	120.0	30.0	120.0	50	20
8	120.0	30.0	170.0	30.0	120.0	50	20

Horizontal earthquake coefficient = 0.2
Vertical earthquake coefficient = 0.1

Distributed loads

No.	Left X	Right X	Load (lbs/ft)
1	50.0	70.0	2000.0
2	170.0	190.0	500.0

Depth of tension crack = 10



X= 140.0 Y= 100.0 R= 98.0

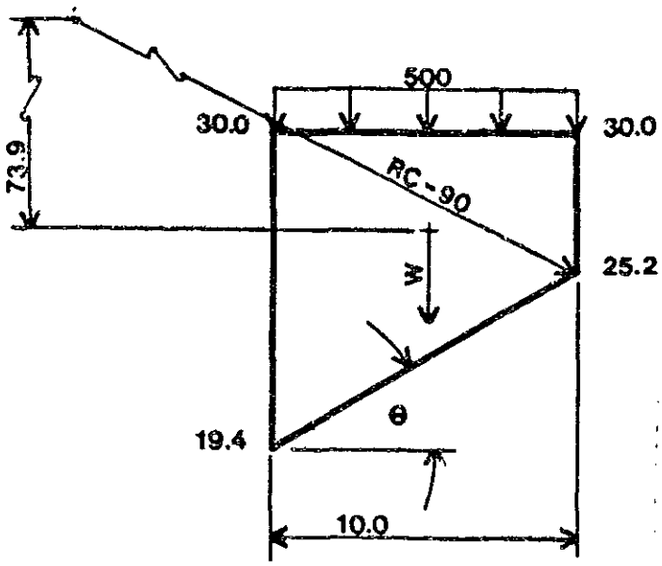
SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	RESISTING TERM	DRIVING TERM
1	52.3	2.9	3.452	0.000	0	6713	0	6532
2	55.1	14.9	1.709	0.268	750	62530	37773	57376
3	70.0	13.4	1.000	0.268	750	56111	27590	45678
4	83.4	12.2	0.681	0.364	50	57032	20706	39962
5	95.6	12.2	0.472	0.364	50	60392	21098	34408
6	107.8	12.2	0.304	0.364	50	59920	20952	26670
7	120.0	10.0	0.169	0.364	50	46409	16547	15545
8	130.0	10.0	0.056	0.364	50	41774	15394	9659
9	140.0	10.0	-0.056	0.364	50	35924	13890	4530
10	150.0	10.0	-0.169	0.364	50	28059	11949	566
11	160.0	10.0	-0.290	0.364	50	20530	9357	-1814
12	170.0	10.0	-0.423	0.364	50	18257	9290	-4519
13	180.0	10.0	-0.579	0.364	50	12846	7724	-4914
14	190.0	6.6	-0.736	0.364	50	1714	1650	-715

DD12A - Final checkout w/all options (dry)
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 140.0, Y= 100.0
FS= 0.934 at R= 98.0

002768

The resisting and driving terms for slice 13 are calculated as follows:



W = 77*120 = 9240
LF = 500*10 = 5000
WT = 14240

VEC = +.1
WA = 14240*(1 - .1) = 12816

HEC = +.2
EM = 100-(30+30+19.4+25.2)/4
= 73.9

$$ED = \frac{73.9*9240*.2}{90} = 1517$$

$$H = \left[(25.2-19.4)^2 + 10^2\right]^{1/2} = 11.6$$

$$\sin(\theta) = \frac{19.4 - 25.2}{11.6} = -.502$$

$$\cos(\theta) = .865$$

$$\tan(\theta) = -.580$$

c = 50 $\tan(\phi) = .364$ F = .934

$$R = \frac{50*10 + .364*12816}{.865 * \left[1 + \frac{.364*-.580}{.934}\right]} = 7715$$

D = 12816* -.502 + 1517 = -4916

002769

9.10 EXAMPLE CALCULATION USING PORE PRESSURE RATIO WITH OPTIONS

Consider the following example:

SB-SLOPE

PROJECT DATA
Project: Heather Lake Dam
Location: Getaway, Colorado
Filename: DD12RA Description: Final checkout w/Ru & all options

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density PCF	Cohesion PSF	Phi Deg	Ru
1	10.0	60.0	50.0	80.0	130.0	250	30	0.50
2	50.0	80.0	70.0	80.0	115.0	750	15	0.50
3	70.0	80.0	170.0	30.0	130.0	250	30	0.50
4	170.0	30.0	250.0	30.0	120.0	50	20	0.50
5	10.0	40.0	50.0	80.0	115.0	750	15	0.50
6	70.0	80.0	120.0	30.0	115.0	750	15	0.50
7	10.0	30.0	120.0	30.0	120.0	50	20	0.50
8	120.0	30.0	170.0	30.0	120.0	50	20	0.50
9	130.0	50.0	250.0	50.0	Free water line			

Horizontal earthquake coefficient = 0.2
Vertical earthquake coefficient = 0.1

Depth of tension crack = 10

Distributed loads

No.	Left X	Right X	Load (lbs/ft)
1	50.0	70.0	2000.0
2	170.0	190.0	500.0
3	150.0	170.0	500.0

