REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

at the

GRATWICK-RIVERSIDE PARK SITE

NIAGARA COUNTY, NEW YORK

APPENDICES A THRU F

SITE #932060

Prepared for :

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

50 Wolf Road, Albany, New York 12233

Thomas C. Jorling - Commissioner

DIVISION OF HAZARDOUS WASTE REMEDIATION

Michael J. O'Toole, Jr., P.E. - Director

URS Consultants, Inc.
570 Delaware Avenue
Buffalo, New York 14202

MARCH 1991

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1142

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APPENDICES

Appendix G has been appended to the Feasibility Study volume.

APPENDIX A

CLIMATIC DATA

APPENDIX A
CLIMATIC DATA

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APPENDIX A
CLIMATIC DATA

A.1 INTRODUCTION

The following section presents climatic data for the region centered around Gratwick-Riverside Park. Data for the Niagara Falls, New York area was obtained from the U.S. Department of the Air Force, Weather Squadron located at the Niagara Falls International Airport. Included are precipitation, temperature and wind data for the period June 1, 1951 through December 31, 1987. Additionally, climatic data for the Buffalo area was obtained from the National Climatic Data Center, Ashville, North Carolina as recorded by the National Oceanic and Atmospheric Administration at the Buffalo International Airport. These data were utilized for the hydrologic evaluation of the Gratwick-Riverside Park site.

A.2 CLIMATIC DATA FOR NIAGARA FALLS INTERNATIONAL AIRPORT NIAGARA FALLS, NEW YORK

FROM: DEPARTMENT OF THE AIR FORCE
OL-B, Detachment 8, 26th Weather Squadron (MAC)
Niagara Falls IAP, NY 14304-5000

4 January 1988

REPLY TO ATTN OF: Mr. Michael G. Berg (236-2393)

SUBJECT: Weather Information for the Period June 1, 1951- December 31, 1987.

TO: Ms. Amy M. Monti
URS Consultants, INC.
570 Delaware Avenue
Buffalo, New York 14202-1207 (716-883-5525)

I have attached the information you requested regarding mean annual precipitation, mean annual temperature, maximum monthly precipitation, 24 hour maximum precipitation, maximum and minimum temperature and wind information for the period June 1, 1951- December 31, 1987. Also attached is the daily precipitation values for the month of December 1987. However, the recipient is advised that the Air Force will not assume legal, financial, or moral responsibility for the data provided. If you have any questions about this data, please feel free to contact me at the above number.

Michael G. Berg
Michael G. Berg
Supervisor

cc: Det 8, 26WS

RECEIVED
URS COMPANY
JAN 8 1988

JOB # 35149

MAXIMUM AND MINIMUM TEMPERATURES BY MONTH FOR THE PERIOD JUNE 1, 1951 - DECEMBER 31, 1987
(degrees Farenheit)

	Max/ Min
January	57 / -16
February	64 / -17
March	79 / -8
April	84 / 12
May	92 / 29
June	93 / 33
July	95 / 46
August	93 / 40
September	96 / 30
October	84 / 23
November	79 / -2
December	71 / -8

WIND INFORMATION FOR THE PERIOD JUNE 1, 1951 - DECEMBER 31, 1987

The prevailing wind direction for the period was out of the southwest and average wind speed was 9 knots.

MEAN ANNUAL TEMPERATURE BY MONTH FOR THE PERIOD JUNE 1, 1951 - DECEMBER 31, 1987
(degrees Farenheit)

January	24
February	26
March	34
April	47
May	57
June	66
July	71
August	70
September	62
October	52
November	41
December	31

MEAN ANNUAL PRECIPITATION BY MONTH FOR THE PERIOD
JUNE 1, 1951 - DECEMBER 31, 1987 (in inches)

January - 2.50
February - 2.34
March - 2.60
April - 2.90
May - 2.90
June - 2.80
July - 2.70
August - 3.70
September - 3.20
October - 2.90
November - 3.20
December - 3.10

MAXIMUM MONTHLY PRECIPITATION BY MONTH FOR THE
PERIOD JUNE 1, 1951 - DECEMBER 31, 1987 (in inches)

January - 4.60
February - 4.50
March - 5.00
April - 4.70
May - 6.50
June - 4.90
July - 5.80
August - 9.00
September - 7.90
October - 4.97
November - 7.54
December - 4.76

24 HOUR MAXIMUM PRECIPITATION BY MONTH FOR THE
PERIOD JUNE 1, 1951 - DECEMBER 31, 1987 (in inches)

January - 1.40
February - 3.10
March - 2.30
April - 1.60
May - 1.90
June - 2.50
July - 2.00
August - 3.20
September - 4.40
October - 2.40
November - 1.66
December - 1.30

DAILY PRECIPITATION FOR DECEMBER 1987

December   T= Trace

1) .03
2) T
3) .11
4) .04
5) .04
6) T
7) 0
8) T
9) .32
10) T
11) T
12) .11
13) T
14) T
15) .96
16) .02
17) T
18) T
19) .10
20) .47
21) 0
22) T
23) .03
24) .02
25) .17
26) .01
27) 0
28) .09
29) .09
30) T
31) T

A.3 CLIMATIC DATA FOR BUFFALO, NEW YORK

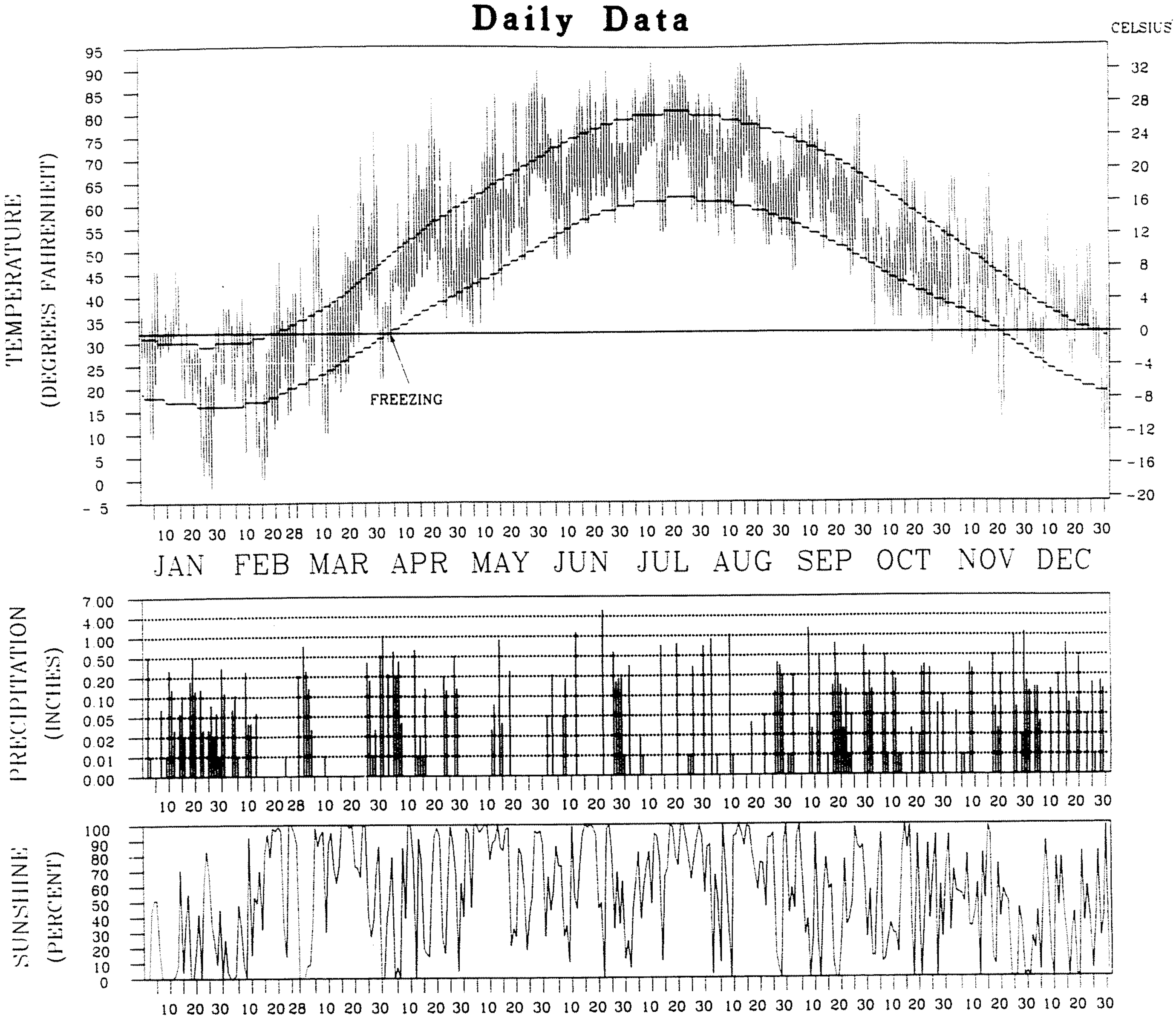
ISSN 0198-3571

LOCAL CLIMATOLOGICAL DATA

1987 ANNUAL SUMMARY WITH COMPARATIVE DATA

BUFFALO,
NEW YORK

Daily Data



TEMPERATURE DEPICTS NORMAL MAXIMUM, NORMAL MINIMUM AND ACTUAL DAILY HIGH AND LOW VALUES (FAHRENHEIT)
PRECIPITATION IS MEASURED IN INCHES. SCALE IS NON-LINEAR
SUNSHINE IS PERCENT OF THE POSSIBLE SUNSHINE

I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND IS COMPILED FROM RECORDS ON FILE AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE, NORTH CAROLINA, 28801

Kenneth D Hadeen
DIRECTOR
NATIONAL CLIMATIC DATA CENTER

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER ASHEVILLE NORTH CAROLINA

METEOROLOGICAL DATA FOR 1987

BUFFALO, NEW YORK

LATITUDE: 42°56' N   LONGITUDE: 78°44' W   ELEVATION: FT. GRND 705 BARO 715   TIME ZONE: EASTERN   WBAN: 14733

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F:													
Averages													
-Daily Maximum	32.[illegible]	32.9	47.6	58.9	70.7	78.2	82.6	77.9	71.4	56.1	49.4	39.6	58.[illegible]
-Daily Minimum	20.0	[illegible]	27.8	41.0	50.2	59.6	65.8	59.9	55.3	39.6	35.5	29.0	[illegible]
-Monthly	26.[illegible]	25.0	37.7	50.0	60.5	68.9	74.2	68.9	63.4	47.9	42.5	34.3	50.[illegible]
-Monthly Dewpt	19.6	16.8	26.0	39.2	46.3	57.0	63.6	57.4	55.2	38.0	33.[illegible]	26.5	39.9
Extremes													
-Highest	46	48	77	84	90	90	92	92	81	71	68	58	92
-Date	14	[illegible]	29	20	30	25	12	[illegible]	[illegible]	16	17	3	AUG [illegible]
-Lowest	-2	3	10	22	33	48	54	5[illegible]	44	29	13	8	-2
-Date	2[illegible]	16	11	1	5	10	16	25	25	26	21	30	JAN 2[illegible]
DEGREE DAYS BASE 65 °F:													
Heating	1199	1115	837	447	213	28	3	25	91	527	665	948	6098
Cooling	0	0	0	4	79	151	298	152	49	0	0	0	733
% OF POSSIBLE SUNSHINE	24	54	65	54	76	63	71	65	50	49	42	37	56
AVG. SKY COVER (tenths)													
Sunrise - Sunset	8.6	7.0	5.9	7.0	5.7	6.3	5.6	5.8	7.1	6.9	8.5	8.9	6.[illegible]
Midnight - Midnight	8.5	6.6	5.8	6.9	5.5	6.2	5.6	5.6	6.7	6.6	8.2	9.0	6.[illegible]
NUMBER OF DAYS:													
Sunrise to Sunset													
-Clear	1	7	10	7	9	8	7	9	6	5	0	0	6[illegible]
-Partly Cloudy	5	4	7	6	9	6	17	10	6	10	6	6	92
-Cloudy	25	17	14	17	13	16	7	12	18	16	24	25	204
Precipitation .01 inches or more	22	9	11	14	5	11	9	11	17	16	14	15	154
Snow, Ice pellets 1.0 inches or more	10	3	2	1	0	0	0	0	0	0	0	4	20
Thunderstorms	1	0	1	1	1	10	7	2	6	1	2	1	33
Heavy Fog, visibility 1/4 mile or less	0	0	1	0	0	0	0	0	4	0	0	0	5
Temperature °F													
-Maximum													
90° and above	0	0	0	0	1	1	2	3	0	0	0	0	[illegible]
32° and below	17	9	3	0	0	0	0	0	0	0	2	5	36
-Minimum													
32° and below	30	28	20	3	0	0	0	0	0	1	11	21	[illegible]
0° and below	1	2	0	0	0	0	0	0	0	0	0	0	3
AVG. STATION PRESS. (mb)	987.8	993.9	992.6	988.3	992.9	988.5	990.7	991.2	990.2	992.9	993.2	989.0	990.[illegible]
RELATIVE HUMIDITY (%)													
Hour 01	77	77	74	81	73	79	82	78	87	80	75	78	79
Hour 07 (Local Time)	81	79	79	82	74	78	82	78	88	81	76	78	80
Hour 13	73	62	54	59	51	53	61	57	63	58	63	68	[illegible]
Hour 19	78	69	65	67	56	60	64	64	76	73	71	74	[illegible]
PRECIPITATION (inches):													
Water Equivalent													
-Total	2.90	0.85	3.66	3.40	1.35	8.36	3.09	3.38	5.32	2.62	4.44	2.78	42.[illegible]
-Greatest (24 hrs)	0.53	0.33	1.55	0.79	0.96	5.01	0.81	1.27	2.15	0.50	1.51	0.88	[illegible]
-Date	2- 3	8- 9	30-31	4- 5	14-15	22	20	9-10	8- 9	7	29	15-16	JUN 22
Snow, Ice pellets													
-Total	28.5	7.7	10.8	2.0	0.0	0.0	0.0	0.0	0.0	T	0.9	9.8	59.[illegible]
-Greatest (24 hrs)	5.3	4.7	7.9	1.3	0.0	0.0	0.0	0.0	0.0	T	0.7	3.4	[illegible]
-Date	2- 3	8- 9	31	4						22	20	28-29	MAR 3[illegible]
WIND:													
Resultant													
-Direction (!!)	261	281	282	093	231	237	232	236	229	238	248	253	[illegible]
-Speed (mph)	5.8	3.1	1.5	0.5	5.0	5.1	5.7	2.9	2.7	5.7	5.0	7.5	[illegible]
Average Speed (mph)	11.9	10.2	10.4	11.3	11.0	10.2	10.1	9.8	8.3	10.2	12.2	13.6	[illegible]
Fastest Mile													
-Direction (!!)	W	NW	SW	SW	W	W	SW	W	S	SW	SW	SW	S
-Speed (mph)	35	32	32	37	34	28	24	27	42	27	34	40	42
-Date	23	12	2	29	14	27	24	31	29	24	17	16	SEP 29
Peak Gust													
-Direction (!!)	W	SW	SW	W	SW	SW	SW	W	S	SW	SW	SW	S
-Speed (mph)	46	43	47	53	49	40	31	38	62	43	45	61	62
-Date	23	8	2	29	9	8	24	31	29	24	4	16	SEP 29

(!!) See Reference Notes on Page 68

NORMALS, MEANS, AND EXTREMES

BUFFALO, NEW YORK

LATITUDE: 42°56'N   LONGITUDE: 78°44'W   ELEVATION: FT. GRND 705 BARO 715   TIME ZONE: EASTERN   WBAN: 14733

	(a)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F:														
Normals														
-Daily Maximum		30.0	31.4	40.4	54.4	65.9	75.6	80.2	78.2	71.4	60.2	47.0	35.0	55.8
-Daily Minimum		17.0	17.5	25.6	36.3	46.3	56.4	61.2	59.6	52.7	42.7	33.6	22.5	39.3
-Monthly		23.5	24.5	33.0	45.4	56.1	66.0	70.7	68.9	62.1	51.5	40.3	28.8	47.6
Extremes														
-Record Highest	44	72	65	81	88	90	95	94	99	98	87	80	74	99
-Year		1950	1981	1945	1986	1987	1957	1968	1948	1953	1951	1961	1982	AUG 1948
-Record Lowest	44	-16	-20	-7	12	26	35	43	38	32	20	9	-10	-20
-Year		1982	1961	1984	1982	1947	1945	1945	1982	1963	1965	1971	1980	FEB 1961
NORMAL DEGREE DAYS:														
Heating (base 65°F)		1287	1134	992	588	294	53	9	25	130	423	741	1122	6798
Cooling (base 65°F)		0	0	0	0	18	83	186	146	43	0	0	0	476
% OF POSSIBLE SUNSHINE	44	31	38	46	52	58	65	68	64	58	50	29	26	49
MEAN SKY COVER (tenths)														
Sunrise - Sunset	44	8.5	8.2	7.6	7.1	6.7	6.2	6.0	6.2	6.4	6.7	8.3	8.6	7.2
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	44	1.4	2.1	3.8	5.0	5.7	6.3	6.9	6.8	6.4	6.5	2.0	1.2	54.1
-Partly Cloudy	44	6.2	5.5	7.5	8.0	9.7	11.4	13.0	11.8	9.8	8.3	5.5	6.0	102.7
-Cloudy	44	23.5	20.7	19.7	17.0	15.7	12.3	11.0	12.4	13.8	16.2	22.5	23.8	208.5
Precipitation														
.01 inches or more	44	20.2	16.8	16.1	14.3	12.3	10.4	9.9	10.6	11.0	11.5	15.9	19.6	168.6
Snow,Ice pellets														
1.0 inches or more	44	7.5	5.4	3.7	1.0	0.*	0.0	0.0	0.0	0.0	0.1	3.1	6.0	26.9
Thunderstorms	44	0.2	0.2	1.3	2.4	2.9	5.2	5.7	6.1	3.8	1.5	1.1	0.5	30.7
Heavy Fog Visibility														
1/4 mile or less	44	1.6	1.8	2.5	2.3	2.4	1.3	0.9	0.9	1.1	1.4	1.3	1.3	18.7
Temperature °F														
-Maximum														
90° and above	27	0.0	0.0	0.0	0.0	0.1	0.6	1.2	0.4	0.*	0.0	0.0	0.0	2.3
32° and below	27	18.4	15.7	7.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	2.0	12.1	56.1
-Minimum														
32° and below	27	28.9	25.7	24.1	10.6	0.7	0.0	0.0	0.0	0.*	3.3	14.0	25.7	133.0
0° and below	27	2.4	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	4.8
AVG. STATION PRESS. (mb)	15	989.9	991.4	989.7	989.0	989.0	989.3	990.2	991.7	992.1	992.7	991.4	990.8	990.6
RELATIVE HUMIDITY (%)														
Hour 01	27	78	79	78	75	76	79	80	83	83	80	79	80	79
Hour 07 (Local Time)	27	79	80	80	77	75	77	78	83	84	82	81	81	80
Hour 13	27	73	70	66	58	55	56	55	58	60	60	69	74	63
Hour 19	27	77	75	73	64	62	61	60	67	72	73	77	78	70
PRECIPITATION (inches):														
Water Equivalent														
-Normal		3.02	2.40	2.97	3.06	2.89	2.72	2.96	4.16	3.37	2.93	3.62	3.42	37.52
-Maximum Monthly	44	6.88	5.80	5.59	5.90	6.39	8.36	6.43	10.67	8.99	9.13	9.75	8.02	10.67
-Year		1982	1960	1976	1961	1953	1987	1963	1977	1977	1954	1985	1977	AUG 1977
-Minimum Monthly	44	1.03	0.81	1.20	1.27	1.21	0.11	0.99	1.10	0.77	0.30	1.44	0.69	0.11
-Year		1946	1968	1967	1946	1965	1955	1972	1948	1964	1963	1944	1943	JUN 1955
-Maximum in 24 hrs	44	2.57	2.31	2.14	1.71	3.52	5.01	3.38	3.88	4.94	3.49	2.51	2.16	5.01
-Year		1982	1954	1954	1977	1986	1987	1963	1963	1979	1945	1949	1945	JUN 1987
Snow,Ice pellets														
-Maximum Monthly	44	68.3	54.2	29.2	15.0	2.0	T			T	3.1	31.3	68.4	68.4
-Year		1977	1958	1959	1975	1945	1980			1956	1972	1976	1985	DEC 1985
-Maximum in 24 hrs	44	25.3	19.4	15.8	6.8	2.0	T			T	2.5	19.9	24.3	25.3
-Year		1982	1984	1954	1975	1945	1980			1956	1972	1955	1945	JAN 1982
WIND:														
Mean Speed (mph)	48	14.3	13.7	13.4	12.8	11.5	11.0	10.4	9.8	10.4	11.1	12.7	13.4	12.0
Prevailing Direction through 1963		WSW	SW	SW	SW	SW	SW	SW	SW	S	S	S	WSW	SW
Fastest Mile														
-Direction (!!)	41	SW	SW	W	W	SW	NW	NW	SW	SW	SW	SW	S	SW
-Speed (MPH)	41	91	70	68	67	63	56	59	56	59	63	66	60	91
-Year		1950	1946	1959	1957	1950	1954	1953	1944	1954	1954	1948	1945	JAN 1950
Peak Gust														
-Direction (!!)	4	SW	SW	W	W	SW	W	SW	W	S	NW	W	SW	W
-Speed (mph)	4	71	51	72	74	55	47	41	52	62	53	61	66	74
-Date		1985	1985	1986	1985	1984	1985	1985	1986	1987	1986	1985	1985	APR 1985

(!!) See Reference Notes on Page 6B.