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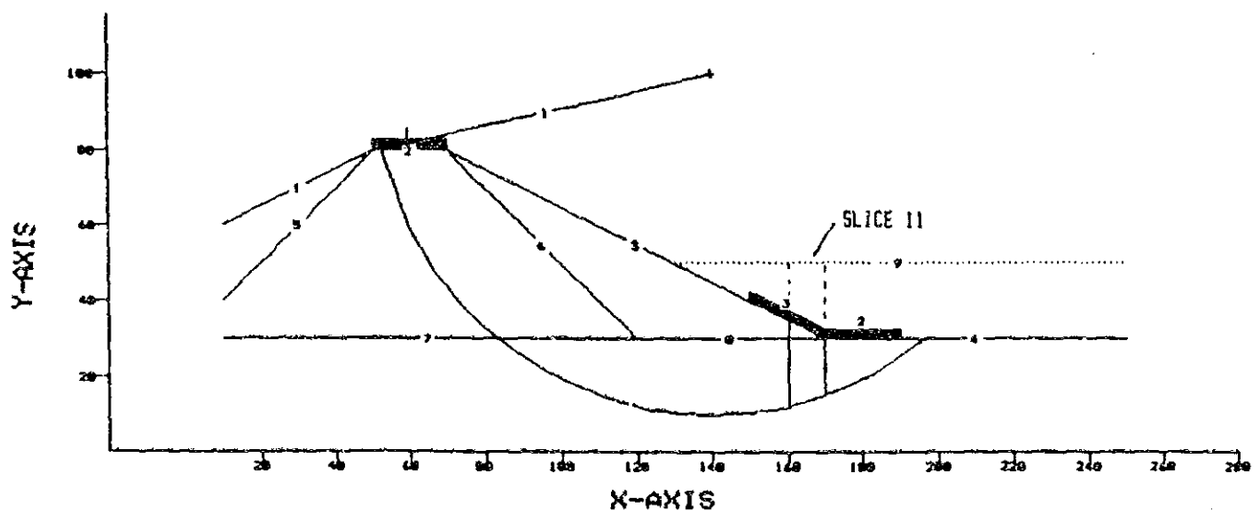


X= 140.0 Y= 100.0 R= 90.0

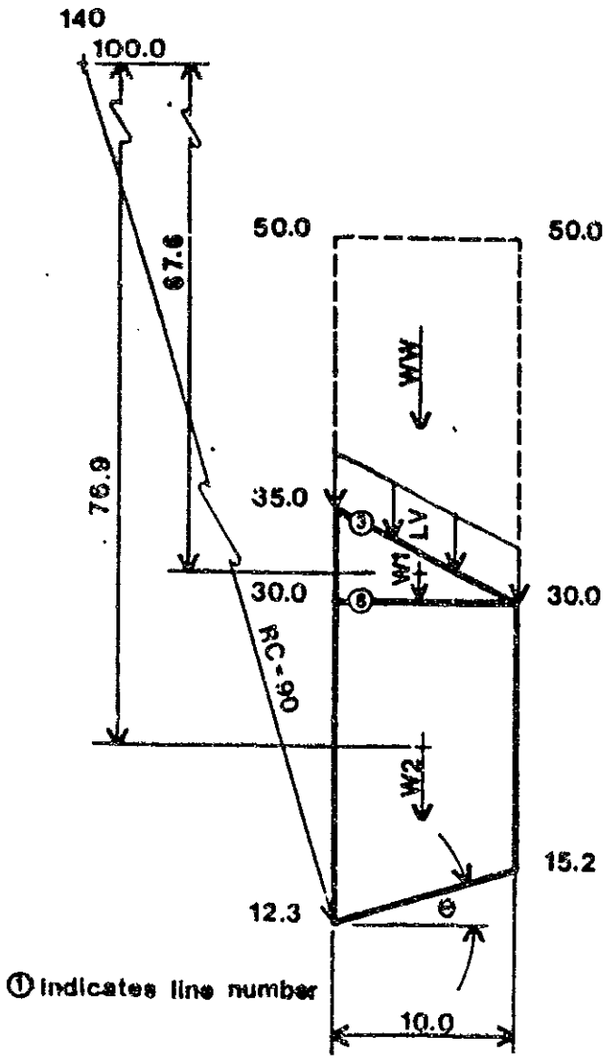
SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	52.3	7.9	3.452	0.000	0	6713	0	0	6532
2	55.1	14.9	1.789	0.268	750	62530	19806	26775	57376
3	70.0	13.4	1.000	0.268	750	56111	31173	16847	45678
4	83.4	12.2	0.681	0.364	50	57832	32129	8761	39962
5	95.6	12.2	0.472	0.364	50	60392	33551	9104	34400
6	107.8	12.2	0.304	0.364	50	59920	33293	9222	26876
7	120.0	10.0	0.169	0.364	50	46489	25783	7427	15545
8	130.0	10.0	0.056	0.364	50	43170	23988	7272	9275
9	140.0	10.0	-0.056	0.364	50	40136	22290	7226	2794
10	150.0	10.0	-0.169	0.364	50	40379	19933	8886	-4073
11	160.0	10.0	-0.290	0.364	50	34058	16866	8736	-9983
12	170.0	10.0	-0.423	0.364	50	29489	13083	8756	-8895
13	180.0	10.0	-0.579	0.364	50	24978	10077	9010	-10542
14	190.0	6.6	-0.736	0.364	50	9093	5051	3763	-5087

DD12RA - Final checkout w/Ru & all options
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 140.0, Y= 100.0
FS= 0.659 at R= 90.0

(2-3-86)

The resisting and driving terms for slice 11 are calculated as follows:



W1 = 25*130 = 3250
W2 = 163*120 = 19560
WT = = 22810

FV = 175*62.4 = 10920
LV = 10*500 = 5000

W = (22810 + 10920 + 5000)
= 38730

VEC = +.1
WA = 38730*(1 - 0.1)
= 34857

Ru = .5
U = 33730*.5 = 16865

$$H = \left[(15.2 - 12.3)^2 + 10^2\right]^{1/2} = 10.4$$

$$\sin(\theta) = \frac{12.3 - 15.2}{10.4} = -.279$$

cos(θ) = .960
tan(θ) = -.290

$$FM = 50 + 15 + \frac{5*(2*5 + 3*15)}{3*(5+30)}$$
= 67.6

$$LS = \left|\frac{-5}{10}\right| = .5$$

$$FD = \frac{10920*.5*67.6}{90} = 4102$$

EM = 100-(35+30+12.3+15.2)/4
= 76.9

HEC = +.2 c = 50 tan(φ) = .364 F = .659

$$ED = \frac{76.9*22810*.2}{90} = 3898$$

$$R = \frac{50*10 + .364*(34857 - 16865)}{.960*\left[1 + \frac{.364* -.290}{.659}\right]} = 8743$$

D = (34857* -.279) + 3898 - 4102 = -9929

002771

9.11 EXAMPLE CALCULATION USING A PHREATIC SURFACE AND OPTIONS

Consider the following example:

SB-SLOPE

PROJECT DATA
Project: Heather Lake Dam
Location: Getaway, Colorado
Filename: 0012PA Description: Final checkout w/PL and all options

ANALYSIS DATA

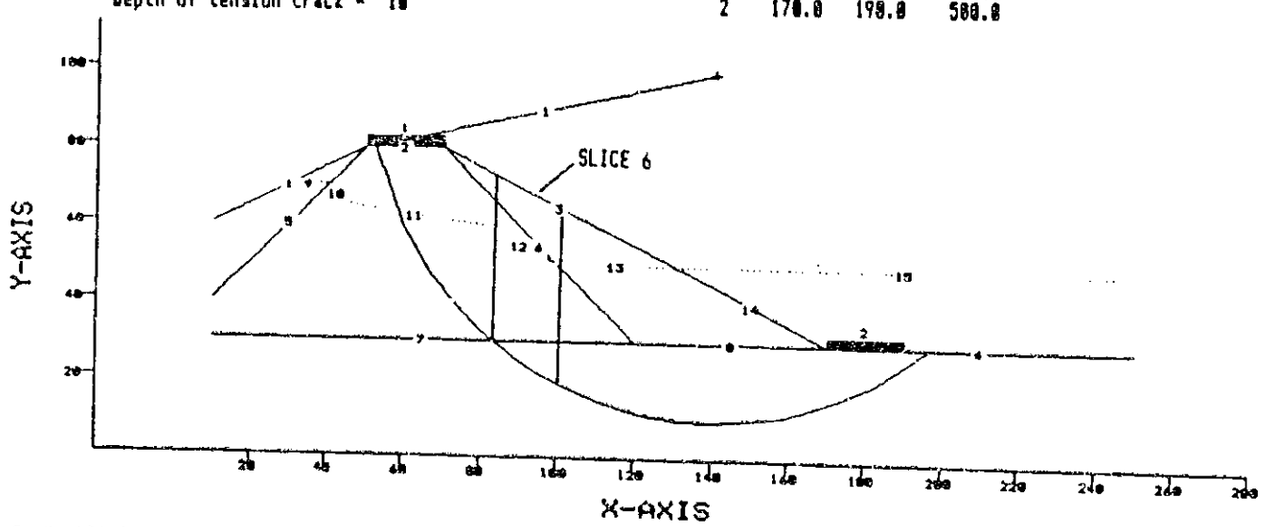
Line No.	Left X	Left Y	Right X	Right Y	Density PCF	Cohesion PSF	Phi Deg	Phreatic Line
1	10.0	60.0	50.0	80.0	130.0	250	30	N
2	50.0	80.0	70.0	80.0	115.0	750	15	N
3	70.0	80.0	130.0	50.0	130.0	250	30	N
4	170.0	30.0	250.0	30.0	120.0	50	20	N
5	10.0	40.0	50.0	80.0	115.0	750	15	N
6	70.0	80.0	120.0	30.0	115.0	750	15	N
7	10.0	30.0	120.0	30.0	120.0	50	20	N
8	120.0	30.0	170.0	30.0	120.0	50	20	N
9	30.0	70.0	40.0	70.0	130.0	250	30	Y
10	40.0	70.0	45.0	65.0	115.0	750	15	Y
11	45.0	65.0	80.0	60.0	115.0	750	15	Y
12	80.0	60.0	100.0	50.0	115.0	750	15	Y
13	100.0	50.0	130.0	50.0	130.0	250	30	Y
14	130.0	50.0	170.0	30.0	130.0	250	30	N
15	130.0	50.0	250.0	50.0	Free water line			