PRECIPITATION (inches)

BUFFALO, NEW YORK

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1958	3.81	4.78	1.36	1.35	1.79	2.91	1.49	3.16	4.59	1.40	3.49	1.66	34.39
1959	6.47	3.45	3.87	3.21	2.10	1.94	1.98	4.78	2.52	4.93	3.58	3.48	42.81
1960	3.90	5.80	2.35	2.34	4.05	2.48	1.89	3.75	1.20	1.89	2.94	2.57	35.16
1961	1.41	2.63	2.59	5.90	3.01	3.66	3.02	4.03	2.53	2.41	3.30	2.62	37.11
1962	2.78	2.65	1.23	2.25	2.36	2.80	1.89	3.00	3.14	1.90	1.78	2.77	28.55
1963	1.51	1.03	2.19	2.77	2.22	0.61	6.43	8.04	1.20	0.30	5.07	1.83	33.20
1964	2.12	1.09	3.72	3.36	2.91	1.55	2.57	5.02	0.77	1.89	2.09	2.58	29.67
1965	3.27	2.99	1.97	1.99	1.21	1.50	3.69	4.12	2.37	5.07	4.69	2.60	35.47
1966	3.74	2.11	2.78	2.06	1.36	1.97	4.92	3.60	2.65	0.93	4.50	2.25	32.87
1967	1.18	1.39	1.20	2.60	3.69	2.50	1.57	4.04	6.36	4.78	3.13	2.16	34.60
1968	2.18	0.81	2.67	1.78	3.30	4.45	1.19	5.33	5.63	3.03	4.47	3.42	38.26
1969	3.85	0.97	1.62	4.16	3.75	3.51	3.83	2.48	2.04	2.77	4.09	3.09	36.16
1970	2.06	1.74	1.72	2.54	2.87	2.55	4.02	2.01	4.55	4.20	3.20	3.25	34.71
1971	1.46	3.03	2.07	1.48	1.56	4.25	4.50	4.43	1.88	1.57	3.07	3.61	32.91
1972	2.17	3.44	3.99	2.99	3.64	6.06	0.99	4.19	3.06	2.96	4.28	3.86	41.63
1973	2.03	1.98	3.27	3.56	2.99	1.68	3.68	2.98	1.44	4.27	4.07	4.89	36.84
1974	2.44	2.19	3.19	3.15	3.36	3.86	1.80	3.64	2.42	1.75	5.38	3.13	36.31
1975	2.11	2.93	2.92	1.86	3.31	3.65	2.34	8.49	2.44	1.13	2.77	4.58	38.53
1976	3.19	3.43	5.59	4.01	4.70	3.36	5.65	1.65	5.39	3.61	2.11	3.83	46.52
1977	3.38	1.59	2.42	3.60	1.39	2.79	3.64	10.67	8.99	2.61	4.45	8.02	53.55
1978	6.29	1.36	1.72	1.84	3.95	2.42	1.48	3.51	4.40	3.72	1.55	3.50	35.74
1979	5.43	2.03	2.48	3.16	1.63	2.18	3.51	6.26	5.61	3.88	4.14	3.43	43.74
1980	1.97	1.08	4.05	2.43	1.60	5.82	3.55	3.58	4.53	4.69	2.36	2.65	38.31
1981	1.11	3.50	1.70	3.09	2.56	3.68	5.05	3.13	4.24	3.31	2.22	2.87	36.46
1982	6.88	1.28	2.64	2.33	3.66	3.14	1.50	4.62	3.37	2.06	6.31	3.32	41.11
1983	1.44	1.30	3.20	2.55	3.28	2.99	2.01	3.51	2.11	4.62	5.19	7.30	39.50
1984	1.54	3.59	1.77	2.53	4.67	6.86	1.37	4.16	3.73	0.87	2.66	3.67	37.42
1985	4.27	3.34	4.42	1.33	3.46	3.21	1.81	4.63	1.20	3.73	9.75	4.85	46.00
1986	2.31	2.60	1.95	3.33	4.42	4.15	2.82	2.73	3.88	4.34	3.11	4.02	39.66
1987	2.90	0.85	3.66	3.40	1.35	8.36	3.09	3.38	5.32	2.62	4.44	2.78	42.15
Record Mean	3.10	2.67	2.76	2.69	2.89	2.89	2.90	3.24	3.08	3.05	3.32	3.28	35.87

See Reference Notes on Page 6B.

AVERAGE TEMPERATURE (deg. F)

BUFFALO, NEW YORK

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1958	25.1	20.4	34.5	48.2	54.0	61.9	71.3	68.9	62.1	52.2	41.8	22.3	46.9
1959	22.3	24.2	31.0	46.0	60.2	66.8	72.8	74.8	66.8	52.6	38.6	32.3	49.1
#1960	26.5	27.2	24.1	48.4	58.1	65.8	69.1	69.0	64.3	50.6	42.8	21.6	47.3
1961	18.5	26.5	34.2	39.8	53.1	63.4	69.7	69.6	68.6	54.5	40.8	29.7	47.4
1962	22.6	21.3	32.5	44.9	60.9	64.9	68.2	68.1	58.6	51.5	37.1	25.1	46.3
1963	18.9	18.8	35.4	44.2	52.9	66.7	70.2	64.3	57.1	57.1	43.6	23.4	46.1
1964	29.3	23.5	34.0	46.9	59.2	65.7	73.1	64.9	60.9	48.1	42.1	29.5	48.1
1965	23.6	25.8	30.0	41.2	59.6	64.3	67.6	67.8	63.5	47.8	40.0	34.3	47.1
1966	20.4	24.9	34.7	43.3	52.2	67.4	71.4	68.5	58.7	48.8	41.5	28.6	46.7
1967	29.8	20.6	30.9	46.1	50.1	72.5	71.2	68.1	60.7	51.9	36.3	33.0	47.6
1968	19.9	20.7	35.7	49.2	53.4	64.8	71.2	69.4	66.1	53.5	40.7	26.8	47.6
1969	25.0	24.6	30.9	46.8	54.4	64.4	70.5	71.2	62.2	51.0	39.1	24.8	47.1
1970	17.6	24.8	30.1	46.9	57.3	66.0	71.0	70.2	64.0	54.5	41.6	27.4	47.6
1971	20.9	27.0	29.8	41.8	54.5	67.6	68.7	67.8	65.4	58.7	39.1	33.5	47.9
1972	25.5	22.0	30.1	41.1	59.1	62.6	71.0	67.7	62.8	46.2	35.0	30.8	46.3
1973	27.6	22.9	42.4	46.9	54.5	68.2	72.3	71.8	61.7	54.3	40.8	29.0	49.4
1974	27.1	22.3	33.0	46.2	53.1	65.6	69.9	69.9	59.6	49.2	40.2	31.7	47.3
1975	30.1	29.1	30.8	39.3	62.1	68.0	72.3	69.7	58.3	53.1	46.9	28.3	49.0
1976	19.7	31.8	37.2	46.5	53.4	68.4	67.8	67.5	60.1	46.3	34.1	22.0	46.3
1977	13.8	24.6	39.8	47.0	60.3	64.4	72.0	68.1	62.6	49.6	43.3	27.9	47.8
1978	20.4	15.5	28.2	42.5	57.4	65.1	70.4	70.3	60.8	49.5	40.4	30.4	45.9
1979	20.5	14.9	38.2	44.3	56.9	66.5	71.3	67.5	61.9	50.7	43.5	33.4	47.5
1980	25.8	21.2	31.8	46.1	58.1	61.9	71.7	72.6	62.4	48.7	39.4	25.3	47.1
1981	19.3	32.9	33.9	47.2	56.4	66.2	71.8	70.0	60.9	48.2	40.4	29.0	48.0
1982	17.2	23.2	32.5	41.6	61.0	62.2	71.8	65.0	61.6	52.6	43.0	37.5	47.5
1983	27.0	29.6	36.7	43.6	53.9	67.6	74.2	71.2	63.7	51.7	40.8	22.7	48.6
1984	20.4	33.8	27.1	47.7	52.9	67.8	70.3	70.3	58.5	53.2	39.0	35.6	48.1
1985	21.1	24.8	35.6	49.5	59.5	62.7	69.7	69.2	64.2	52.5	42.0	25.6	48.0
1986	25.5	24.5	36.2	47.8	59.7	64.1	71.1	67.9	61.8	50.9	37.7	32.4	48.3
1987	26.1	25.0	37.7	50.0	60.5	68.9	74.2	68.9	63.4	47.9	42.5	34.3	50.0
Record													
Mean	24.7	24.6	32.5	43.6	54.9	64.8	70.4	68.9	62.5	51.6	40.0	29.6	47.4
Max	31.1	31.5	39.8	51.8	63.5	72.5	78.2	76.9	70.5	59.1	46.3	35.4	54.7
Min	18.3	17.6	25.3	35.4	46.3	57.0	62.6	60.9	54.4	44.1	33.8	23.7	40.0

See Reference Notes on Page 6B.

HEATING DEGREE DAYS Base 65 deg. F

BUFFALO, NEW YORK

SEASON	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	TOTAL
1958-59	2	19	124	395	687	1318	1317	1134	1050	562	216	63	6887
1959-60	1	1	111	388	784	1004	1188	1088	1258	494	235	48	6600
# 1960-61	16	10	77	441	660	1339	1435	1072	952	749	385	90	7226
1961-62	30	17	76	323	722	1089	1310	1216	1002	609	195	66	6655
1962-63	9	26	213	415	832	1231	1420	1288	907	618	370	57	7386
1963-64	20	72	240	241	635	1282	1099	1198	955	535	204	98	6579
1964-65	5	68	176	518	680	1097	1277	1092	1080	706	186	100	6985
1965-66	23	46	122	525	742	942	1374	1114	931	648	401	68	6936
1966-67	[illegible]	19	199	495	700	1124	1086	1239	1047	560	457	4	6937
1967-68	12	26	162	403	853	985	1393	1281	901	469	352	84	6921
1968-69	11	29	58	374	722	1180	1233	1125	1052	540	325	102	6751
1969-70	13	16	147	433	769	1240	1459	1121	1076	552	255	66	7147
1970-71	6	6	93	328	695	1161	1361	1057	1085	691	327	36	6846
1971-72	11	29	87	202	771	971	1218	1237	1070	707	187	112	6602
1972-73	16	33	113	574	860	1054	1152	1173	696	542	318	24	6555
1973-74	2	14	171	326	720	1107	1167	1187	989	553	365	51	6652
1974-75	2	10	187	483	738	1024	1077	1001	1053	764	175	32	6536
1975-76	3	15	197	368	535	1134	1400	958	853	557	358	40	6418
1976-77	15	35	180	573	921	1328	1580	1123	775	544	207	90	7371
1977-78	5	40	110	473	646	1146	1376	1378	1130	670	282	81	7337
1978-79	14	3	154	472	732	1067	1371	1400	823	619	285	65	7005
1979-80	16	35	134	455	636	973	1208	1265	1022	559	240	142	6685
1980-81	2	10	128	498	759	1224	1411	895	956	527	269	33	6702
1981-82	6	11	170	514	732	1108	1476	1163	1002	698	147	95	7122
1982-83	4	65	140	382	656	848	1172	987	868	636	342	71	6171
1983-84	5	10	125	418	722	1304	1378	899	1167	519	385	35	6967
1984-85	11	22	210	360	774	905	1354	1120	902	476	196	95	6425
1985-86	8	12	114	378	685	1215	1215	1128	885	519	197	80	6436
1986-87	4	42	137	430	811	1003	1199	1115	837	447	213	28	6266
1987-88	3	25	91	527	665	948							

See Reference Notes on Page 6B.

COOLING DEGREE DAYS Base 65 deg. F

BUFFALO, NEW YORK

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
1969	0	0	0	0	1	88	192	212	69	6	0	0	568
1970	0	0	0	16	21	108	197	173	72	12	0	0	599
1971	0	0	0	0	9	119	136	122	107	15	0	0	508
1972	0	0	0	0	12	48	210	123	57	0	0	0	450
1973	0	0	0	6	2	126	233	230	78	3	0	0	678
1974	0	0	0	0	7	71	163	158	29	0	0	0	428
1975	0	0	0	0	90	129	238	171	3	3	0	0	634
1976	0	0	0	8	7	149	109	119	40	0	0	0	432
1977	0	0	0	12	68	78	228	142	45	0	1	0	574
1978	0	0	0	0	52	91	189	173	35	0	0	0	540
1979	0	0	0	6	40	118	217	120	49	20	0	0	570
1980	0	0	0	0	32	56	217	242	58	2	0	0	607
1981	0	0	0	2	13	78	225	173	55	0	0	0	546
1982	0	0	0	3	31	18	221	74	45	2	0	2	396
1983	0	0	0	0	5	157	300	214	90	15	0	0	781
1984	0	0	0	5	16	123	183	193	23	1	0	0	544
1985	0	0	0	18	32	32	161	151	96	0	1	0	491
1986	0	0	0	7	38	60	200	137	46	0	0	0	488
1987	0	0	0	4	79	151	298	152	49	0	0	0	733

See Reference Notes on Page 6B.

SNOWFALL (inches)

BUFFALO, NEW YORK

SEASON	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	TOTAL
1958-59	0.0	0.0	0.0	0.0	13.5	19.0	38.4	14.0	29.2	0.4	T	0.0	114.5
1959-60	0.0	0.0	0.0	T	12.2	14.2	18.3	49.5	19.5	1.9	T	0.0	115.6
1960-61	0.0	0.0	0.0	1.0	15.9	31.9	23.5	11.9	5.1	13.1	T	0.0	102.4
1961-62	0.0	0.0	0.0	T	5.6	30.2	26.2	28.2	6.7	4.5	0.0	0.0	101.4
1962-63	0.0	0.0	0.0	2.0	2.5	30.2	31.5	15.5	7.7	0.3	0.1	0.0	89.8
1963-64	0.0	0.0	0.0	0.0	3.1	24.0	13.7	14.6	12.8	3.3	0.0	0.0	71.5
1964-65	0.0	0.0	0.0	T	5.4	15.2	19.2	9.4	17.5	4.2	0.0	0.0	70.9
1965-66	0.0	0.0	0.0	1.2	12.2	7.0	48.0	15.2	11.4	3.2	0.1	0.0	98.3
1966-67	0.0	0.0	0.0	0.0	10.0	12.1	11.6	19.8	10.8	0.6	1.2	0.0	66.1
1967-68	0.0	0.0	0.0	T	19.7	10.4	19.1	11.7	10.6	0.1	0.0	0.0	71.6
1968-69	0.0	0.0	0.0	T	11.6	11.7	31.2	12.8	8.0	3.1	0.0	0.0	78.4
1969-70	0.0	0.0	0.0	1.0	22.1	23.4	38.0	21.9	12.6	1.5	T	0.0	120.5
1970-71	0.0	0.0	0.0	0.0	2.6	32.3	17.2	19.4	22.6	2.9	0.0	0.0	97.0
1971-72	0.0	0.0	0.0	0.0	18.7	12.9	27.6	31.4	14.1	5.2	0.0	0.0	109.9
1972-73	0.0	0.0	0.0	3.1	18.9	19.8	9.9	16.1	8.5	2.4	0.1	0.0	78.8
1973-74	0.0	0.0	0.0	0.0	3.0	23.1	19.7	22.8	12.9	7.1	0.1	0.0	88.7
1974-75	0.0	0.0	0.0	T	22.1	23.6	11.0	16.3	7.6	15.0	0.0	0.0	95.6
1975-76	0.0	0.0	0.0	T	5.5	27.3	21.6	8.3	17.3	2.5	T	0.0	82.5
1976-77	0.0	0.0	0.0	0.2	31.3	60.7	68.3	22.7	13.5	2.2	0.5	0.0	199.4
1977-78	0.0	0.0	0.0	T	15.0	53.4	56.5	21.7	5.8	1.8	0.1	0.0	154.3
1978-79	0.0	0.0	0.0	T	3.0	10.1	42.6	28.3	4.6	8.7	0.0	0.0	97.3
1979-80	0.0	0.0	0.0	T	12.6	19.7	10.2	11.7	13.9	0.3	T	T	68.4
1980-81	0.0	0.0	0.0	T	6.7	21.6	14.4	5.0	13.2	T	0.0	0.0	60.9
1981-82	0.0	0.0	0.0	T	1.8	24.8	53.2	12.7	9.0	10.9	0.0	0.0	112.4
1982-83	0.0	0.0	0.0	0.0	15.8	12.9	9.0	5.5	6.9	2.3	T	0.0	52.4
1983-84	0.0	0.0	0.0	T	17.7	52.0	13.4	32.5	16.0	0.9	T	0.0	132.5
1984-85	0.0	0.0	0.0	0.0	1.4	11.2	65.9	20.9	6.3	1.5	0.0	0.0	107.2
1985-86	0.0	0.0	0.0	0.0	5.2	68.4	17.3	17.3	4.8	1.7	T	0.0	114.7
1986-87	0.0	0.0	0.0	0.0	13.7	4.8	28.5	7.7	10.8	2.0	0.0	0.0	67.5
1987-88	0.0	0.0	0.0	T	0.9	9.8							
Record Mean	0.0	0.0	T	0.2	12.0	22.9	24.8	17.7	11.5	3.1	0.1	T	92.4

See Reference Notes on Page 6B.

REFERENCE NOTES

BUFFALO, NEW YORK

GENERAL
T - TRACE AMOUNT
BLANK ENTRIES DENOTE MISSING/UNREPORTED DATA.
# INDICATES A STATION OR INSTRUMENT RELOCATION
SEE STATION LOCATION TABLE ON PAGE 8.

SPECIFIC
PAGE 2
PM - INCLUDES LAST DAY OF PREVIOUS MONTH

PAGE 3
(a) - LENGTH OF RECORD IN YEARS, ALTHOUGH
INDIVIDUAL MONTHS MAY BE MISSING.
* LESS THAN .05
NORMALS - BASED ON THE 1951-1980 RECORD PERIOD.
EXTREMES - DATES ARE THE MOST RECENT OCCURRENCE.
WIND DIR - NUMERALS SHOW TENS OF DEGRESS CLOCKWISE
FROM TRUE NORTH. "00" INDICATES CALM.
RESULTANT DIRECTIONS ARE GIVEN TO WHOLE DEGREES.

PAGE 4B
MAX AND MIN ARE LONG TERM MEAN DAILY MAXIMUM
AND MEAN DAILY MINIMUM TEMPERATURES.

EXCEPTIONS

PAGES 4A, 4B, 6A
RECORD MEANS ARE THROUGH THE CURRENT YEAR,
BEGINNING IN 1874 FOR TEMPERATURE
1871 FOR PRECIPITATION
1944 FOR SNOWFALL

STATION LOCATION

BUFFALO, NEW YORK

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above Sea level: Ground at temperature site	Elevation above Ground: Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	Remarks
CITY																
Downtown Buffalo Main and Seneca Streets	11/1/70	3/24/71	NA	42° 53'	78° 53'	610	68	53					66			
Brown Building Main and Seneca Streets	3/25/71	8/30/71	NA	42° 53'	78° 53'	610	68	34					62			
Weed Block Main and Swan Streets	8/31/71	6/21/73	500 ft. N	42° 53'	78° 53'	616	72	58					68			Thermometer exposed in window shelter until 6/20/73. Large instrument shelter on roof beginning 6/21/73.
Weed Block Main and Swan Streets	6/21/73	11/1/81	NA	42° 53'	78° 53'	616	85	72					67			
White Building Main and Swan Streets	11/1/81	11/1/83	NA	42° 53'	78° 53'	616	113	107					98			
Board of Trade Building Seneca and Pearl Streets	11/1/83	5/1/87	650 ft.SSW	42° 53'	78° 53'	608	108	100	100				108			8/1/86, whirling psychrometer first used. 5/1/87, Standard Hazen instrument shelter first used.
Downtown Buffalo Board of Trade Building Seneca and Pearl Streets	5/1/87	10/7/95	NA	42° 53'	78° 53'	608	108	103	103				93			
Downtown Buffalo Board of Trade Building Seneca and Pearl Streets	10/7/95	2/28/96	NA	42° 53'	78° 53'	608	123	118	118				108			
Guaranty (Prudential) Bldg. Church and Pearl Streets	3/1/96	2/13/13	825 ft. N	42° 53'	78° 53'	612	206	178	178				168			13th Floor. Tower used for anemometer and wind vane.
New York Telephone Bldg. Church & Franklin Streets	2/13/13	6/30/43	175 ft. W	42° 53'	78° 53'	604	280	247	247		238		238			Consolidated at airport.
AIRPORT																
Buffalo Airport Administration Building	7/12/29	11/18/39	NA	42° 56'	78° 44'	702	58	19	19				a16			a - Installed 1936.
Buffalo Airport Administration Building	11/18/39	8/22/60	750 ft.ESE	42° 56'	78° 44'	693	96 d20	34	34	NA bUnk	NA b32	NA b4 c32	32	NA	NA	b - Installed 7/1/43. c - Effective 7/27/53. d - Moved to field site 8/24/59.
Wea. Bur. Observatory † Greater Buffalo International Airport † NWS Observatory †† effective 10/3/70.	8/23/60	Present	0.4 mi. NE	42° 56'	78° 44'	705	20 f33 g33	5	5	33	5	5	4	NA e4 h4	NA	e - Commissioned 2000' WNW of thermometer site 10/23/63. f - Raised 5/18/77. g - Moved 2400' E 7/17/81. h - Type change 10/23/85.

* Type
M = AMOS
T = AUTOB

††WEA. SVC CONTRACT MET. Observatory eff. 10/1/80.

SUBSCRIPTION:
Price and ordering information available through: National Climatic Data Center, Federal Building, Asheville, North Carolina 28801

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APPENDIX B

GEOLOGY

APPENDIX B

GEOLOGY

TABLE OF CONTENTS

APPENDIX B.1

SURFACE GEOPHYSICAL SURVEY REPORT

B.1.1 INTRODUCTION

A surface geophysical survey was conducted by Hager-Richter Geoscience, Inc. during September, 1987. Geophysical methods including seismic refraction and magnetometer surveys were used to identify the extent of fills, depth to bedrock, and locations of magnetic anomolies within the site area prior to drilling. A second magnetometer survey was performed in April, 1989, to further identify areas where drums may have been buried and select areas for test pits. The following section contains the Hager-Richter reports, which included a discussion of the investigation procedures and results for the geophysical investigations conducted at the Gratwick-Riverside Park site.

B.1.2 HAGER-RICHTER GEOSCIENCE, INC.

SURFACE GEOPHYSICAL SURVEY REPORT

HAGER-RICHTER
GEOSCIENCE, INC.

SURFACE GEOPHYSICAL STUDIES
GRATWICK-RIVERSIDE PARK
NORTH TONAWANDA, NEW YORK

- SEPTEMBER, 1987 -

Prepared for:

URS Corporation
570 Delaware Avenue
Buffalo, New York 14202

Prepared by:

Hager-Richter Geoscience, Inc.
P.O. Box 572
Windham, New Hampshire 03087

October 26, 1987
File 86D15

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. conducted seismic refraction and magnetic surveys at Gratwick-Riverside Park, North Tonawanda, New York in September, 1987. The work was performed under contract to URS Corporation of Buffalo, New York as part of a larger RI/FS for the New York State Department of Environmental Conservation.

The seismic refraction survey indicates that the bedrock surface is relatively flat and occurs 26-32 feet below the surface of the Site. Lateral changes in velocity of the material overlying the bedrock are interpreted to be areas of fill vs. sediments.

There is good correlation of areas of fill as determined by seismic refraction and regions of magnetic highs determined from the magnetic survey, indicating that magnetic objects are buried in the fill. Several prominent linear magnetic anomalies were located by the survey. These features might be caused by trenches filled with drums and should be considered high priority targets for excavation if contamination is found in their vicinity.

Magnetic profiling over two metal outfalls exposed along the Niagara River was partially successful in locating the outfalls in the subsurface. The outfalls are likely connected to the storm grates nearby.

Surface Geophysical Studies
Gratwick-Riverside Park
North Tonawanda, New York
September, 1987 86D15

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- TABLES, FIGURES, AND PLATES -

Surface Geophysical Studies
Gratwick-Riverside Park
North Tonawanda, New York
September, 1987 86D15

1.0 INTRODUCTION

Hager-Richter Geoscience, Inc. was subcontracted by URS Corporation of Buffalo, New York to conduct surface geophysical studies at the Gratwick-Riverside Park in North Tonawanda, New York as part of a larger RI/FS project on behalf of the New York State Department of Environmental Conservation. The park is a public facility of the City of North Tonawanda. Figure 1 is a location map for the Site.

Two types of geophysical surveys were conducted at the Site: (1) a seismic refraction survey, and (2) a magnetic survey. The purpose of the seismic refraction survey was determination of the depth to bedrock and assistance in the definition of the subsurface stratigraphy. The purpose of the magnetic survey was identification of the locations of possible concentrations of buried metallic objects (such as drums) on Site and identification of the locations of two metal outfall pipes.

The Site is located on a former municipal and industrial landfill. Presently the Site is used as a public park. The Site is generally level with groomed lawns and scattered shrubs and trees in the developed areas of the park. Public recreational facilities at the Site consist of picnic areas, paved roads and parking lots, a boat launching area, and a grassy enclosure set aside for dogs. The developed areas of the park are about 4000 feet long and 250-500 feet wide. River Road, a moderately busy 4-lane undivided highway, forms one edge of the park and the Niagara River forms the other edge. An undeveloped section about 1000 feet long occurs at the southern end of the property. In this section the terrain is very irregular and is covered by brushy undergrowth. Construction and industrial debris is partially exposed in places.

Hager-Richter personnel were on Site September 9, 1987 through September 17, 1987. Dorothy Richter, the H-R project manager, Jeffrey Mann, senior geophysicist, and Jeffrey Reid, project geologist, conducted the seismic refraction survey. Jeffrey Mann and Jutta L. Hager, Ph.D., senior geologist, conducted the magnetic survey. Gunther Funk, senior hydrogeologist for URS Corporation, monitored the progress of the field work. James Moras of the NYSDEC was present during the seismic refraction survey. All field work was conducted under Level D personnel protection as supervised by George Moretti, the URS health and safety officer. All equipment was decontaminated at the conclusion of the field work. Subsequent data analysis and interpretation were done at the Hager-Richter offices. Original data and field notes reside in the Hager-Richter files and will be retained for a minimum of five years.

URS Corporation established a surveyed baseline ("P" Line) and orthogonal coordinate system (Right and Left of the baseline) at the Site. Locations on the Site referred to in this document are based on the conventions established by URS.

2. EQUIPMENT AND PROCEDURES

2.1 Seismic Refraction Survey

The seismic refraction survey was conducted with an EG&G Model ES1225 Multiple Channel Signal Enhancement Seismograph, 240 foot spread cable, and twelve vertical geophones. The spacing between geophones was 20 feet.

The ES1225 is a microprocessor controlled instrument that allows seismic signals from several successive shots to be accumulated, or "stacked," and added selectively to the 12 channels in order to increase the signal-to-noise ratio. The field data were recorded both on permanent paper seismograms and on digital cassette by an ADPI Megabyte Bucket portable digital recorder. The field data were further backed up by daily copying the taped data to floppy disks and the hard disk of a Compaq portable computer.

Energy for the seismic refraction survey was provided by either a downhole Betsy Seisgun or a weight drop. The seisgun fired 8 or 12 gauge shotgun blanks that were buried approximately 18" below the surface. The weight drop consisted of a 60 pound mass dropped from a height of 4 to 5 feet onto a steel baseplate. We found that the data obtained from either seismic source were comparable during the course of the survey and selected the appropriate source for particular locations for convenience. In either case, the seismograph recorded data for 250 milliseconds after each shot.

A seismic refraction profile was conducted along most of the surveyed baseline established by URS through the Site and along 4 profiles oriented perpendicular to the baseline (Figure 2). The seismic refraction survey covered 5520 linear feet. Shots (or "drops") were made at the ends and at 80 foot intervals along the spread cable. This procedure provides reversed refraction profiles for all segments. The profiles were all longer than the 240 spread cable so the end shot point of each segment was reoccupied as the first shot point of the next segment of the profile.

The seismic data were analyzed by the crossover-distance method (illustrated in Figure 3). The time of the fastest arriving seismic signals are determined for each geophone from the digital seismograms. These arrival times are plotted on a time-distance graph and lines are drawn through data points having similar time-distance relationships. The slope of each line is the inverse of the velocity of the material in a particular layer. The intersections of the line segments are called the critical or crossover distances. The values for the velocity and crossover distances are used in standard equations to calculate layer thicknesses.

The calculated results were plotted for each shot point along a seismic line in order to construct an interpreted velocity profile of the subsurface. The velocities of seismic waves are strong functions of the types of geologic material through which they pass. Table 1 lists the correlation of velocities to geologic materials expected at this Site. One can thus infer the subsurface stratigraphy from the velocities exhibited.

With the seismic refraction method, one cannot detect thin layers of lower velocity material underlying higher velocity material, a common situation in stratified sediments. If present, the lower velocity layers cause an error in the thickness calculated for the upper layer. The uncertainty in depth estimates due to this cause may be as much as 10%.

2.2 Magnetic Survey

The magnetic survey was conducted using an EG&G Model G856 Proton Precession Portable Magnetometer. The G856 is a microprocessor controlled instrument with a resolution of 0.1 gamma and accuracy of 1 gamma. The G856 has a memory capable of storing the data for approximately 1000 stations. The field data were "dumped" to digital cassette tape with an ADPI Megabyte Bucket portable digital recorder at noon and at the end of each field day. The field data were further backed up by daily copying the taped data to floppy disks and the hard disk of a Compaq portable computer. In addition, hardcopy printouts of the magnetic data were made in the field with a portable printer.

Magnetic data were collected at 4788 stations at Gratwick-Riverside Park. We used a 20 foot grid for most of the Site. Figure 4 is a map showing the location of all stations occupied for the magnetic survey. The grid was oriented by the surveyed baseline and coordinates established by URS. In the region to the south of the "dog enclosure," the thick brush and irregular terrain made data collection difficult. In that region, the magnetic data were collected at 20 foot intervals along lines spaced 40 feet apart. A base magnetic station was occupied every few hours during the field work in order to obtain data necessary for the removal of the temporal variation in the Earth's magnetic field.

Two 2 1/2 foot diameter corrugated steel outfalls are exposed along the banks of the Niagara River at the Site. One goal of the magnetic survey was to locate the outfalls in the subsurface. A series of parallel traverses was made perpendicular to the suspected direction of each outfall, taking magnetic measurements at ten foot intervals with the expectation that the outfall would produce a local magnetic high.

The magnetic survey data were processed by correcting each reading for the temporal "drift" of the magnetic field based on the base station data. The corrected data were then plotted and contoured by a proprietary contouring program. The contouring program was developed for use with spatial geophysical data such as those obtained in gravity, magnetic and certain other surveys.

The program first converts randomly spaced data to values on a regularly spaced hexagonal grid using a second order polynomial and fitting the surface to all original data located within a specified distance. For each grid point to be included in the final map, the program requires at least one data point to be located in each quadrant (or it eliminates the grid point from the set of values to be contoured). The values between adjacent grid points are interpolated linearly.

The values to be connected with a contour line are determined from the minimum value in the data chosen to be shown and the contour interval. The contour lines actually consist of very short straight line segments.

3. RESULTS

3.1 Seismic Refraction Survey

The locations of the seismic refraction profiles are shown in Figure 2. Line P was run along the surveyed baseline from P71+20 to P35+20, providing a continuous seismic profile throughout the developed areas of the Site.

Two 240 foot spreads were run along the baseline in the undeveloped region of the Site between P35+20 and P25+00. We were not able to obtain useful data from either spread. The fill material in that region is too soft and uncompacted to allow the seismic signal to penetrate below the fill sufficiently to produce detectable refracted signals.

Four seismic refraction profiles were obtained perpendicular to the surveyed baseline. Line A crossed the baseline at P64+80; Line B crossed the baseline at P52+00; Line C crossed the baseline at P36+00; Line D crossed the baseline at P23+77. Except for Line D, the cross profiles all share a shot point with the baseline profile, Line P. Line D was located beyond the soft and uncompacted area along the edge of the roadway into the adjacent yacht club.

Figures 5 - 10 are interpreted profiles for each seismic line. The profiles are plotted with the same horizontal scale (1" = 100') as the main Site maps provided by URS Corporation for ease of comparison. The long profile along the "P" Line is separated into two segments by the same "match line" as that on the Site map. For clarification of the data, we plotted all seismic profiles twice: the upper profile has no vertical exaggeration; and the lower profile has a 5X vertical exaggeration.

Shot points are shown on the profiles as solid circles and the calculated depth to each layer is plotted beneath the shot point. The velocity range (in feet per second) exhibited by each layer is also indicated. The seismic data for certain shot points were degraded by seismic "noise," due mainly to traffic on nearby River Road. In a few cases, the noise was sufficient to mask completely the subsurface arrivals despite stacking signals from repeated shots.

In general, three layers were detected in the subsurface by seismic refraction profiling. The top and bottom layers were fairly consistent throughout the Site. The top layer is thin (4-8 feet) of low velocity unsaturated soil and fill. The bottom layer is bedrock, generally 26-32 feet below the surface.

An intermediate layer of variable velocity was detected between the thin low velocity material and high velocity bedrock for each shot point. The velocities in this intermediate layer vary from 2000 - 5700 fps. The material in the velocity range 2000 - 4700 may be unsaturated fill and the material in the range 4700 - 5700 is likely saturated sediments. Where the lower velocity material occurs, a higher velocity interface (i.e., the water table and/or the bottom of the landfill) between the low velocity material and the bedrock cannot be recognized in the seismic data. Thus, the bottom of the landfill and the water table cannot be recognized as discrete horizons in the seismic data for those shot points and they are shown schematically in the seismic profiles. The depths and thicknesses shown for the lower velocity material should not be taken literally.

The bedrock velocities and depths are fairly consistent across the Site, indicating that the bedrock, expected from previous reports to be Camillus Shale, is competent and the bedrock surface is relatively flat.

3.2 Magnetic Survey

Plate 1 is a contour map of the magnetic data for the Site. The contour interval is 200 gammas. That contour interval was selected because of the wide range in magnetic field encountered at the Site. The contoured data are presented as total intensity above 55,000 gammas, an arbitrary datum near the "normal" or undisturbed total field in the area.

A single metallic drum buried to a depth of 4 feet produces a maximum disturbance to the local magnetic field of about 200 gamma (Figure 11). This survey, by necessity, cannot be interpreted in terms of the locations of every possible buried drum at the Site.

The tightly closed contours on Plate 1 represent magnetic highs. Most magnetic highs probably represent buried metallic objects. Unfortunately, magnetic data alone cannot be used to differentiate types of metallic objects. Construction debris and other metallic objects cannot be discriminated from metallic drums. All of the magnetic highs should be considered as possible drum sites if contamination is found in their vicinity.

Some of the magnetic highs clearly correlate to metallic objects on the surface. A notable example in the current data set is the pronounced anomaly in the vicinity of the Park's military tank displayed near P61+00 on the baseline. The magnetic highs in the parking lot near the boat launch correlate to automobiles and boat trailers that were parked there at the time of our survey. Other isolated magnetic highs such as the one at P68+00 100L occur near metal barbecues and concrete picnic tables containing rebar. Note that there might be metallic objects in the subsurface at the same locations that have surface metal, however.

There is very good correlation between broad regions of magnetic highs along the baseline (e.g., between P62+00 and P64+00, P46+00 and P48+00) and regions with lower velocity in the intermediate layer of the seismic refraction profiles. Other regions of broad magnetic highs likewise probably represent regions of fill that might contain drums.

The region of the Site between P45+00 and P38+00 has a somewhat more hummocky topography and is a few feet higher than the adjacent Park land. Several markedly linear magnetic anomalies occur in this region, e.g., at P44+00 60R-300R and P39+60 20R-160R. These features might be caused by trenches filled with drums and should be considered high priority targets for future excavation if such activities are planned, and especially if the ground water monitoring program detects higher levels of contamination in the vicinity of these features.

In the region between P34+40 and P25+00, the magnetic stations were spaced 20 feet apart on lines spaced 40 feet apart. Consequently, the resolution of the magnetic data is not as strong as in the rest of the Site. The number of magnetic highs appears to be less in that region but linear anomalies such as the ones discussed above could have been missed in the survey.

3.3 Location of Metal Outfalls by Magnetic Profiling

Two 2 1/2 foot diameter outfalls are exposed along the river edge at approximately P60+50 and P51+20 170L. We attempted to locate the outfalls in the subsurface by running a number of magnetic profiles perpendicular to the expected directions of the pipes. The data were collected at 10 foot intervals along lines spaced 25 - 80 feet apart. Figure 12 is a sketch map of the locations of the profile lines. In an area without interference from other metallic objects, the outfalls should produce pronounced disturbances in the local magnetic field, i.e., sharp magnetic highs, along the profiles.

The magnetic profiles over the two outfalls are shown in Figures 13 and 14. The outfall at P51+20 can be picked in the profiles (Figure 13) but the outfall at P60+50 does not show clearly in the profiles over it, probably because of outside disturbances. Note, however, that the outfalls very likely are connected to the surface storm grates in the vicinity (see sketch maps).

4. CONCLUSIONS

Surface geophysical studies of the Gratwick-Riverside Park, North Tonawanda, New York have outlined areas of concentrations of fill and metallic objects in the subsurface.

The seismic refraction survey indicates that the bedrock surface is relatively flat and occurs 26-32 feet below the surface of the Site. Lateral changes in velocity of the material overlying the bedrock are interpreted to be areas of fill vs. sediments.

There is very good correlation of areas of fill as determined by seismic refraction and regions of magnetic highs determined from the magnetic survey, indicating that magnetic objects are buried in the fill. Several prominent linear magnetic anomalies were located by the survey. These features might be caused by trenches filled with drums and should be considered high priority targets for excavation if contamination is found in their vicinity.

Magnetic profiling over two metal outfalls exposed along the Niagara River was partially successful in locating the outfalls in the subsurface. The outfalls are likely connected to the storm grates nearby.

TABLE 1. EXPECTED RELATIONSHIP BETWEEN VELOCITY OF SEISMIC WAVES AND GEOLOGIC MATERIALS

VELOCITY (Ft/Sec)	TYPE OF MATERIAL
800-2800	Soft & uncompacted low-density materials including fill, unsaturated silt, sand, gravel and cobbles. May also include random boulders in such material. Permeable.
4400-5200	Materials of the types above, but saturated with ground water. The ground water table is generally found at or near the upper surface of zones having this velocity range.
6000-6600	Generally clay or silty clay of low to very low permeability. May be interlayered with tills or alluvial sediments.
7200-8600	Till. Low to very low permeability.
<10,000	Bedrock. Low permeability except along fractures.