Horizontal earthquake coefficient = 0.2
Vertical earthquake coefficient = 0.1

Depth of tension crack = 10

Distributed loads

No.	Left X	Right X	Load (lbs/ft)
1	50.0	70.0	2000.0
2	170.0	190.0	500.0



X= 140.0 Y= 100.0 R= 90.0

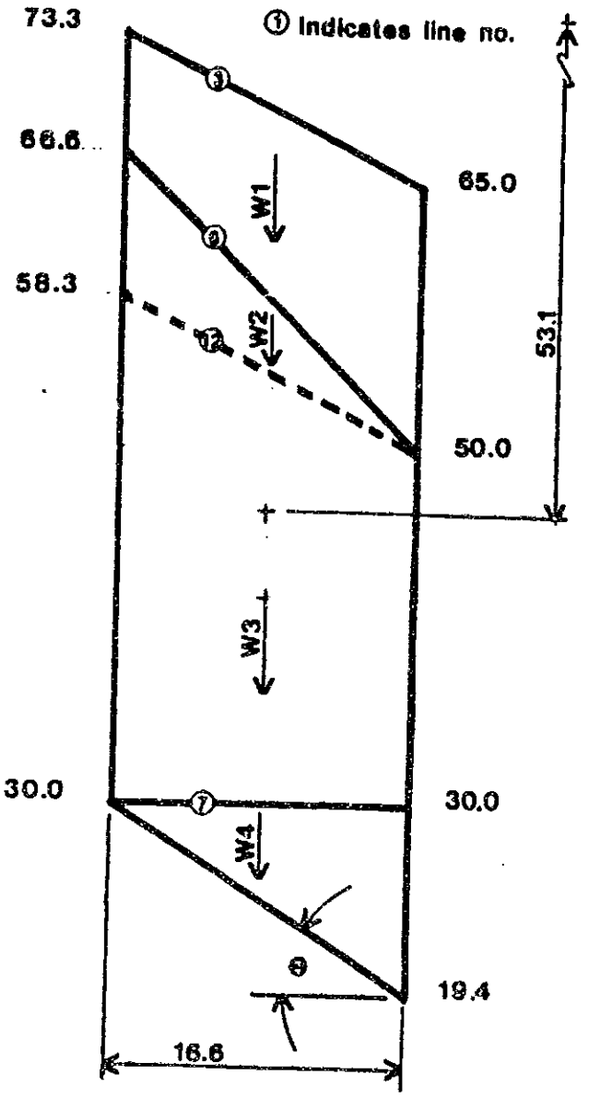
SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	52.3	2.9	3.452	0.000	0	6713	0	0	6532
2	55.1	2.7	2.498	0.268	750	8735	0	5717	8360
3	57.9	12.1	1.628	0.268	750	55288	6882	24868	49871
4	70.0	10.0	1.051	0.268	750	41039	14065	14741	34009
5	80.0	3.4	0.850	0.268	750	15428	5927	4920	11793
6	83.4	16.6	0.641	0.364	50	79057	38452	16028	53832
7	100.0	10.0	0.423	0.364	50	49757	28428	9740	26771
8	110.0	10.0	0.298	0.364	50	49105	22652	9826	21472
9	120.0	10.0	0.169	0.364	50	46409	24084	7965	15545
10	130.0	10.0	0.056	0.364	50	43178	24786	6979	9275
11	140.0	10.0	-0.056	0.364	50	40136	24786	6308	2794
12	150.0	10.0	-0.169	0.364	50	35879	24084	5392	-3322
13	160.0	10.0	-0.298	0.364	50	30350	22652	4137	-8651
14	170.0	10.0	-0.423	0.364	50	29409	28428	5467	-8895
15	190.0	10.0	-0.579	0.364	50	24878	17302	5165	-10542
16	190.0	6.6	-0.736	0.364	50	9893	9189	636	-5087

0012PA - Final checkout w/PL and all options
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 140.0, Y= 100.0
FS= 0.626 at R= 90.0

002772

The resisting and driving terms for slice 6 are calculated as follows:



W1 = 179.8*130 = 23370
W2 = 68.8*115 = 7907
W3 = 400.1*115 = 46015
W4 = 88.0*120 = 10560
WT = = 87852

U = 488.1*62.4 = 30459

VEC = +.1
WA = 87852*(1- .1) = 79067

$$EM = 100 - \frac{24.7 + 69.1}{2} = 53.1$$

HEC = +.2

$$ED = \frac{53.1*87852*.2}{90} = 10367$$

$$H = \left[(30-19.4)^2 + 16.6^2\right]^{1/2} = 19.7$$

$$\sin(\theta) = \frac{30 - 19.4}{19.7} = .538$$

cos(θ) = .843

tan(θ) = .639

c = 50

tan(φ) = .364

F = .626

$$R = \frac{50*16.6 + .364*(79067 - 30459)}{.843 * \left[1 + \frac{.364*.639}{.626}\right]} = 16020$$

D = 79067*.538 + 10367 = 52905

002773

SB-SLOPE

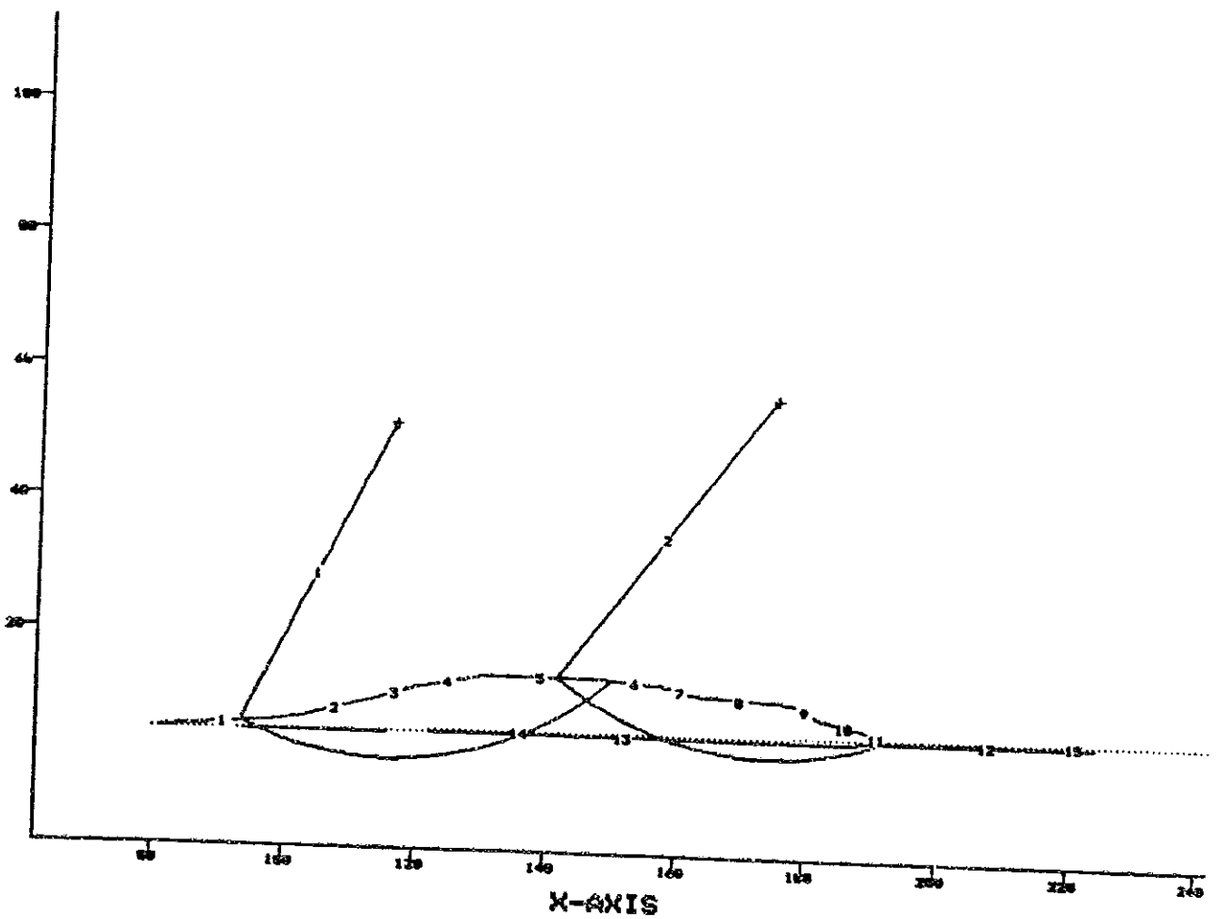
Simplified Bishop Slope Stability Analysis

PROJECT: SHERIDAN

LOCATION: WALLER

ANALYSIS DONE ON FILE REI1
FAILURE CIRCLES AND FACTORS OF SAFETY

No. 1	X= 116.0	Y= 51.7	R= 50.7	FS= 5.83
No. 2	X= 174.5	Y= 56.8	R= 54.1	FS= 6.76



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Minimum FS found during interactive analysis = 5.83
Found at X= 116.0, Y= 51.7, R= 50.7