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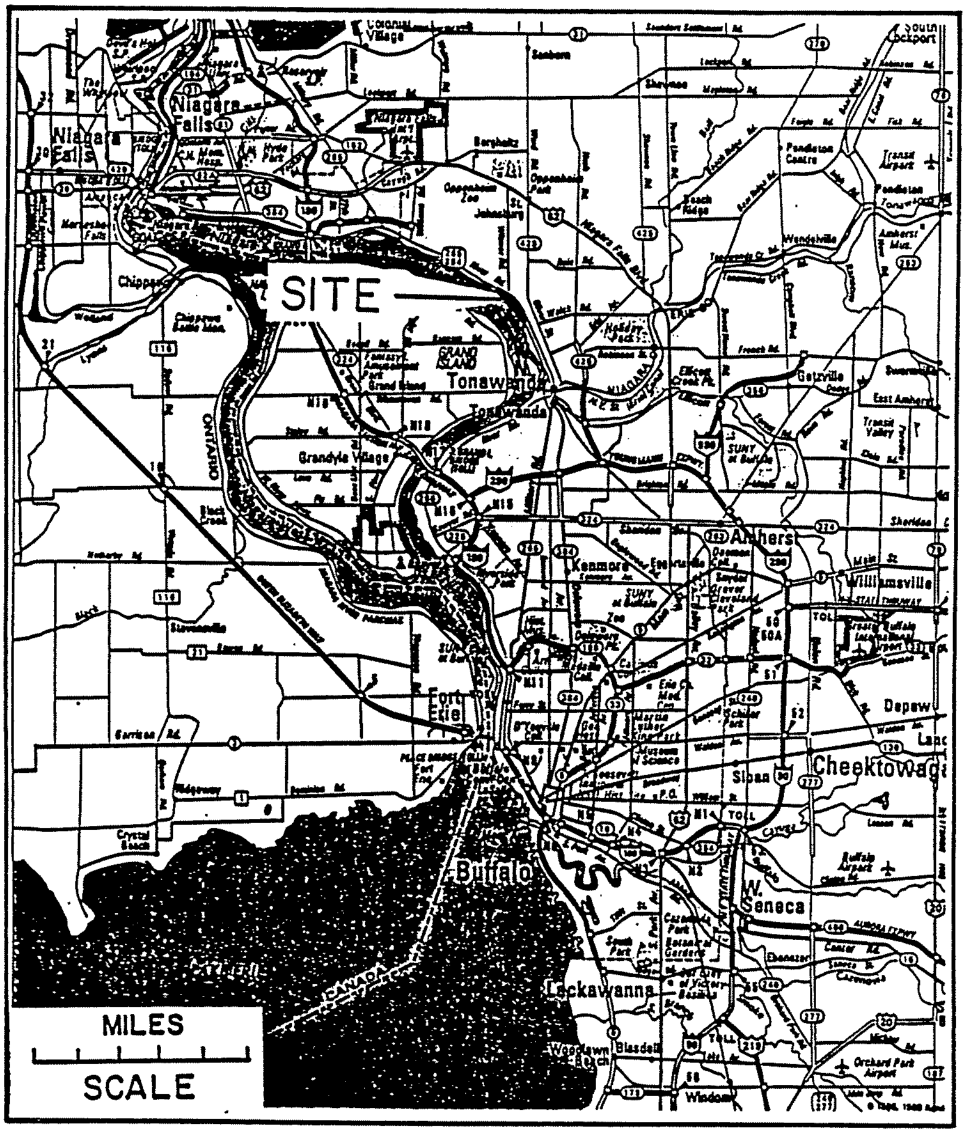


FIG. 1

Figure 1. General location of the Site.

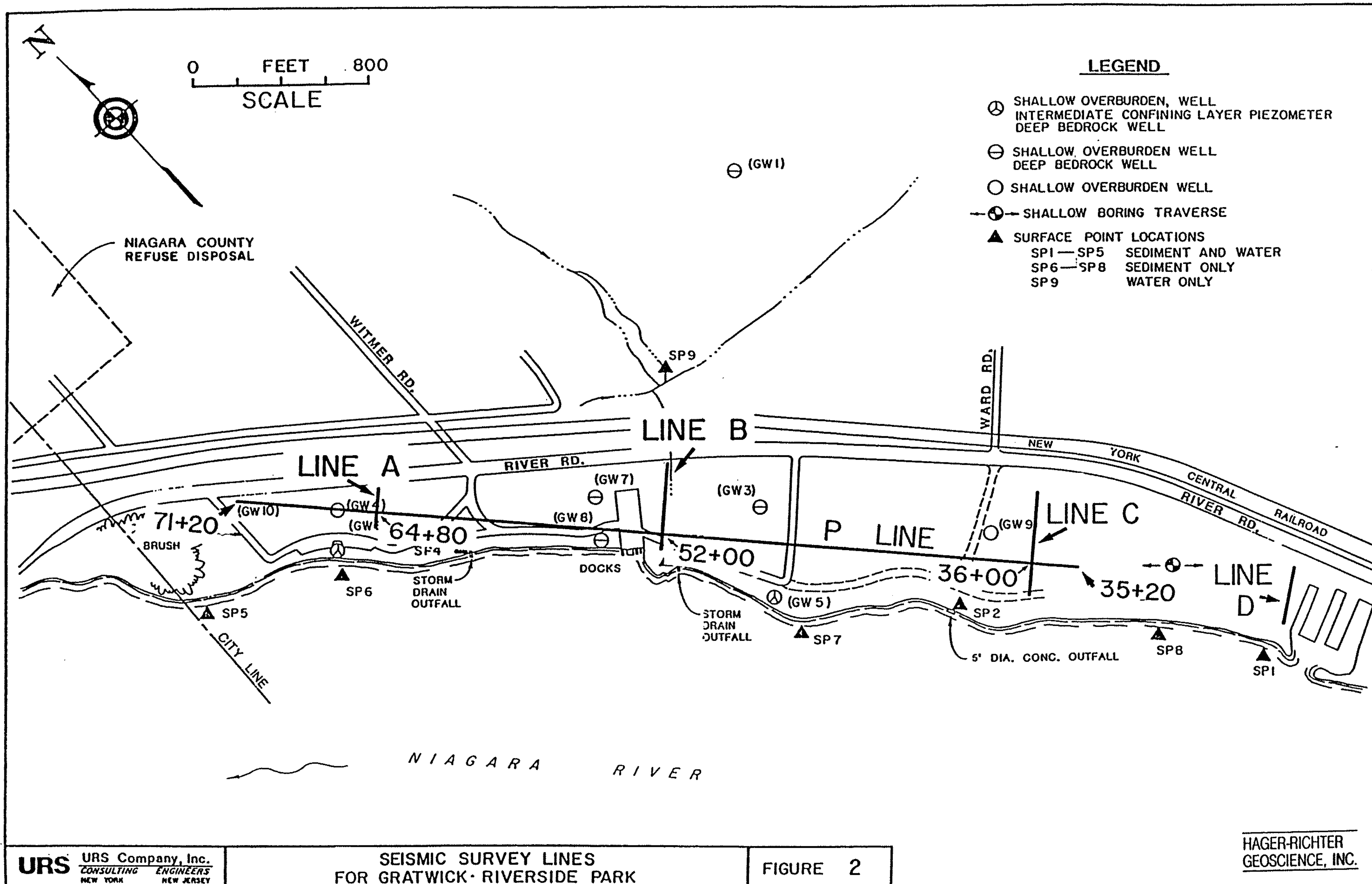


Figure 2. Locations of the seismic refraction profiling lines. Base map courtesy of URS Corporation.

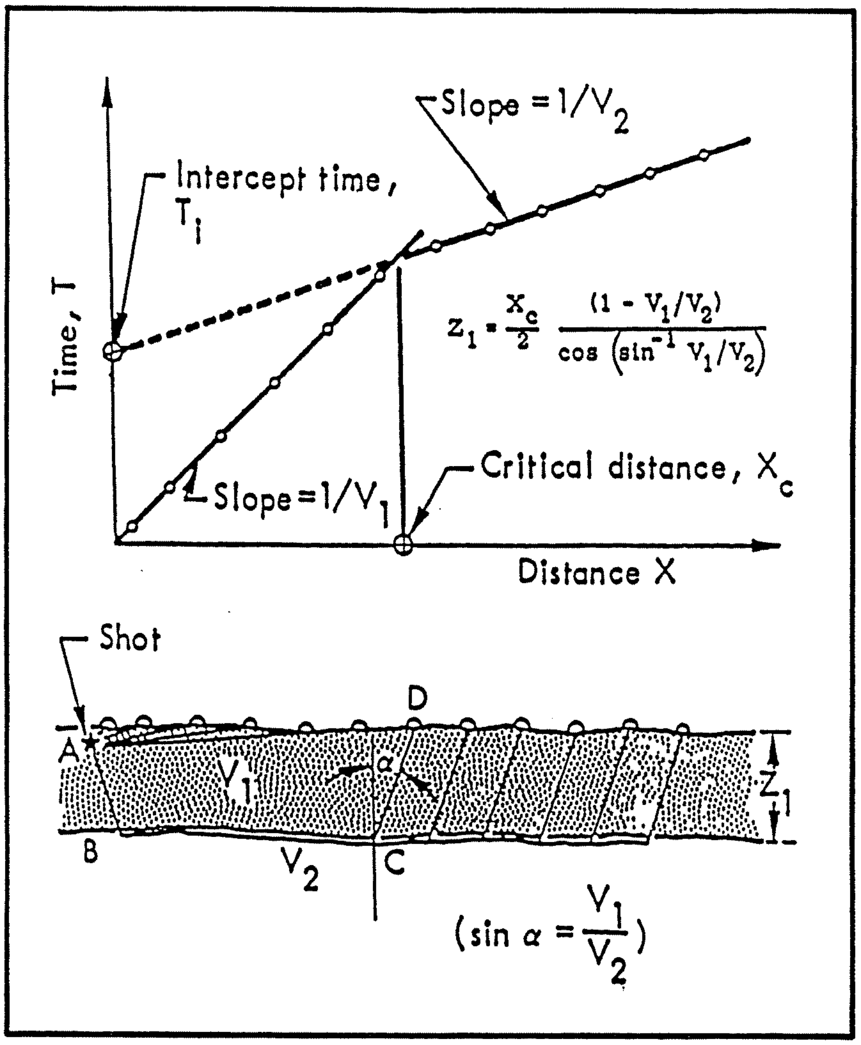


Figure 3. Simple 2-layer model illustrating the principles of seismic refraction and the crossover distance method of data reduction. A seismic source at A produces elastic waves that travel into Layer 1, which has a velocity of V_1. Some waves travel directly along the surface directly to the geophones (small open circles); others travel through Layer 1 to Layer 2. Because V_2 is greater than V_1, the time for path ABCD is less than for path AD for sufficiently large distances. The distance at which the two travel times are equal, termed the critical or crossover distance, is a function of the depth to the interface and the two velocities.

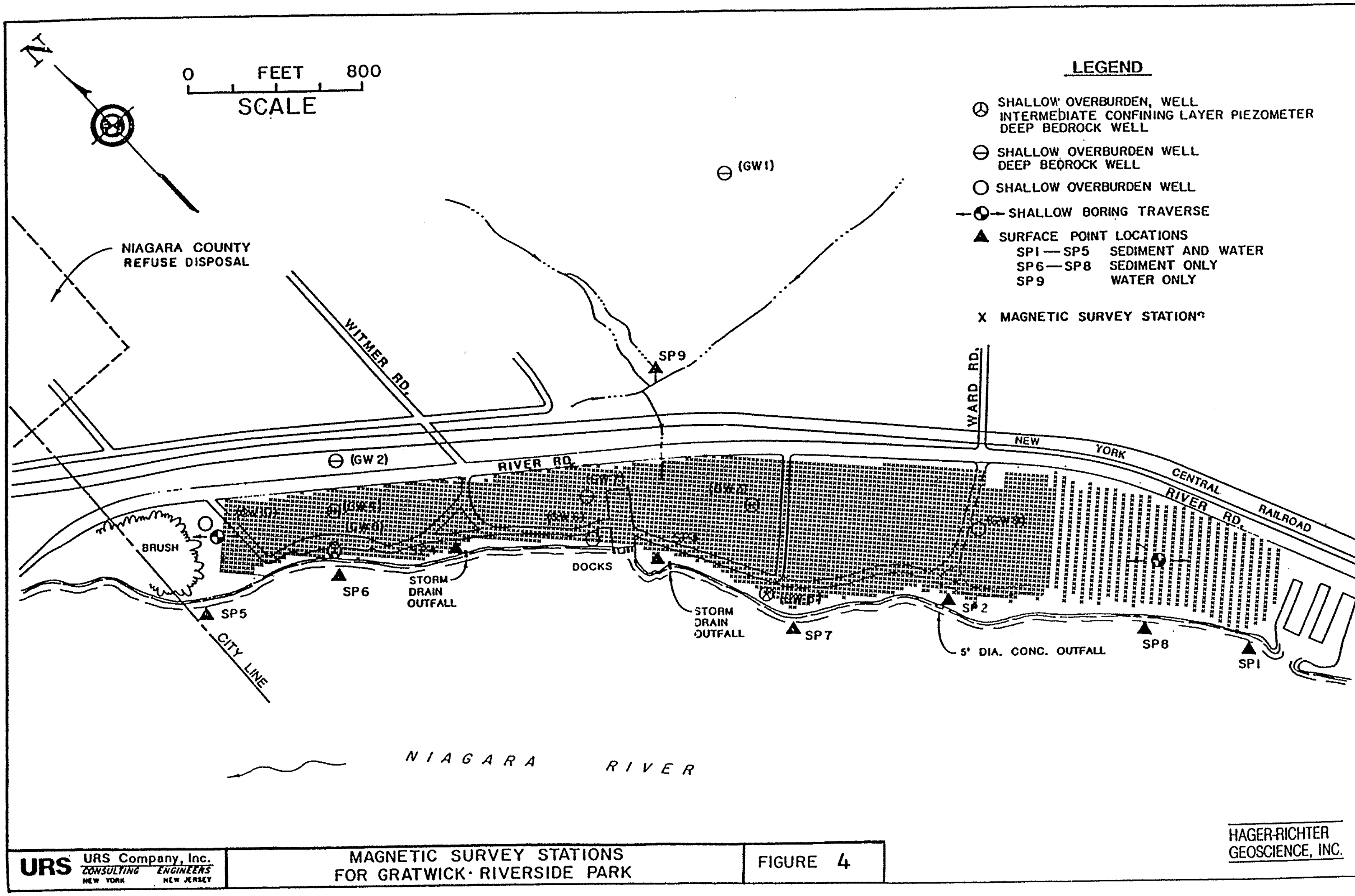
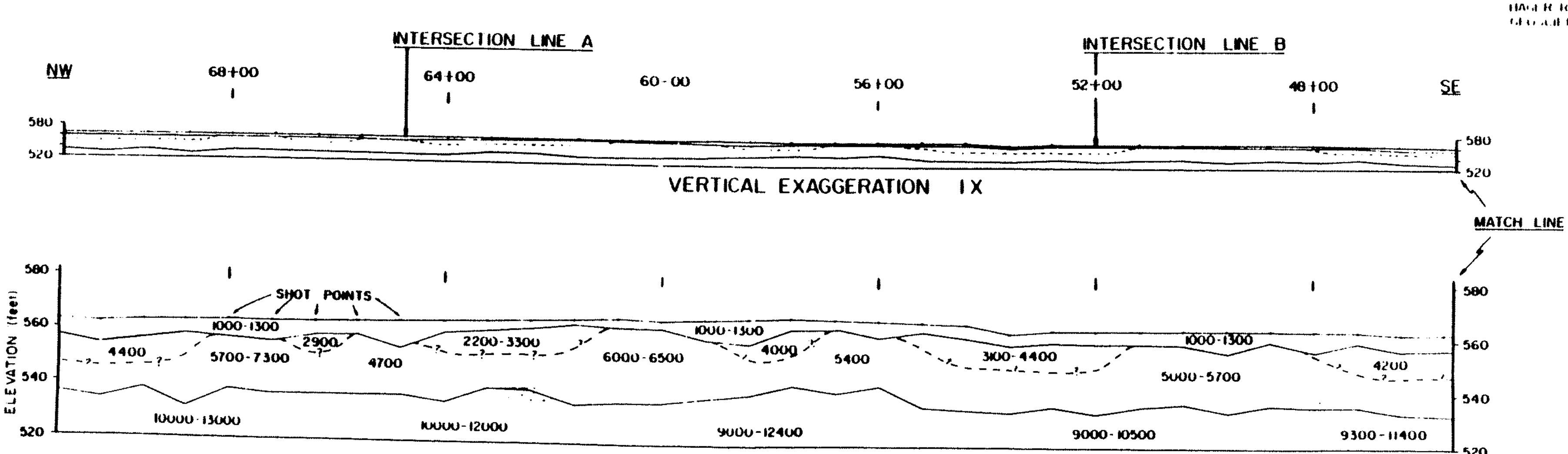


Figure 4. Locations of the stations occupied for the magnetic survey. Base map courtesy of URS Corporation.

Figure 5. Interpreted seismic profile the "P" Line, P71+20 to P45+40 (Match Line). This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.



NOTE:
ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

SEISMIC PROFILE P-LINE
71+20 to 45+40

FIG. 5

Figure 6. Interpreted seismic profile of the "P" Line, P45+40 (Match Line) to P35+20. This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.

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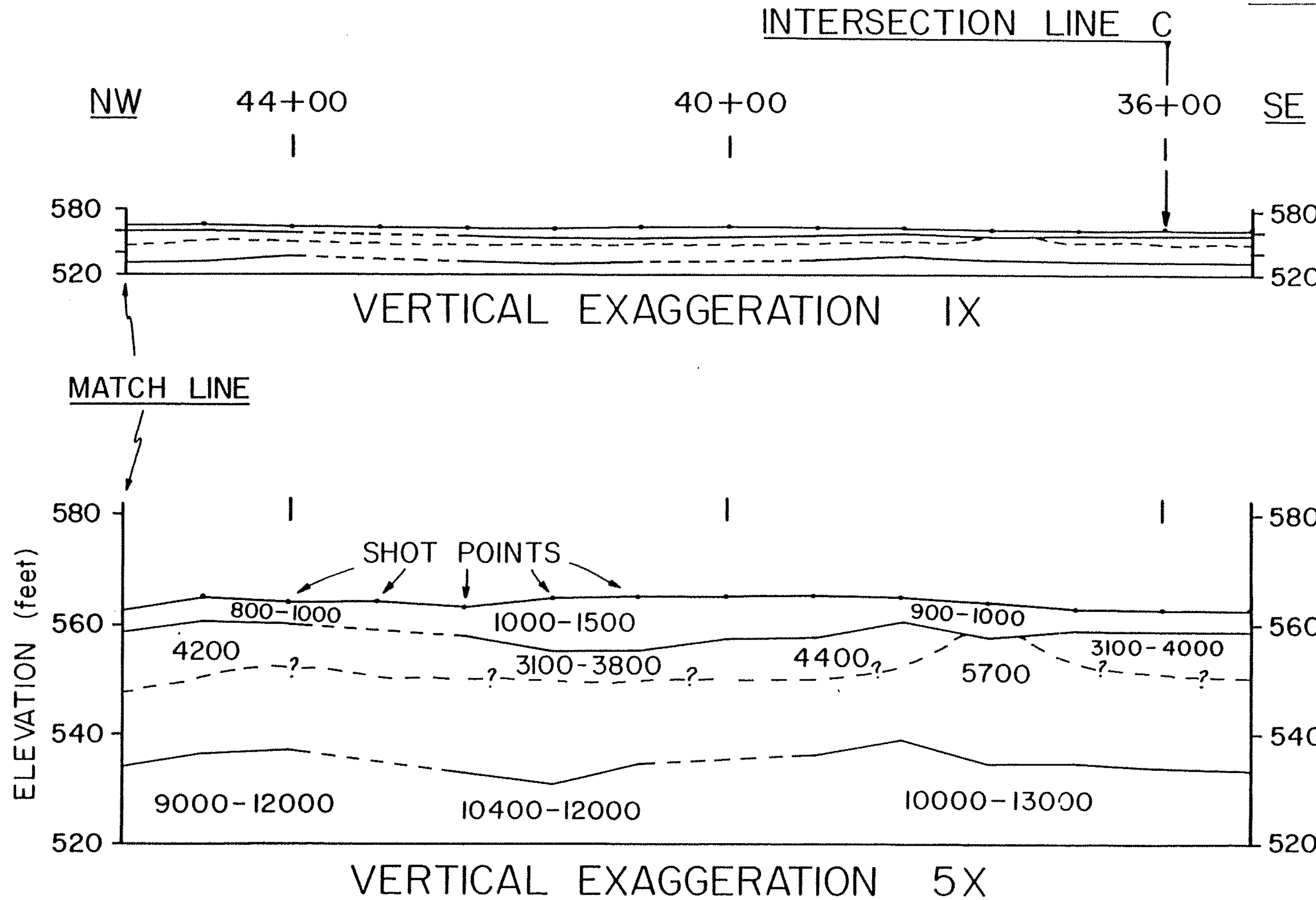

NOTE:
ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

SEISMIC PROFILE P-LINE
45+40 to 35+20

FIG. 6

Figure 7. Interpreted seismic profile of Line A. This line is oriented perpendicular to the baseline ("P" Line) and crosses it at P64+80. This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.