X= 116.0 Y= 51.7 R= 50.7

SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	93.5	2.4	-0.464	0.364	500	186	0	1418	-78
2	95.8	0.2	-0.431	0.364	500	31	1	120	-12
3	96.0	6.0	-0.356	0.577	200	2003	437	2310	-672
4	102.0	4.0	-0.244	0.577	200	2488	690	1938	-589
5	106.0	4.0	-0.160	0.577	200	3372	900	2292	-533
6	110.0	4.0	-0.079	0.577	200	4091	1027	2597	-323
7	114.0	2.0	-0.020	0.577	200	2296	540	1418	-45
8	116.0	4.0	0.039	0.577	200	5025	1068	3074	198
9	120.0	5.0	0.129	0.577	200	6738	1222	4166	864
10	125.0	5.0	0.233	0.577	200	6772	952	4376	1537
11	130.0	6.2	0.359	0.577	200	7502	543	5404	2537
12	136.2	0.7	0.444	0.364	500	707	6	633	287
13	136.9	5.5	0.529	0.364	500	4704	0	4908	2201
14	142.5	5.5	0.707	0.364	500	2427	0	4285	1401
15	148.0	1.8	0.852	0.364	500	182	0	1201	118

002775

SB-SLOPE

PROJECT DATA
Project: SHERIDAN
Location: WALLER
Filename: REI1 Description: SHERIDAN

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density pcf	Cohesion psf	Phi Deg	Phreatic Line
1	80.0	5.0	102.0	7.0	120.0	500	20	N
2	102.0	7.0	114.0	10.0	120.0	500	20	N
3	114.0	10.0	120.0	12.0	120.0	500	20	N
4	120.0	12.0	130.0	14.0	120.0	500	20	N
5	130.0	14.0	148.0	14.0	120.0	500	20	N
6	148.0	14.0	159.0	13.0	120.0	500	20	N
7	159.0	13.0	162.0	12.0	120.0	500	20	N
8	162.0	12.0	178.0	11.0	120.0	500	20	N
9	178.0	11.0	182.0	9.0	120.0	500	20	N
10	182.0	9.0	190.0	7.0	120.0	500	20	N
11	190.0	7.0	192.0	5.9	120.0	500	20	N
12	192.0	5.9	224.0	5.4	120.0	500	20	N
13	80.0	5.0	224.0	5.4	125.0	200	30	N
14	80.0	5.0	192.0	5.9	120.0	500	20	Y
15	192.0	5.9	250.0	5.9	Free water line			

REI1 - SHERIDAN
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 174.5, Y= 56.8
FS= 6.755 at R= 54.1

X= 174.5 Y= 56.8 R= 54.1

SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	141.4	6.6	0.662	0.364	500	1726	0	4544	953
2	148.0	4.5	0.502	0.364	500	2846	0	3572	1278
3	152.5	4.5	0.393	0.364	500	3708	0	3780	1356
4	157.0	1.2	0.329	0.364	500	1128	16	1049	353
5	158.2	0.8	0.308	0.577	200	773	27	604	227
6	159.0	3.0	0.268	0.577	200	2866	202	2164	742
7	162.0	4.2	0.196	0.577	200	4088	499	2912	788
8	166.2	4.2	0.116	0.577	200	4298	678	2914	497
9	170.3	4.2	0.039	0.577	200	4336	770	2885	167
10	174.5	3.5	-0.032	0.577	200	3552	659	2378	-115
11	178.0	4.0	-0.102	0.577	200	3397	695	2393	-346
12	182.0	4.0	-0.179	0.577	200	2396	563	1917	-421
13	186.0	4.0	-0.258	0.577	200	1480	353	1532	-370
14	190.0	1.1	-0.311	0.577	200	206	51	332	-61
15	191.1	0.9	-0.332	0.364	500	75	25	504	-24
	192.0	0.8	-0.351	0.364	500	14	8	432	-5

002776

SB-SLOPE

PROJECT DATA
Project: SHERIDAN
Location: WALLER
Filename: REI1 Description: SHERIDAN

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density pcf	Cohesion psf	Phi Deg	Phreatic Line
1	80.0	5.0	102.0	7.0	120.0	500	20	N
2	102.0	7.0	114.0	10.0	120.0	500	20	N
3	114.0	10.0	120.0	12.0	120.0	500	20	N
4	120.0	12.0	130.0	14.0	120.0	500	20	N
5	130.0	14.0	148.0	14.0	120.0	500	20	N
6	148.0	14.0	159.0	13.0	120.0	500	20	N
7	159.0	13.0	162.0	12.0	120.0	500	20	N
8	162.0	12.0	178.0	11.0	120.0	500	20	N
9	178.0	11.0	182.0	9.0	120.0	500	20	N
10	182.0	9.0	190.0	7.0	120.0	500	20	N
11	190.0	7.0	192.0	5.9	120.0	500	20	N
	192.0	5.9	224.0	5.4	120.0	500	20	N
13	80.0	5.0	224.0	5.4	125.0	200	30	N
14	80.0	5.0	192.0	5.9	120.0	500	20	Y
15	192.0	5.9	250.0	5.9	Free water line			