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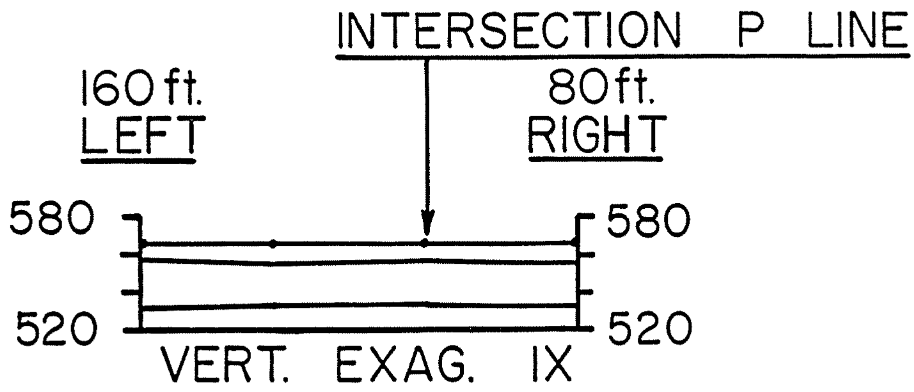

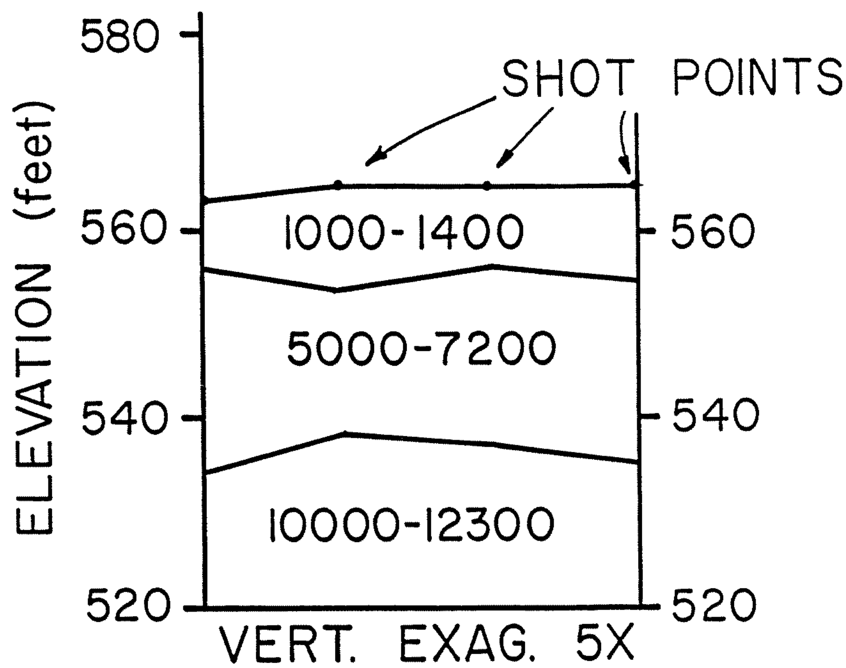

SEISMIC PROFILE LINE A
64+80

NOTE: ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

FIG. 7

Figure 8. Interpreted seismic profile of Line B. This line is oriented perpendicular to the baseline ("P" Line) and crosses it at P52+00. This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.

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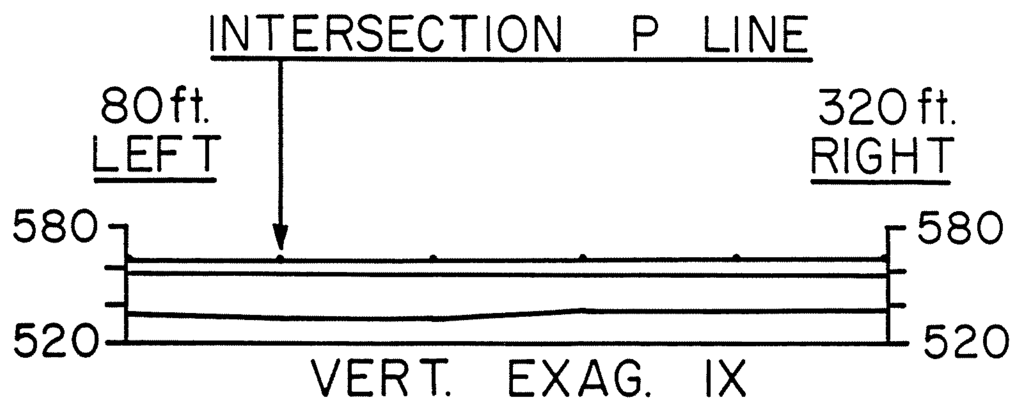

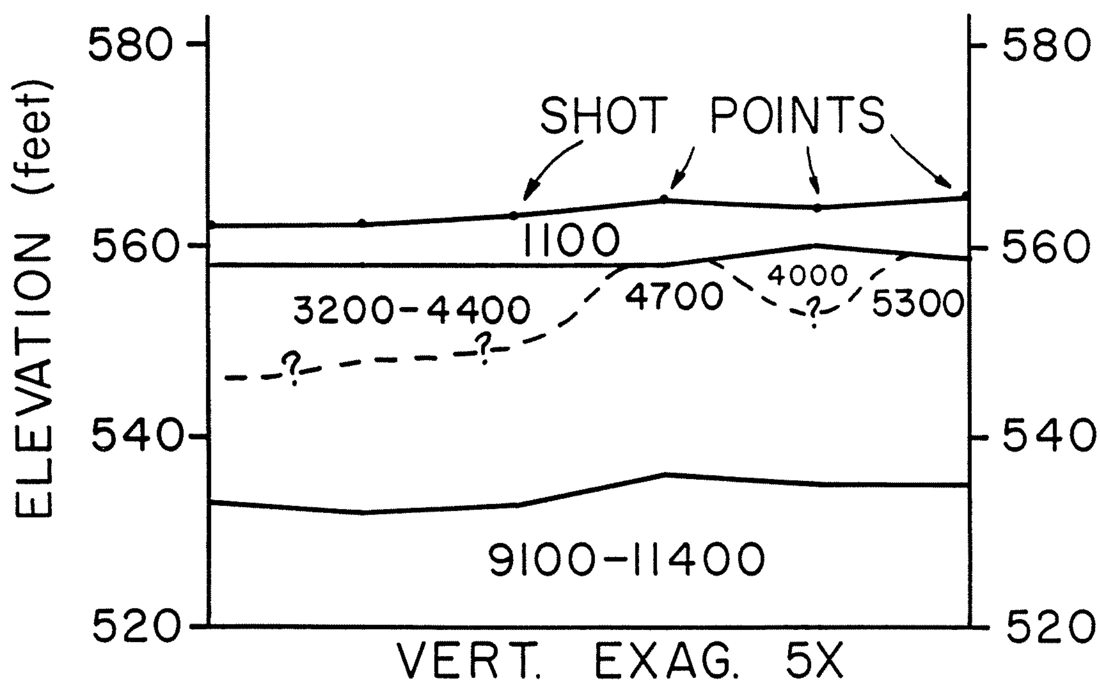

SEISMIC PROFILE LINE B
52+00

NOTE: ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

FIG. 8

Figure 9. Interpreted seismic profile of Line C. This line is oriented perpendicular to the baseline ("P" Line) and crosses it at P36+00. This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.

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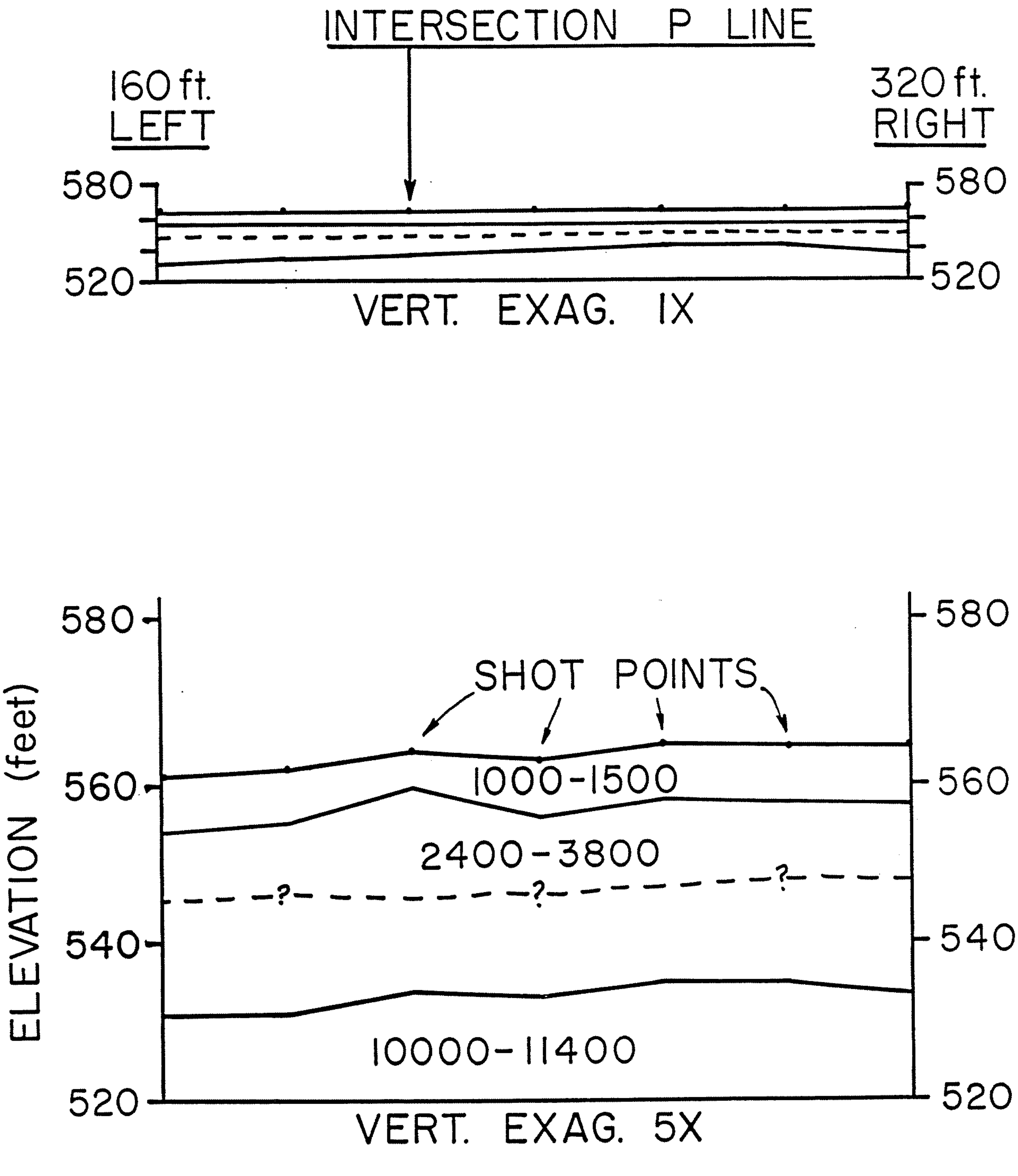

SEISMIC PROFILE LINE C
36+00

NOTE: ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

FIG. 9

Figure 10. Interpreted seismic profile of Line D. This line is oriented perpendicular to the baseline ("P" Line) and crosses it at P23+77. This profile is at the same scale (1" = 100') as the Site map provided by URS and Plate 1 of this report. The upper profile has no vertical exaggeration; the lower profile has a 5X vertical exaggeration in order to display the data more clearly. The solid circles are the shot points. Velocity ranges (in feet per second) are shown for the various layers. The dashed lines are inferred interfaces for which there are no hard data.

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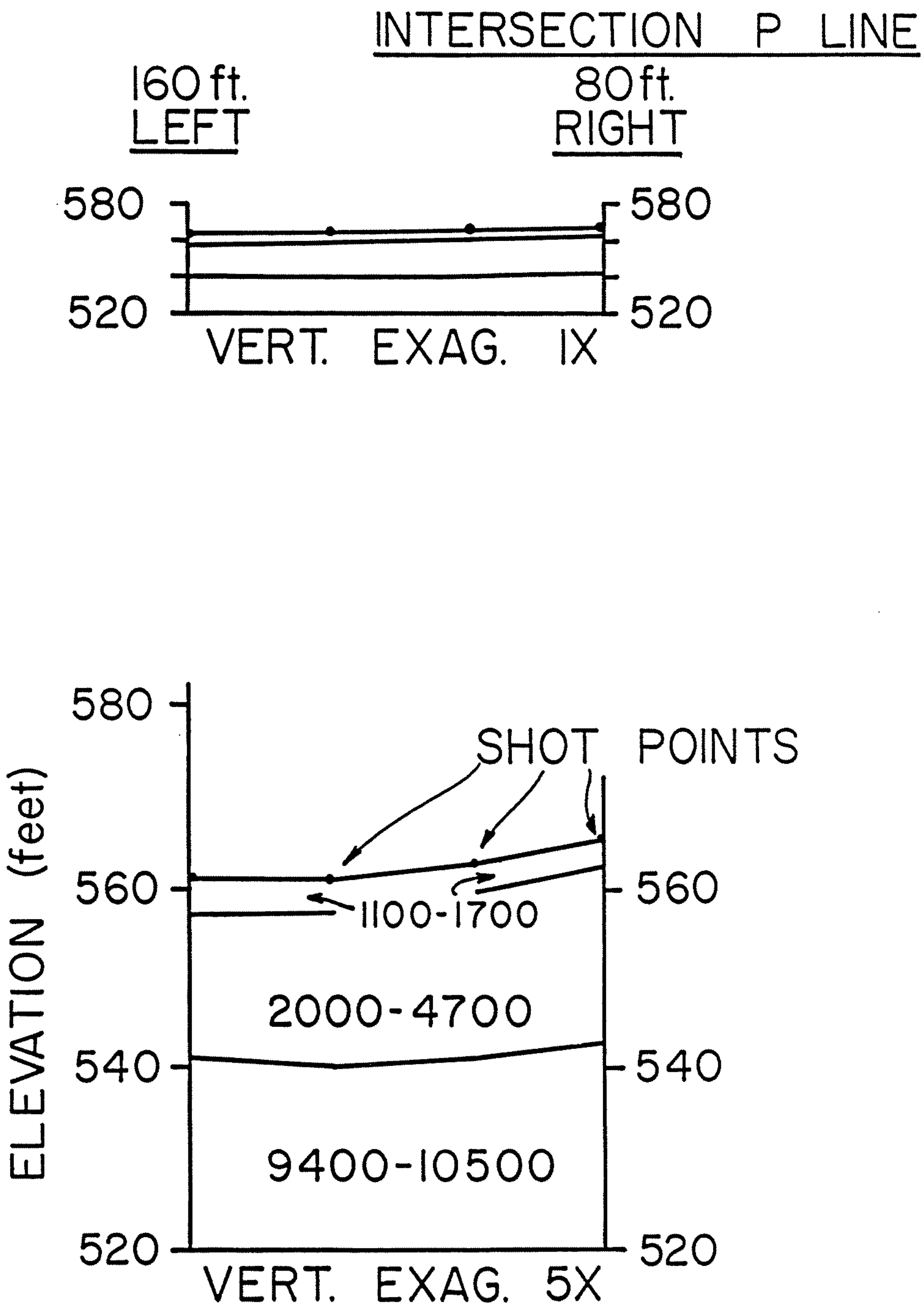

SEISMIC PROFILE LINE D
23+77

NOTE: ELEVATIONS DEPICTED ON THIS FIGURE ARE 9.38 FEET TOO LOW.

FIG. 10

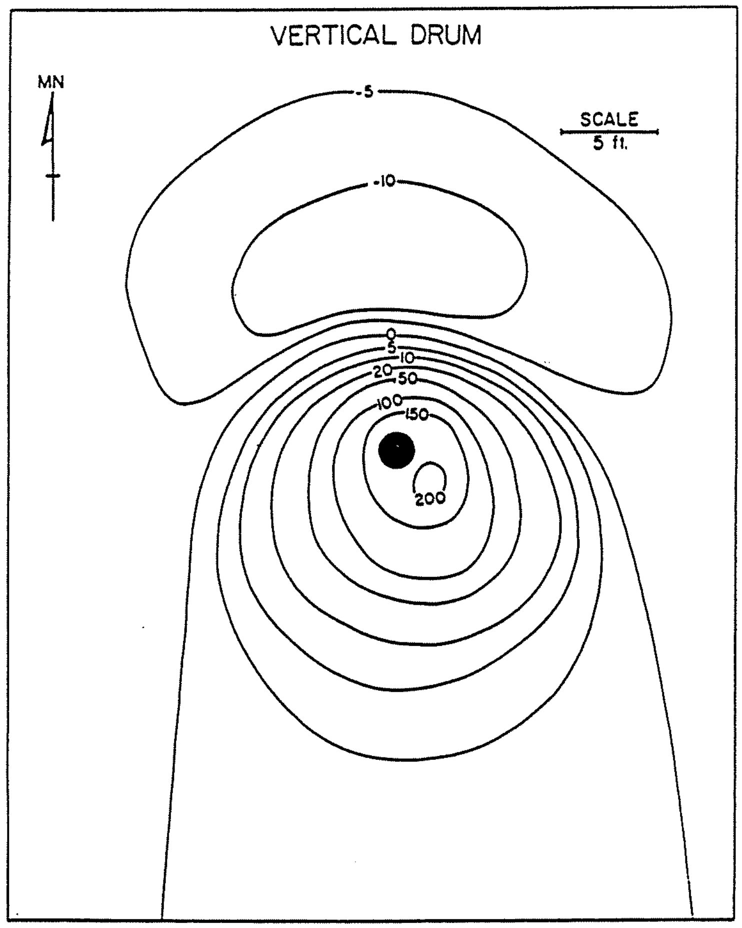

Figure 11. Magnetic signature of a vertical drum buried to a depth of about 4 feet. This contour map was produced from measurements made in the field at 5 foot intervals. (Map courtesy of Geoscience Services of Salem, Inc.)

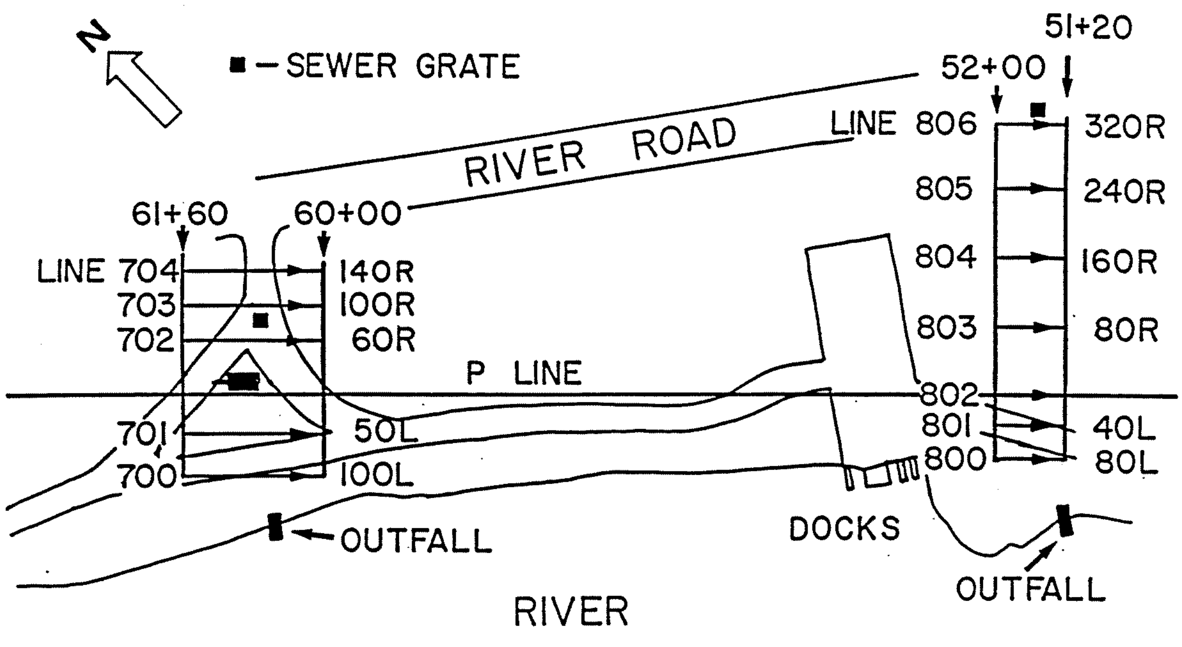

FIG. 12

Figure 12. Sketch map of the area around the outfalls showing the location of magnetic profiling lines.

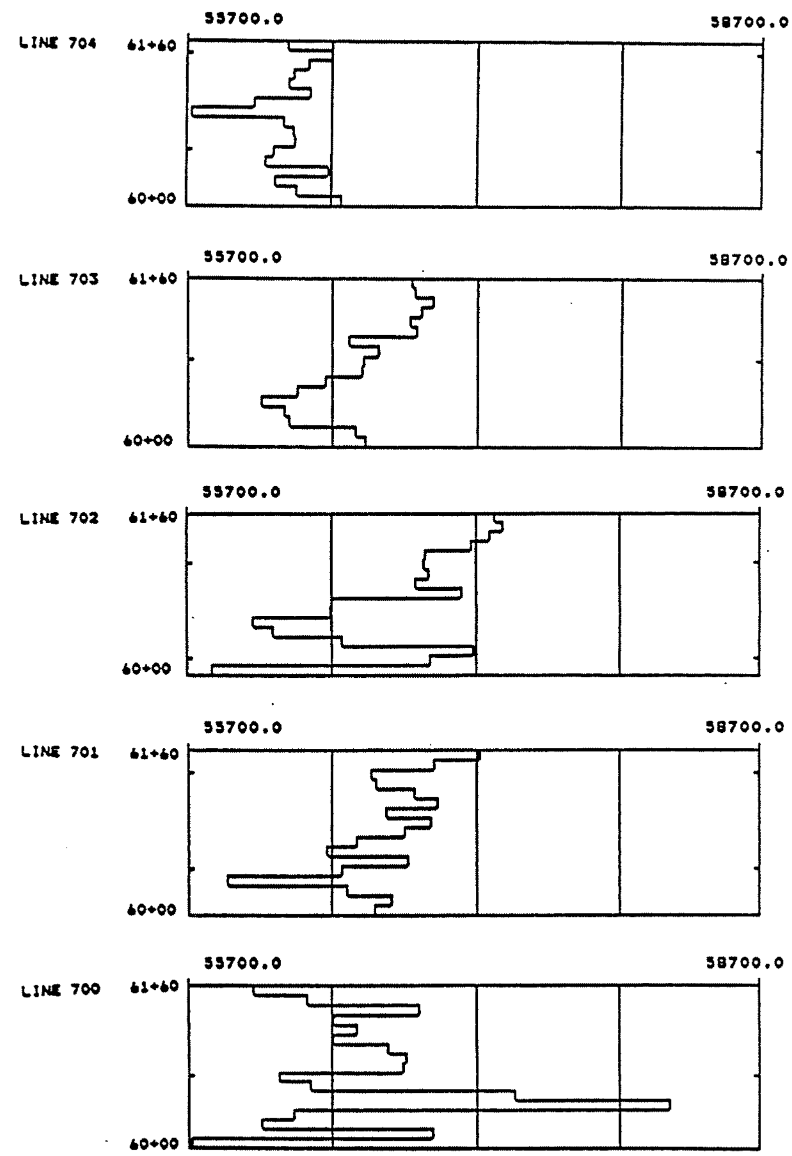

FIG. 13

Figure 13. Magnetic profiles over the outfall located near P51+20.

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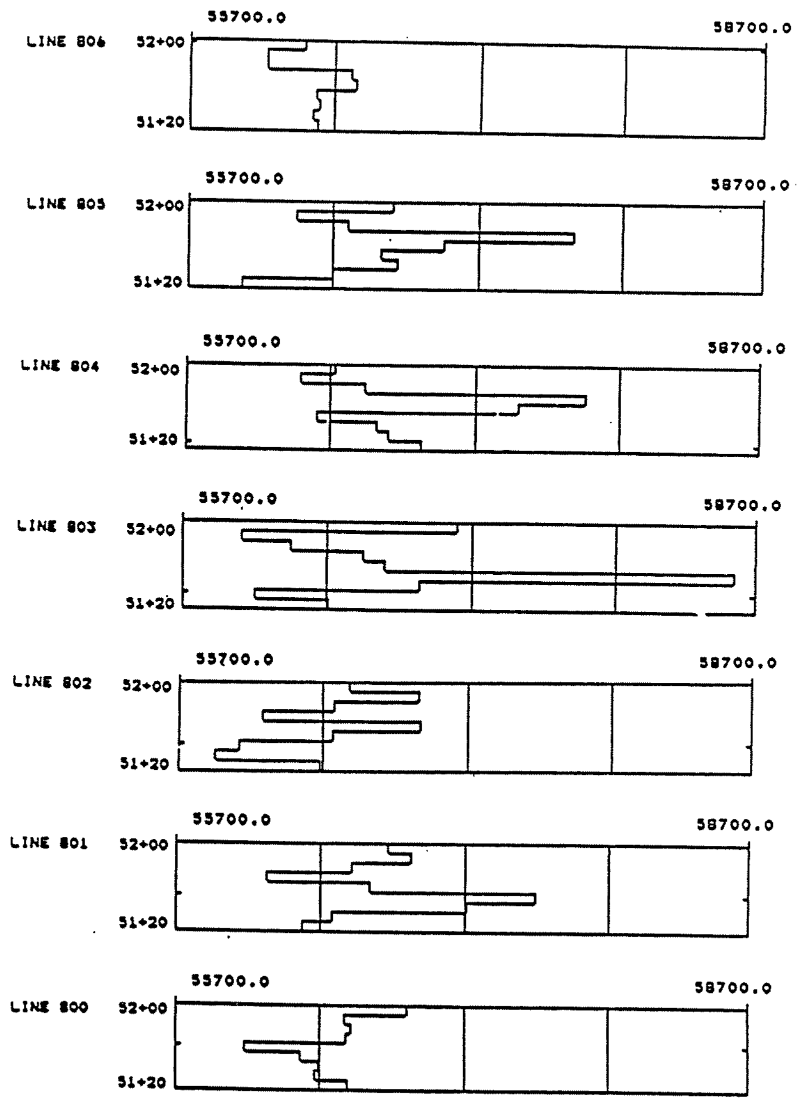

FIG. 14

Figure 14. Magnetic profiles over the outfall located near P60+50.

NO	DATE	DESCRIPTION	NO	DATE	DESCRIPTION

REVISIONS

DESIGNED BY
DRAWN BY
CHECKED BY
PROJ ENGR

BASE MAP COURTESY OF
URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

JOB No.

HAGER-RICHTER GEOSCIENCE, INC.
CONSULTANTS IN GEOLOGY & GEOPHYSICS
P.O. BOX 572
WINDHAM, NH 03087

GRATWICK RIVERSIDE PARK
CITY OF NORTH TONAWANDA
NIAGARA COUNTY NEW YORK

PLATE I. MAGNETIC FIELD
SEPTEMBER 1987

Scale 1"=100' FILE 86D15

URS Consultants, Inc.
BUFFALO, NEW YORK
FEB 22 1991
DATE PRINTED

B.1.3 HAGER-RICHTER GEOSCIENCE, INC.

MAGNETIC SURVEY REPORT

HAGER-RICHTER
GEOSCIENCE, INC.

MAGNETIC SURVEY
GRATWICK-RIVERSIDE PARK
NORTH TONAWANDA, NEW YORK

Prepared for:

URS Consultants
570 Delaware Avenue
Buffalo, New York 14202

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way, D10
Salem, New Hampshire 03079

File 88D26
April, 1989

HAGER-RICHTER
GEOSCIENCE, INC.

Magnetic Survey
Gratwick-Riverside Park
North Tonawanda, New York
April, 1989 File 88D26

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Magnetic Survey
Gratwick-Riverside Park
North Tonawanda, New York
April, 1989 File 88D26

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. conducted a magnetic survey in an eight acre portion of Gratwick-Riverside Park, North Tonawanda, New York in April, 1989 for URS Consultants of Buffalo, New York. A reconnaissance magnetic survey of the entire 50-acre park in September, 1987 had indicated the widespread presence of buried metal objects in the landfill material underlying the park and three linear features located between P39+00 and P45+00 of the URS P-Line.

The purpose of the present magnetic survey was to improve the definition of the linear magnetic features recognized in the reconnaissance magnetic survey of 1987.

The present survey was conducted on a 10-foot grid, resulting in four times as much magnetic data for the same survey area. Although the present survey recognized magnetic highs comparable to those detected in the 1987 survey in approximately the same locations, the detailed shapes have changed. The magnetic highs have retained their essentially linear shape, but on the basis of the improved understanding due to the additional data, they have widened somewhat in places and have even become discontinuous in others. (Plate 2)

As in the reconnaissance survey, the present magnetic survey indicates that metallic objects are widely distributed throughout the fill material underlying the survey area. The interpretation of the data is shown in Plate 3. Most of the anomalies match anomalies recognized in the reconnaissance survey. The steep magnetic gradients at the edges of the anomalies indicate that the metal objects causing these disturbances are buried in the shallow subsurface. Whether or not the metal is present in the form of drums cannot be determined by the magnetic data alone. We recommend that, if test pits are to be excavated at this site, these areas be investigated to determine the type(s) of objects causing the anomalies.

1. INTRODUCTION

Hager-Richter Geoscience, Inc. was contracted by URS Consultants of Buffalo, New York to conduct a magnetic survey at Gratwick-Riverside Park in North Tonawanda, New York as part of a RI/FS on behalf of the New York State Department of Environmental Conservation. The park is located on the site of a former landfill. Figure 1 is a location map for the Site.

Hager-Richter conducted a reconnaissance magnetic survey of the entire 50 acre Park on a 20-foot grid in September, 1987. The results are reported in a document entitled "Surface Geophysical Study, Gratwick-Riverside Park, North Tonawanda, New York." The reconnaissance survey indicated that metal is widely distributed in the fill underlying the entire park and that several prominent linear anomalies occur between P39+00 and P45+00 and between 200L and 200R. One possible explanation for the linear magnetic highs is that they are caused by drum-filled trenches. The purpose of the present survey was to define better the shape of the magnetic features for determining the location of test pits at a later time.

The approximately 8-acre region between P39+00 and P45+00 on the URS p-line is a few feet higher than the adjacent groomed areas of the park. The ground surface is hummocky and covered by grass. Partially buried construction and industrial debris is visible in many of the pits and animal burrows. Monitoring wells GW-8S, GW-8I, and GW-11S are also located within the survey area.

URS Consultants staked a 100 foot grid at the Site between P39+00 and P45+00 prior to our magnetic survey. Locations on the Site referred to in this document are based on the conventions established by URS.

Hager-Richter personnel, Dorothy Richter and Jeffrey Reid, conducted the magnetic survey from April 11, 1989 through April 13, 1989. The field work was coordinated by Mr. Robert Murphy, P.E., and Mr. Thomas Fralick of URS Consultants. Data analysis and interpretation were completed at the Hager-Richter offices. Original data and field notes reside in the Hager-Richter files and will be retained for a minimum of five years.

2. EQUIPMENT AND PROCEDURES

The magnetic survey was conducted with an EG&G Model G856 Proton Precession Portable Magnetometer. The G856 is a microprocessor controlled instrument with a resolution of 0.1 gamma and accuracy of 1 gamma. The G856 has a memory capable of storing the data for approximately 1000 stations for later transfer to a computer.

Magnetic data were collected on a 10-foot grid at 3410 stations. This grid resulted in the gathering of four times more data for the region than were obtained in the previous reconnaissance survey. Distances between the 100-foot stakes were paced and are precise to one to two feet, a precision judged suitable for this survey. Plate 1 shows the locations of all magnetic stations. Magnetic data are strongly affected by surface features such as powerlines, chainlink fences, and automobiles. At this Site, special care was taken to avoid the influence of passing freight trains and vehicles on River Road. Any visible surface metal was noted during the survey.

A base magnetic station was occupied every 30 minutes to 1 hour during the field work in order to obtain data necessary for the removal of the temporal variation in the Earth's magnetic field. The magnetic survey data were processed by correcting each reading for the temporal "drift" of the magnetic field based on the base station data. The corrected data were then plotted and contoured by a contouring program developed for use with spatial geophysical data such as those obtained in magnetic surveys.

3. RESULTS and DISCUSSIONS

When interpreting magnetic data, the width, gradient, and amplitude of a magnetic disturbance are useful in estimating the size and depth of the causative body. In general, the broader the magnetic signature, the deeper the object. Magnetic disturbances with very steep gradients are caused by objects at or near the surface. A single metallic drum buried to a depth of 4 feet produces a maximum disturbance to the local magnetic field of about 200 gamma (Figure 2). Note that the magnetic technique is limited to detecting metallic objects. Neither the particular type of metallic object causing a magnetic disturbance nor its contents can be determined from the magnetic data alone.

Plate 2 is a contour map of the magnetic data for the survey area. The contoured data are presented as total field intensity above and below 56,300 gammas, an arbitrary datum near the "normal" or undisturbed total field in the area. The contour interval is 200 gammas. This contour interval was selected because of large variations in the magnetic field encountered at the Site.

In general, abundant magnetic disturbances with steep gradients between 200L and 200R indicate the widespread presence of buried metal objects in that portion of the Site. Large magnetic highs are present in approximately the same locations as the linear magnetic features noted in the previous survey. The expression of the magnetic highs in Plate 2 is not as prominently linear as was shown by the reconnaissance survey, however, because the additional stations have produced a more complete data set allowing for greater resolution of individual anomalies. For instance, the linear feature located at about P44+00, 100R-300R in the initial survey appears to be somewhat broader in the present data set, and the linear feature located at P39+80, 20R-140R on the original contour map is shown to be a part of a broader and more complex anomaly with the current data set.

Several other large magnetic highs occur on the Site. These anomalies fall into two categories. The first category consists of anomalies caused by "single-station" readings. Such features were verified in the field by repeating the measurements. Such features are caused by small quantities of metallic debris located fairly close to the surface. If they are due to the presence of drums, then no more than 10 or so drums are likely. Examples of "single-station" anomalies occur at P36+00, 330R, and P40+50, 170L.

Large, broad magnetic highs constitute the second category of anomalies found at Gratwick-Riverside Park. Several such areas are outlined in Plate 3. Most of the broad anomalies outlined on Plate 3 correlate with similar features on the contour map of the reconnaissance survey. The large feature located at P40+20, 0-180L was checked by reoccupying the same station locations. These features are attributed to the presence of large concentrations of metal in the shallow subsurface. If the metal is in the form of drums, then several hundred drums may be present.

4. CONCLUSIONS

A magnetic survey conducted by Hager-Richter Geoscience, Inc. on a 10-foot grid in the area bounded by P39+00, P45+00, 200L and 200R at Gratwick-Riverside Park, North Tonawanda, New York, has refined the magnetic features recognized in a previous reconnaissance magnetic survey. In general, the magnetic field is highly variable throughout the survey area. We conclude that buried metal objects are widely distributed in the fill material underlying most of the study area.

The presence of magnetic highs in approximately the same locations as in the reconnaissance survey was confirmed by the present survey. The magnetic highs have retained their essentially linear shape, but on the basis of the improved understanding due to the additional data, they have widened somewhat in places and have even become discontinuous in others.

The interpretation of the large magnetic anomalies is shown in Plate 3. We conclude that significant concentrations of buried metal objects occur in several of these locations.

On the basis of the magnetic data alone, it is not possible to discriminate between metal drums and other metal objects, therefore, we emphasize that our interpretation of the magnetic field requires the presence of subsurface ferrous metal which may or may not be due to metal drums.

The "single-station" anomalies could be, but are not likely, due to the presence of approximately 10 drums. The larger anomalies could be, but also are not necessarily, due to buried metal drums. However, if the large anomalies are due to metal drums, then caches of several hundred drums would be required.

Magnetic Survey
Gratwick-Riverside Park
North Tonawanda, New York
April, 1989 File 88D26

Figure 1. General location of the Site.

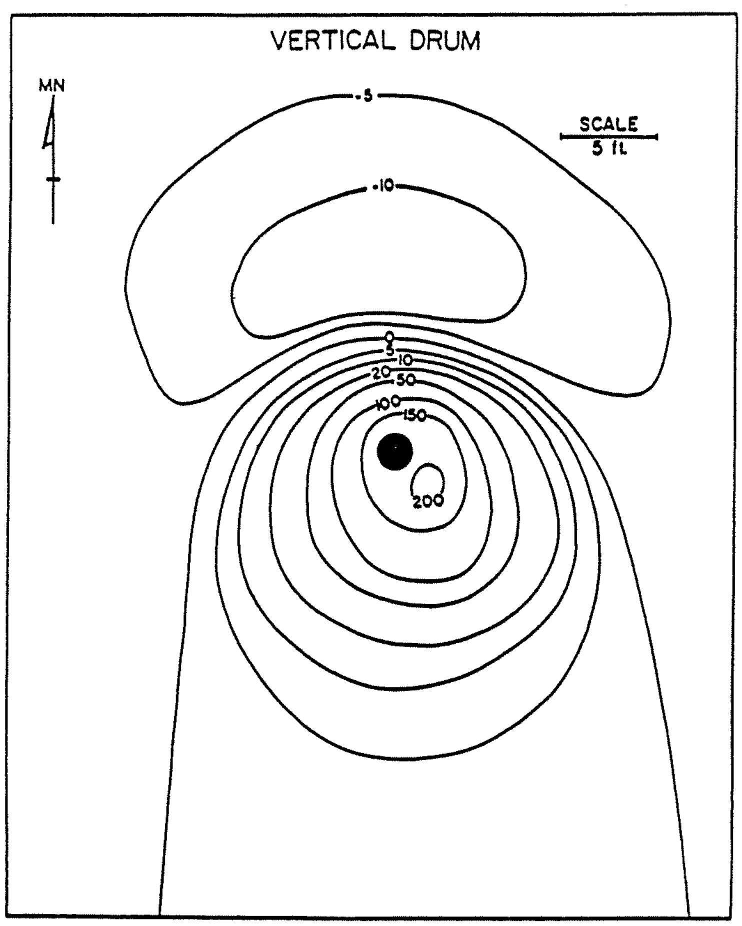


Figure 2. Magnetic signature of a vertical drum buried 4 feet below the surface. This contour map was produced from measurements made in the field at 5 foot intervals.