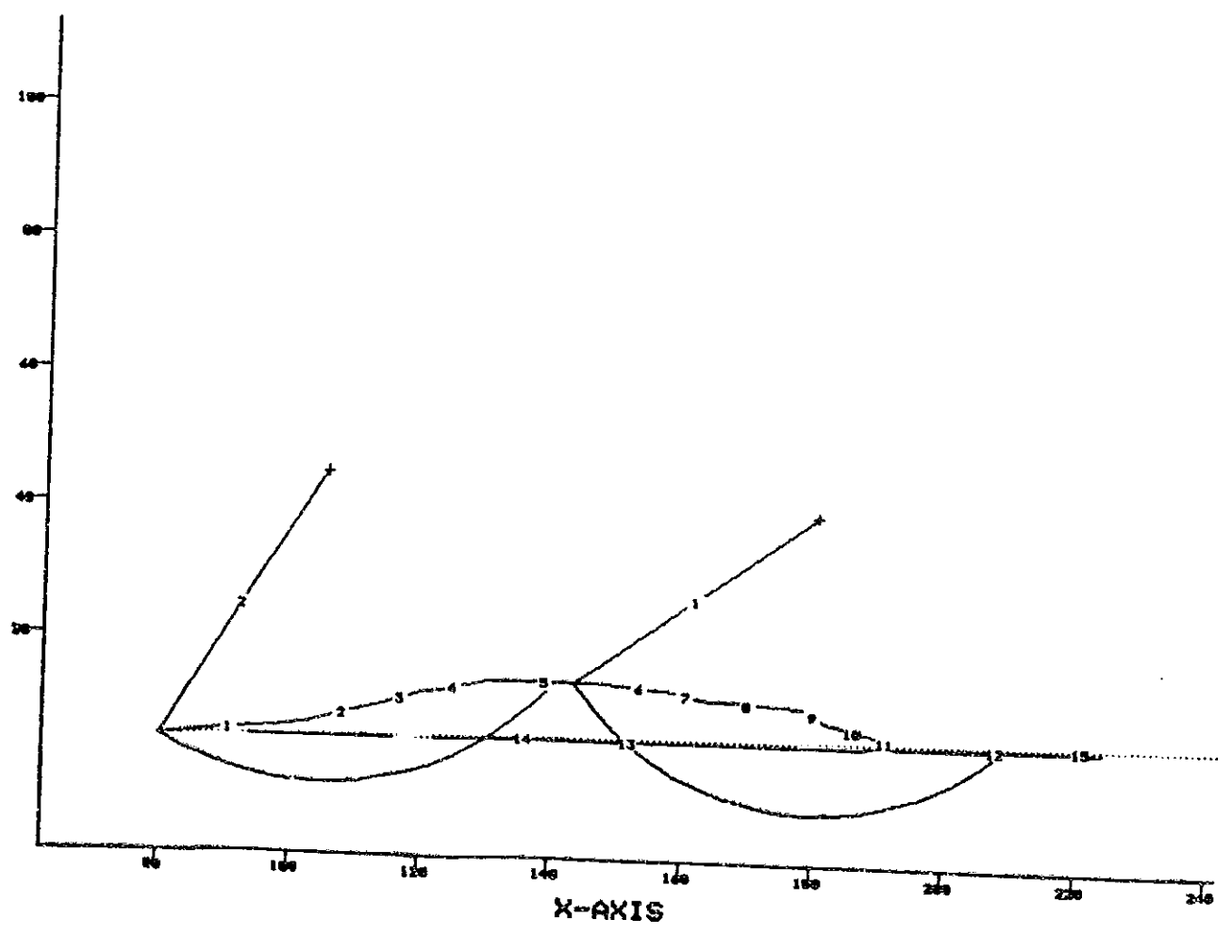
SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: SHERIDAN

LOCATION: WALLER

ANALYSIS DONE ON FILE REI1
FAILURE CIRCLES AND FACTORS OF SAFETY
No. 1 X= 180.0 Y= 40.0 R= 45.0 FS= 5.07
No. 2 X= 105.0 Y= 45.0 R= 47.0 FS= 4.68



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002777

REI1 - SHERIDAN
SINGLE CENTER ANALYSIS
Approximately 15 slices selected

Circle center at X= 180.0, Y= 40.0
FS= 5.073 at R= 45.0

X= 180.0 Y= 40.0 R= 45.0

SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	143.3	4.7	1.192	0.364	500	1600	0	4224	1226
2	148.0	3.0	0.923	0.364	500	2503	0	3092	1697
3	151.0	0.4	0.831	0.364	500	447	5	472	286
4	151.5	7.5	0.664	0.577	200	9709	1365	7056	5370
5	159.0	3.0	0.481	0.577	200	4774	1155	2830	2070
6	162.0	5.3	0.363	0.577	200	9187	2627	4960	3137
7	167.3	5.3	0.228	0.577	200	10026	3166	5026	2232
8	172.7	5.3	0.104	0.577	200	10405	3475	5035	1081
9	178.0	2.0	0.022	0.577	200	3817	1345	1823	85
10	180.0	2.0	-0.022	0.577	200	3577	1347	1693	-80
11	182.0	8.0	-0.135	0.577	200	12307	5125	5889	-1648
12	190.0	2.0	-0.252	0.577	200	2507	1187	1233	-613
13	192.0	5.6	-0.349	0.577	200	5752	2886	3054	-1894
14	197.6	5.6	-0.509	0.577	200	4059	2055	2706	-1841
15	203.1	5.6	-0.708	0.577	200	1668	875	2096	-965
	208.7	0.3	-0.837	0.364	500	11	8	230	-7