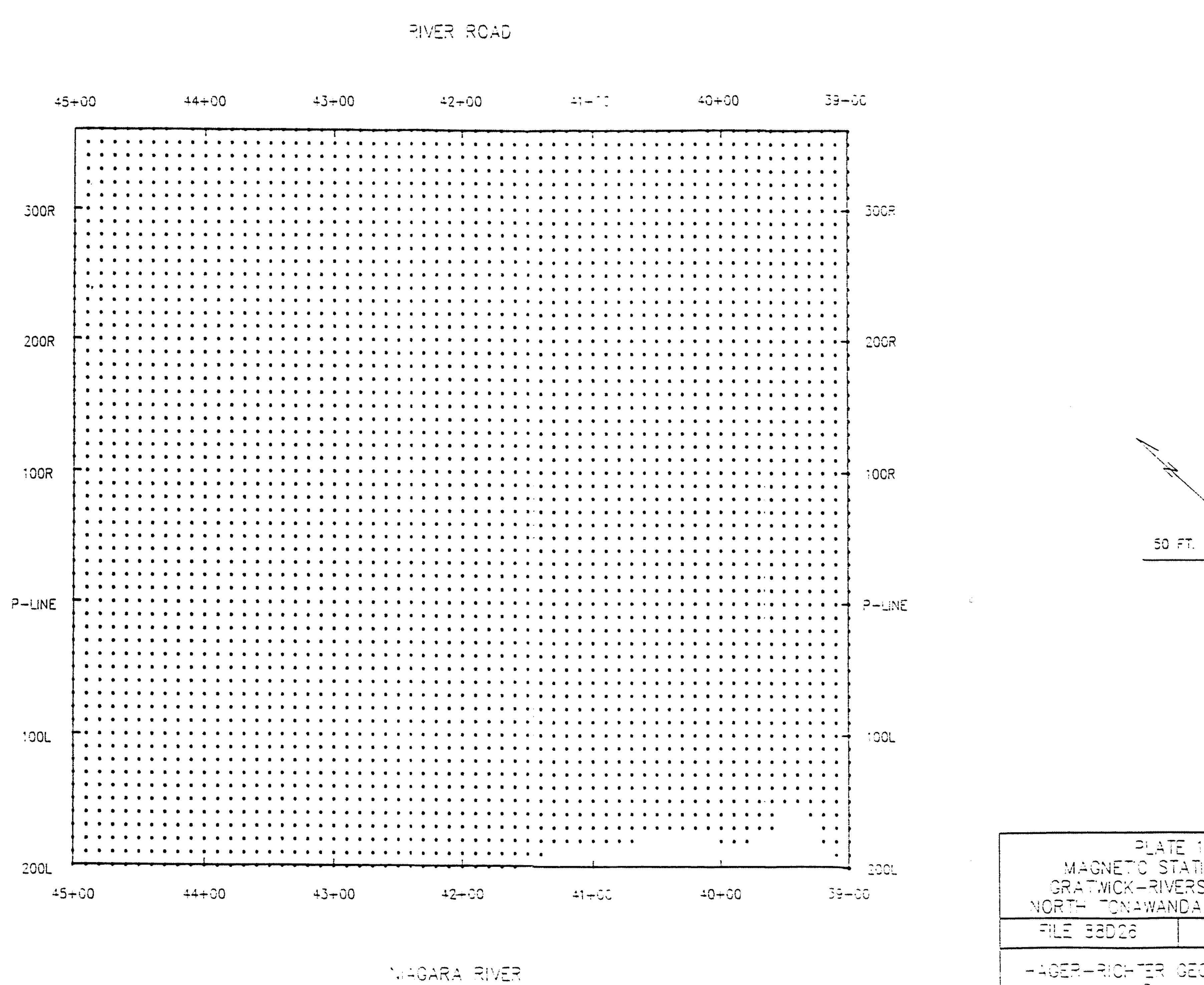
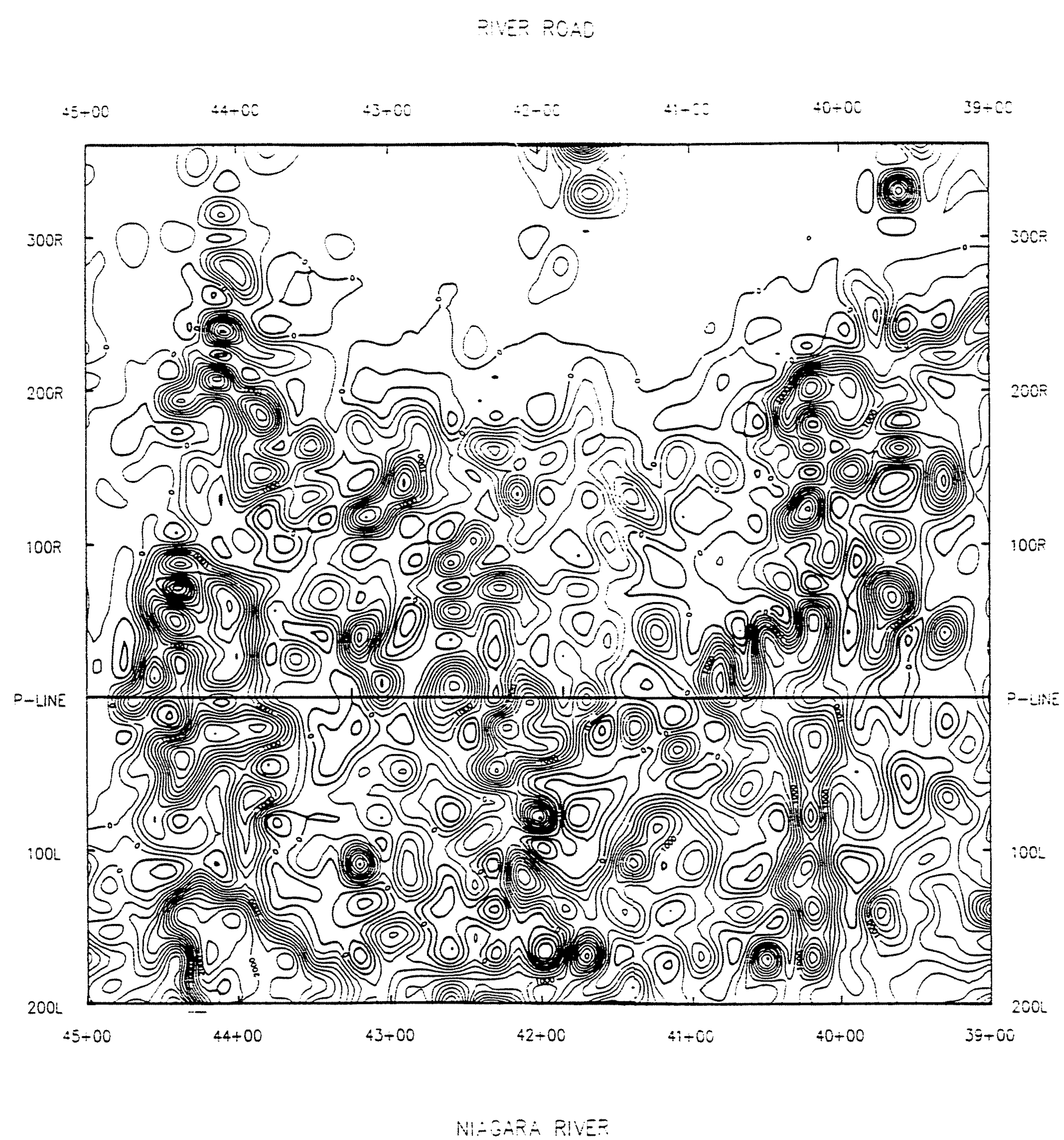


PLATE 1
MAGNETIC STATION MAP
GRATWICK-RIVERSIDE PARK
NORTH TONAWANDA, NEW YORK

FILE 88D26	APRIL 1989

HAGER-RICHTER GEOSCIENCE, INC.
8 Industrial Way, D10
Salem, NH 03079



CONTOUR INTERVAL = 200 GAMMAS

CONTOUR = TOTAL FIELD - 56,300 GAMMAS

50 FT.

PLATE 2 MAGNETIC CONTOUR MAP GRATWICK-RIVERSIDE PARK NORTH TONAWANDA, NEW YORK	
FILE 88D26	APRIL 1989
HAGER-RICHTER GEOSCIENCE, INC. 8 Industrial Way, D10 Salem, NH 03079	

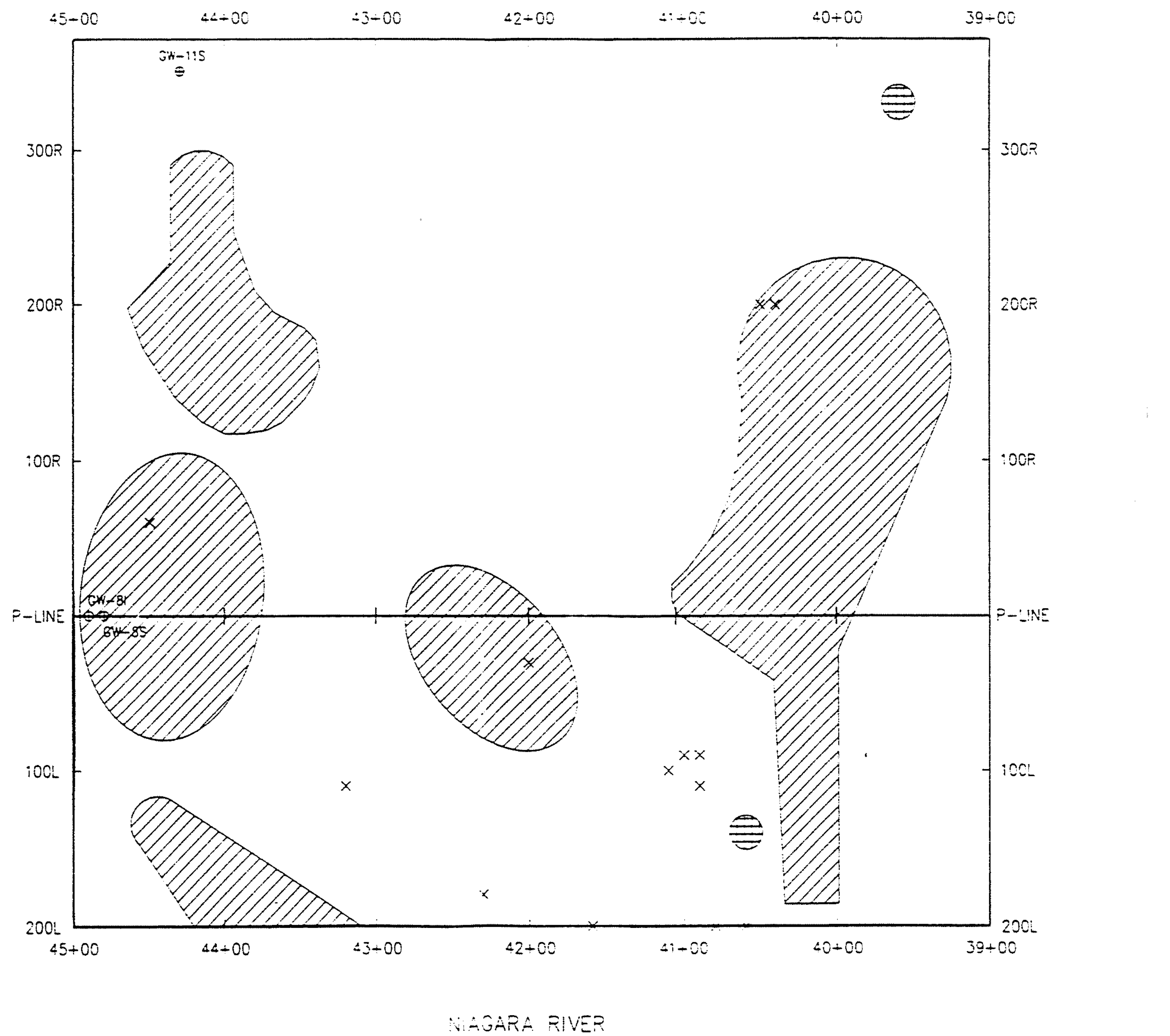


PLATE 3
INTERPRETATION MAP
GRATWICK-RIVERSIDE PARK
NORTH TONAWANDA, NEW YORK

FILE 88D26	APRIL 1989

HAGER-RICHTER GEOSCIENCE, INC.
8 Industrial Way, D10
Salem, NH 03079

APPENDIX B.2
TEST BORING LOGS

B.2.1 INTRODUCTION

The test boring logs which follow were compiled from; field notes prepared by the supervising URS geologist as the boreholes were advanced, the results of geotechnical tests performed on selected samples, and review of the field notes and re-examination of the soil and rock samples by the senior project hydrogeologist. The information presented on the following logs details subsurface conditions at each boring location. The deepest borehole at each location was continuously sampled. Samples from additional adjacent shallower boreholes, at selected locations, were used for geotechnical or chemical testing. Borehole identification numbers are noted at the top of the appropriate log and correspond with borehole and well locations presented on the site plan (Figure 1-5) and cross section locations plan (Figure 4-3). Borehole identification numbers are followed by a letter designating relative borehole depths at each location (i.e. shallow (S), intermediate (I), or deep (d)).

Samples shown on the test boring log include split spoon (SS), Shelby tube (ST), and rock core (RC) samples. A discussion of soil sampling methods for collection of chemical samples is provided in Appendix E.2.

B.2.2 EXPLANATION OF THE TEST BORING LOG FORM

This section provides the reader with information to assist in using the test boring logs. Other than self-explanatory information, each heading used on the Test Boring Log is explained below.

Elevation

Elevation of each borehole location is the ground surface elevation in feet relative to NGVD 1929 datum.

Well Construction

This column provides a graphic description of monitoring well construction and depths of specific construction details. Definitions for well construction symbols are provided on following figure.

Depth

Depth measurements are presented as depth below ground surface.

Strata

This column pictorially illustrates the interpreted stratigraphy of the soil and rock units described on each boring log. Definitions for the stratigraphic symbols used on the logs are provided on following figure.

Description

This column provides a description of geologic materials encountered during drilling of each borehole. Descriptions are based on visual examination and/or laboratory testing. Each stratum is described according to the following classification and terminology which is based on the proportion of individual grain sizes present.

LEGEND-TEST BORING LOGS

WELL CONSTRUCTION

Cement/Bentonite Grout

Bentonite Pellet Seal

Sand Pack

Cave-In

STRATIGRAPHY

Topsoil

Fill

Lacustrine Deposits

Till

Shale Bedrock

Classification	Grain Size (ASTM D422)
Clay	<.005 mm
Silt	0.005 - 0.074 mm
Sand	0.075 - 4.74 mm
Gravel	4.75 - 76.2 mm

Terminology	Proportion
"trace" (eg. trace sand)	<10%
"some" (eg. some sand)	10-20%
adjective (eg. sandy)	20-35%
and (eg. and sand)	35-50%
noun (eg. sand)	>50%

The compactness of noncohesive soils and the consistency of cohesive soils are defined by the following:

Noncohesive Soils

Compactness	Standard Penetration (Blows/ft)
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

Cohesive Soils

Consistency	Standard Penetration (Blows/ft)
Very Soft	0 - 2
Soft	2 - 4
Firm	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Blows per 6 inches

This column presents the number of standard penetration test (ASTM-D-1586-84) blows performed during sampling of the borehole. Each number represents the blow count required to advance a 2-inch diameter split-spoon sampler 6-inches into the subsoil driven by means of a 140-pound hammer falling freely a distance of 30 inches. The standard penetration resistance ("N") is derived by adding the number of blows from the 6- to 12-inch and 12- to 18-inch intervals of each sample attempt.

Percentage Recovery

This column presents the percentage of sample recovered from each sampling attempt.

TIP or OVA

TIP or OVA values are organic vapor readings registered during sampling using either a Photovac TIP or HNu Photoionization Detector. Samples were screened for organic vapors and readings are recorded in parts per million.

Comments

The last column describes pertinent drilling details or field observations and the results of field or geotechnical laboratory tests performed on soil samples.

Geotechnical tests performed on samples, which are noted on the logs, include moisture content, liquid limit and plastic limit. Moisture content of samples is presented as percent water by weight. Liquid limit is the water and plastic limit. Moisture content of samples is presented as percent water by weight. Liquid limit is the water content, in percent, of a soil at the arbitrarily defined boundary between the liquid and plastic states. Plastic limit is the water content, in percent, of a soil at the boundary between the plastic and brittle states. Plasticity index values are also presented indicating the range of water content over which a soil behaves plastically.

Where core sampling of the bedrock was performed, the term RQD is used. The Rock Quality Designation (RQD) is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of the core recovered and counting only those pieces of sound core that are four inches or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths greater than four inches to the total length of the core run. RQD classifications are presented below.

RQD Classification	RQD Value (%)
Very Poor Quality	<25
Poor Quality	25 - 50
Fair Quality	50 - 75
Good Quality	75 - 90
Excellent Quality	90 - 100

B.2.3 URS TEST BORING LOGS

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

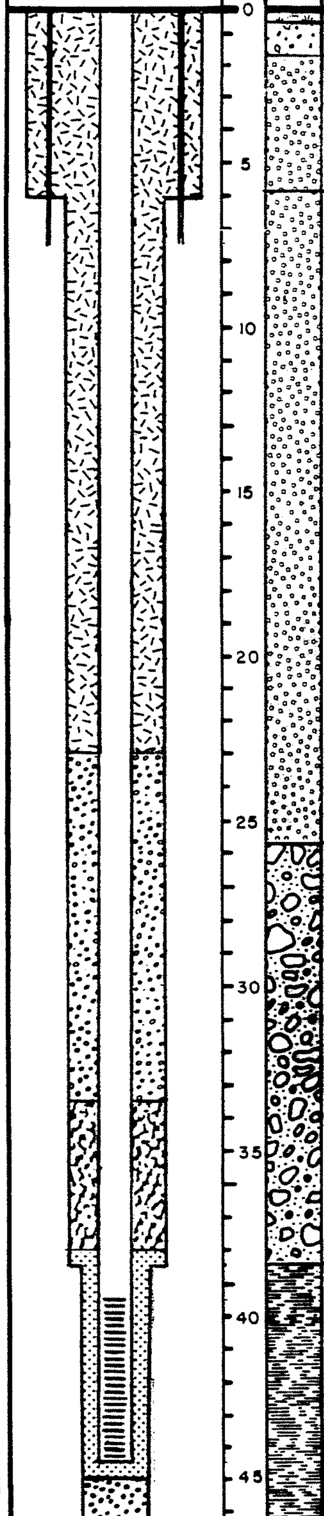
TEST BORING LOG

BORING NO. GW-1D

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 576.79
	DATE STARTED: 10/7/87
	DATE FINISHED: 10/23/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS-SPLIT SPOON	REC (%)-PERCENTAGE RECOVERY
ST-SHELBY TUBE	TIP - ORGANIC VAPOR CONCENTRATION (PPM)
T - SPLIT TUBE	MC-MOISTURE CONTENT, LL-LIQUID LIMIT
RC-ROCK CORE	PL-PLASTIC LIMIT, PI-PLASTICITY INDEX

WELL CONSTRUCTION / DEPTH FEET / STRATA



DESCRIPTION

TOPSOIL - REDDISH BROWN ORGANIC CLAYEY SILT. MOIST. MODERATELY PLASTIC. SOME ROOT MATERIAL. STIFF. 0.4

FILL - BLACK COARSE GRANULAR MATERIAL (ASPHALT). LOOSE. MOIST. STIFF 1.7

MOTTLED REDDISH BROWN, BROWN TAN SILTY FINE SAND. SOME CLAY. MOIST TO VERY MOIST. STIFF. LOOSE. 5.8

MOTTLED REDDISH BROWN, BROWN TAN CLAYEY SILT. SOME SAND VARVED STRUCTURE. MOIST. VERY STIFF.
BECOMING REDDISH BROWN & GRAY SILTY CLAY AT 8.0 FT. MOIST. DTPL. FIRM.
BECOMING MORE MOIST. APL 12.3 FT.
BECOMING SOFT TO VERY SOFT 14.0 FT.
WTPL 17.0 FT.

25.7

TILL - REDDISH BROWN GRAVELLY SILTY CLAY. MOIST APL. SOFT.
BECOMING HARD & DENSE 26.5 FT. INCREASED SILT CONTENT.
BECOMING SLIGHTLY MOIST 30.0 FT.
LAMINATED 32.0 TO 38.0 FT.
SATURATED AT 38.0 FT.