SB-SLOPE

PROJECT DATA
Project: SHERIDAN
Location: WALLER
Filename: REI1 Description: SHERIDAN

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density pcf	Cohesion psf	Phi Deg	Phreatic Line
1	80.0	5.0	102.0	7.0	120.0	500	20	N
2	102.0	7.0	114.0	10.0	120.0	500	20	N
3	114.0	10.0	120.0	12.0	120.0	500	20	N
4	120.0	12.0	130.0	14.0	120.0	500	20	N
5	130.0	14.0	148.0	14.0	120.0	500	20	N
6	148.0	14.0	159.0	13.0	120.0	500	20	N
7	159.0	13.0	162.0	12.0	120.0	500	20	N
8	162.0	12.0	178.0	11.0	120.0	500	20	N
9	178.0	11.0	182.0	9.0	120.0	500	20	N
10	182.0	9.0	190.0	7.0	120.0	500	20	N
11	190.0	7.0	192.0	5.9	120.0	500	20	N
12	192.0	5.9	224.0	5.4	120.0	500	20	N
13	80.0	5.0	224.0	5.4	125.0	200	30	N
14	80.0	5.0	192.0	5.9	120.0	500	20	Y
15	192.0	5.9	250.0	5.9	Free water line			

002778

SHERIDAN
GRID SEARCH ANALYSIS
Approximately 15 slices selected

Xmin=	105.0	Xmax=	115.0	Increment=	2.0
Ymin=	45.0	Ymax=	55.0	Increment=	2.0
Rmin=	45.0	Rmax=	55.0	Increment=	2.0

Minimum FS found during grid pattern = 4.68
Found at X= 105.0, Y= 45.0, R= 47.0

X= 105.0 Y= 45.0 R= 47.0

SLICE	X-LEFT	DX	TAN THETA	TAN PHI	COHESION	VERTICAL FORCE	PORE WATER FORCE	RESISTING TERM	DRIVING TERM
1	80.3	0.0	-0.618	0.364	500	0	0	23	-0
2	80.3	0.0	-0.617	0.364	500	0	0	2	-0
3	80.3	4.3	-0.547	0.577	200	760	326	1349	-364
4	84.7	4.3	-0.420	0.577	200	2101	902	1767	-813
5	89.0	4.3	-0.309	0.577	200	3162	1339	2074	-932
6	93.3	4.3	-0.207	0.577	200	3973	1650	2303	-804
7	97.7	4.3	-0.111	0.577	200	4551	1846	2472	-501
8	102.0	3.0	-0.032	0.577	200	3463	1337	1834	-111
9	105.0	4.5	0.048	0.577	200	5667	1997	3008	272
10	109.5	4.5	0.145	0.577	200	6030	1885	3279	867
11	114.0	6.0	0.265	0.577	200	8325	2109	4823	2130
12	120.0	5.0	0.401	0.577	200	6652	1202	4282	2477
13	125.0	5.0	0.544	0.577	200	5792	491	4369	2769
14	129.9	0.1	0.626	0.364	500	105	1	99	56
15	130.0	0.3	0.634	0.364	500	336	2	321	180
16	130.3	5.0	0.737	0.364	500	4053	0	4716	2405
17	135.3	5.0	0.981	0.364	500	1473	0	4003	1032

SB-SLOPE

PROJECT DATA
Project: SHERIDAN
Location: WALLER
Filename: REI1 Description: SHERIDAN

ANALYSIS DATA

Line No.	Left X	Left Y	Right X	Right Y	Density pcf	Cohesion psf	Phi Deg	Phreatic Line
1	80.0	5.0	102.0	7.0	120.0	500	20	N
2	102.0	7.0	114.0	10.0	120.0	500	20	N
3	114.0	10.0	120.0	12.0	120.0	500	20	N
4	120.0	12.0	130.0	14.0	120.0	500	20	N
5	130.0	14.0	148.0	14.0	120.0	500	20	N
6	148.0	14.0	159.0	13.0	120.0	500	20	N
7	159.0	13.0	162.0	12.0	120.0	500	20	N
8	162.0	12.0	178.0	11.0	120.0	500	20	N
9	178.0	11.0	182.0	9.0	120.0	500	20	N
10	182.0	9.0	190.0	7.0	120.0	500	20	N
11	190.0	7.0	192.0	5.9	120.0	500	20	N
12	192.0	5.9	224.0	5.4	120.0	500	20	N
13	80.0	5.0	224.0	5.4	125.0	200	30	N
14	80.0	5.0	192.0	5.9	120.0	500	20	Y
15	192.0	5.9	250.0	5.9	Free water line			

002779