38.4

BEDROCK - MEDIUM GRAY SHALE. THIN BEDDED. HARD. LIMESTONE INTERBEDDED 40.1 - 40.5 FT. MANY DRILLING FRACTURES. BROKEN & CRUSHED ZONES 39.8 TO 40.1 FT 40.5 TO 41.3 FT & 47.4 TO 48.0 FT

SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	TIP	COMMENTS
1	SS	3 / 6	4 / 6	40	0.0	
2	SS	7	8	50	0.0	
3	SS	7 / 8	7 / 6	75	0.0	
4	SS	6	8	70	0.0	
5	SS	7 / 12	10 / 18	90	0.0	
6	SS	3 / 14	7 / 25	80	0.0	MC-27.8%, LL-51 PL-25, PI-26
7	SS	8 / 9	8 / 10	80	0.0	MC-30.8%
8	SS	3 / 4	2 / 4	80	0.0	MC-40.1%
9	SS	1 / 2	2 / 3	100	0.0	MC-40.5%
10	SS	3 / 1	2 / 2	100	0.0	
11	SS	WOH / 2	WOH / 1	90	0.0	
12	SS	WOH / 1	1 / 2	90	0.0	MC-35.1%, LL-45 PL-23, PI-22
13	SS	1 / 2	1 / 2	100	0.0	
14	SS	1 / 2	2 / 2	90	0.0	
15	SS	2 / 25	19 / 23	80	0.0	
16	SS	8 / 25	9 / 22	30	0.0	MC-7.3%
17	SS	14 / 20	18 / 27	30	0.0	MC-5.6%
18	SS	50/4		90	0.0	
19	SS	49	50/2	90	0.0	
20	SS	36	50/4	80	0.0	MC-8.0%
21	SS	50/0		0	—	
1	RC			43		CORE RUN 1 38.4 - 47.4 FT. RQD 0/46 0% RQD - ROCK QUALITY DESIGNATION

A-2567

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-1D

PROJECT: GRATWICK - RIVERSIDE PARK

SHEET NO. 2 OF 2

CLIENT: NYSDEC

JOB NO.: 35149

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)		COMMENTS
	45		BEDROCK - MEDIUM GRAY SHALE						
				2	RC		23		CORE RUN 2 47.4-49.9 FT RQD 0/1 0%
	50		BORING TERMINATED AT 49.9 FT.						
	55								
	60								
	65								
	70								
	75								
	80								
	85								
	90								
	95								

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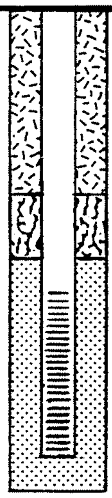
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-1S

PROJECT: Gratwick - Riverside Park	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R&R International	ELEVATION: 576.78

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 10/22/87
ST SHELBY TUBE		DATE FINISHED: 10/23/87
T SPLIT TUBE		DRILLER: Jim Rochford
		DRILL RIG: CME-75
RC ROCK CORE		LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS PER 6 INCHES	REC (%)		COMMENTS
	0		Borehole advanced to 15.0 ft. No samples recovered. Log presumed same as GW-1D.						
	5								
	10								
	15		Boring terminated at 15.0 ft.						
	20								
	25								
	30								
	35								
	40								
	45								

A-2567

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-1S ABANDONED

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R&R INTERNATIONAL	ELEVATION:

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
		DATE STARTED: 11/22/87
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 11/23/87
ST SHELBY TUBE		DRILLER: JIM ROCHFORD
T SPLIT TUBE		DRILL RIG: CME-75
RC ROCK CORE		LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	REC (%)		COMMENTS
	0		BOREHOLE ADVANCED TO 15.0 FT NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-1D.						BOREHOLE ABANDONED DUE TO CAVE IN PROHIBITING WELL CONSTRUCTION
	5								
	10								
	15		BORING TERMINATED AT 15.0 FT.						
	20								
	25								
	30								
	35								
	40								
	45								

A-2567

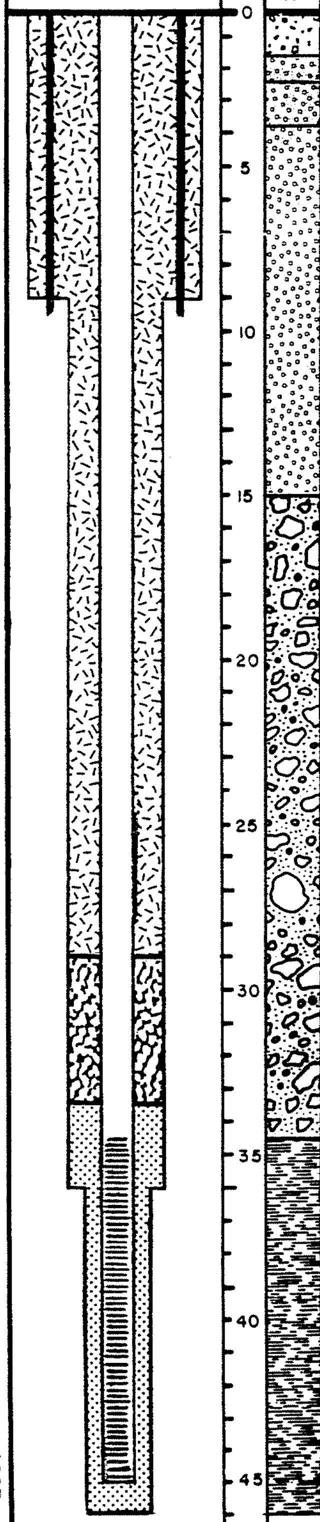
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-2D

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35749
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 575.37

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
		DATE STARTED: 10/8/87
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 10/28/87
ST SHELBY TUBE	TIP - ORGANIC VAPOR CONCENTRATION (PPM)	DRILLER: JIM ROCHFORD
T SPLIT TUBE	MC - MOISTURE CONTENT, LL - LIQUID LIMIT	DRILL RIG: CME-75
RC ROCK CORE	PL - PLASTIC LIMIT, PI - PLASTICITY INDEX	LOGGED BY: AJL

WELL CONSTRUCTION / DEPTH FEET / STRATA



DESCRIPTION

FILL - DARK BROWN ORGANIC CLAYEY SILT. SOME GRAVEL. MOIST. LOOSE.
——— 1.7'
MOTTLED REDDISH BROWN, BROWN, TAN CLAYEY SILT. FIRM TO STIFF. MOIST.
——— 2.5
REDDISH BROWN & BROWN SILTY CLAYEY FINE SAND. SOME GRAVEL. STIFF. WET.
——— 3.8'
MOTTLED REDDISH BROWN, BROWN, TAN SILTY CLAY. VERY STIFF. MOIST. DTPL.
BECOMING HARD 6.5 FT. TRACE GRAVEL.
BECOMING SATURATED 10.8 FT.
——— 11.2'
MOTTLED REDDISH BROWN & GRAY SILTY CLAY. FIRM. VERY MOIST. APL.
——— 15.0'
TILL - REDDISH BROWN GRAVELLY SILTY CLAY. HARD. VERY DENSE. MOIST. DTPL.
BECOMING SLIGHTLY MOIST 18.0 FT.
BECOMING GRAVELLY CLAYEY SILT. VERY STIFF & COMPACT. MOIST.
BECOMING MORE SILTY.
BECOMING VERY MOIST TO WET.
——— 34.5'
BEDROCK - MEDIUM GRAY SHALE. THIN BEDDED. HARD. MODERATELY WEATHERED 36.0 - 38.0 FT. MANY DRILLING FRACTURES. BROKEN & CRUSHED ZONES 36.0 - 36.6 FT., 37.3 - 37.6 FT., 38.6 - 38.9 FT, 42.0 - 42.3 FT & 43.0 - 43.5 FT. GYPSUM DEPOSITS 43.8 - 44.2 FT. & 45.5 - 45.9 FT.
DRILL WATER CIRCULATION LOST AT 45.0 FT
BORING TERMINATED AT 46.0 FT

SAMPLE

NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	TIP	COMMENTS
1	SS	2 3 2 3	40	0.0	
2	SS	3 4	50	0.0	
3	SS	4 6 13 7	75	0.0	
4	SS	9 12	70	0.0	
5	SS	8 10 20 7	90	0.0	
6	SS	11 13	90	0.0	
7	SS	4 4 6 2	90	0.0	
8	SS	2 3	30	0.0	
9	SS	2 2 3 5	80	0.0	MC - 33.7%
10	SS	4 2 2 35	90	0.0	
11	SS	25 50/3	80	0.0	MC - 6.0%
12	SS	18 50/4	90	0.0	
13	SS	50 50/4	80	0.0	
14	SS	20 35 50/2	70	0.0	
15	SS	11 12 15 37	80	0.0	MC-8.0%, LL-20 PL-12, PI-8
16	SS	50/4	80	0.0	
17	SS	7 11 15 50	70	0.0	
18	SS	17 21 31 50/2	70	0.0	MC-8.6%, LL-14 PL-11, PI-3
19	SS	50/2	90	0.0	
20	SS	35 50/2	20	0.0	
21	SS	50/0	0	-	
1	RC		80		CORE RUN 1 36.0-43.5 FT. RQD 5/72 7% RQD - ROCK QUALITY DESIGNATION
2	RC		100		CORE RUN 2 43.5-46.0 FT RQD 4/30 13%

A-2567

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

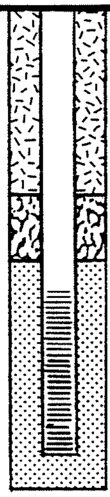
TEST BORING LOG
BORING NO. GW-2S

PROJECT: GRATWICK - RIVERSIDE PARK
CLIENT: NYSDEC
BORING CONTRACTOR: R&R INTERNATIONAL

SHEET NO. 1 OF 1
JOB NO.: 35149
ELEVATION: 575.61
DATE STARTED: 10/28/87
DATE FINISHED: 10/29/87
DRILLER: JIM ROCHFORD
DRILL RIG: CME-75
LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	MC - MOISTURE CONTENT
T SPLIT TUBE	
RC ROCK CORE	

WELL CONSTRUCTION



DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)		COMMENTS
0	FILL - BLACK COARSE GRANULAR MATERIAL. WET. LOOSE. SOFT.	1	SS	2 2 2 1	60		
1.0'	MOTTLED REDDISH BROWN, BROWN TAN GRAY CLAYEY SILT. MOIST. DTPL. SOFT TO VERY STIFF.	2	SS	2 1 3 3	60		
5		3	SS	4 6 10 18	60		
		4	SS	9 13 16 23	40		
		5	SS	8 7 10 13	50		MC-25.5%
15	BORING TERMINATED AT 15.0 FT.						

A-2567

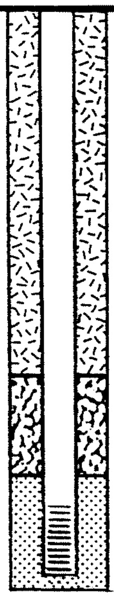
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-3I

PROJECT: Gratwick - Riverside Park	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R International	ELEVATION: 573.93
SAMPLE TYPES / SYMBOLS AND DEFINITIONS	DATE STARTED: 12/1/87
SS SPLIT SPOON / REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 12/2/87
ST SHELBY TUBE / OVA - ORGANIC VAPOR CONCENTRATION (PPM)	DRILLER: Jim Rochford
T SPLIT TUBE	DRILL RIG: CME-75
RC ROCK CORE	LOGGED BY: AJL

WELL CONSTRUCTION



STRATA

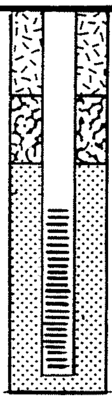
DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	OVA	COMMENTS
0	Topsoil - Reddish brown clayey silt. Moist. Firm. Loose. Organic.	1	SS	4 / 3	4 / 6	50	0.0	
0.5'	Fill - Assorted granular material & silt. Moist, hard & very dense to soft & loose. Predominantly reddish brown.	2	SS	24 / 50/3	47	40	0.0	
5		3	SS	12 / 2	2 / 1	10	0.0	Composite 1 for chemical analysis.
		4	SS	3 / 4	2 / 5	40	0.0	
	Becoming black & wet	5	SS	6 / 31	9 / 30	50	0.0	
10		6	SS	18 / 6	6 / 7	20	0.0	
12.0'	Till - Reddish brown gravelly clayey silt. Some sand 12.0-13.0 ft. Wet to moist. Very stiff. Compact to dense.	7	SS	2 / 23	2 / 50/1	50	0.0	
15		8	SS	37	50/3	80	0.0	Composite 2 for chemical analysis.
		9	SS	27	50/4	50	0.0	
	Boring terminated at 18.0 ft							
20								
25								
30								
35								
40								
45								

A-2567

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-3S

PROJECT: Gratwick - Riverside Park	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R International	ELEVATION: 573.93
SAMPLE TYPES / SYMBOLS AND DEFINITIONS	DATE STARTED: 12/2/87
SS SPLIT SPOON / REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 12/2/87
ST SHELBY TUBE	DRILLER: Jim Rockford
T SPLIT TUBE	DRILL RIG: CME-75
RC ROCK CORE	LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	REC (%)		COMMENTS
	0		Borehole advanced to 12.0 ft. No samples recovered. Log presumed same as GW-3I.						
	5								
	10								
			Boring terminated at 12.0 ft.						
	15								
	20								
	25								
	30								
	35								
	40								
	45								

A-2567

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-4I

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 576.77
	DATE STARTED: 11/30/87
	DATE FINISHED: 12/1/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	OVA - ORGANIC VAPOR CONCENTRATION (PPM)
T SPLIT TUBE	
RC ROCK CORE	

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	OVA	COMMENTS
0	TOPSOIL - DARK BROWN CLAYEY SILT. MOIST. LOOSE. FIRM.	1	SS	4 4 2 2	40	0.0	
1.0'	FILL - ASSORTED GRANULAR MATERIAL & SILT. BRICK & GLASS FRAGMENTS, GRAVEL, ETC. MOIST. LOOSE. FIRM.	2	SS	4 2 6 2	40	0.0	
		3	SS	2 3 12 9	40	0.2	
		4	SS	12 7 50/.2	60	0.2	
	BECOMING WET. OCCURRENCE OF SLAG 9.0-10.4 FT.	5	SS	11 37 15 50/.4	80	0.0	
		6	SS	50/.4	50	0.0	
		7	SS	3 4 3 6	40	0.1	
14.2'	REDDISH BROWN SILTY CLAY. WTPL. SOFT.	8	SS	2 2 2 1	50	2.0	
		1	ST	PUSH	100		3 INCH TUBE Triaxial Permeability
		2	ST	PUSH	100		2 INCH TUBE
		9	SS	2 2 3 5	90		CHEMICAL ANALYSIS
21.8'	TILL - REDDISH BROWN CLAYEY GRAVELLY SILT. WET. SOFT. LOOSE. BORING TERMINATED AT 22.0 FT						

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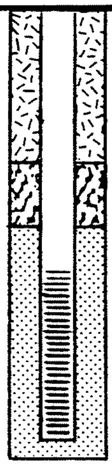
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-4S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 576.87

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 11/30/87
ST SHELBY TUBE		DATE FINISHED: 12/1/87
T SPLIT TUBE		DRILLER: JIM ROCHFORD
		DRILL RIG: CME-75
RC ROCK CORE		LOGGED BY: AJL



DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	COMMENTS
0	BOREHOLE ADVANCED TO 8.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-4I						
5							
	FILL - ABUNDANT SLAG	1	SS	50/.5		80	COMPOSITE 1 FOR CHEMICAL ANALYSIS
10		2	SS	50/.4		80	
		3	SS	57	50/.3	50	
		4	SS	8 6	7 2	90	
15	BORING TERMINATED AT 14.0 FT.						
20							
25							
30							
35							
40							
45							

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URS Company, Inc.
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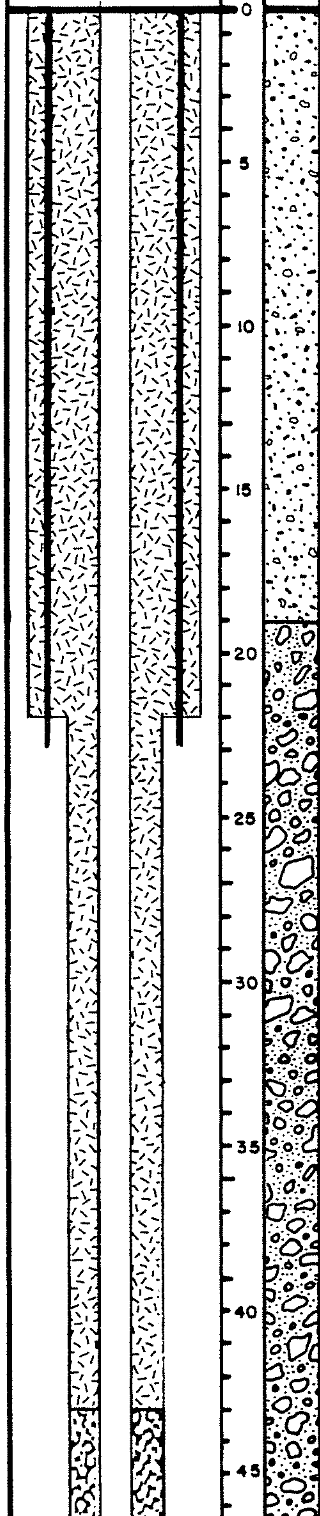
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-5D

PROJECT: Gratwick - Riverside Park	SHEET NO. 1 OF 2
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R International	ELEVATION: 568.92
SAMPLE TYPES / SYMBOLS AND DEFINITIONS	DATE STARTED: 10/8/87
SS SPLIT SPOON / REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 11/4/87
ST SHELBY TUBE / TIP - Organic Vapor Concentration (PPM)	DRILLER: Jim Rochford
T SPLIT TUBE / MC - Moisture Content, LL - Liquid Limit	DRILL RIG: CME-75
RC ROCK CORE / PL - Plastic Limit, PI - Plasticity Index	LOGGED BY: AJL

WELL CONSTRUCTION / DEPTH FEET / STRATA



DEPTH (FT)	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	TIP	COMMENTS
0–5	Fill - Concrete, large gravel & slag fragments. Water level 3.0 ft.					0.0	No samples 0.0 - 14.0 ft due to refusal in fill. TIP reading inside auger
8–10	Becoming sandy with medium angular gravel.	1					Sample 1 - Drill cuttings
13						1.8	
14–16	Fill - Black, dark blue, purple granular material. Wet. Loose. Hard.	2	SS	18 23 / 19	70	0.5	
18						0.4	TIP reading inside auger
19.0'	Till - Reddish brown gravelly clayey silt. Moist. Very stiff. Compact.	3	SS	9 8 / 13 10	70	0.0	
		4	SS	14 22	75	3.0	
		5	SS	7 10 / 11 13	30	0.0	MC-18.6%
25	Becoming sandy & hard.	6	SS	11 22 / 21 28	60	1.6	MC-8.9%, LL-18, PL-15, PI-3
		7	SS	9 50/4	80	0.2	
		8	SS	20 27 / 20 23	70	0.4	MC-8.2%
		9	SS	13 17 / 22 35	40	0.0	
		10	SS	9 12 / 14 29	70	0.0	MC-10.8%
		11	SS	7 11 / 17 21	70	0.0	MC-8.7%
		12	SS	4 5 / 8 15	70	0.0	
		13	SS	50/4	90	0.0	MC-8.3%
		14	SS	24 34 / 39 43	30	0.0	
43	Increased gravel content.	15	SS	27 37 / 47 50/4	60	0.0	MC-5.4%
			SS	50/2	0		

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URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-5D

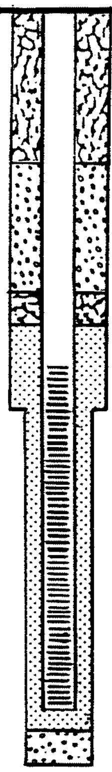
SHEET NO. 2 OF 2

PROJECT: GRATWICK-RIVERSIDE PARK

CLIENT: NYSDEC

JOB NO.: 35149

WELL CONSTRUCTION



STRATA

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)		COMMENTS
45		16	SS	48	50/.4	50	0.0	MC-5.9%
	BECOMING GRAY CLAYEY SILT WITH GRAVEL. SOME SAND. MOIST. HARD. VERY DENSE.	17	SS	42 50/.2	45	100	0.0	MC-8.1%, LL-23, PL-15, PI-8
50			SS	50/.1		0		
	OCCURRENCE OF LARGE SHALE FRAGMENTS.	18	SS	50/.4		90	0.0	
55	INCREASED SAND CONTENT.	19	SS	25	50/.3	90	0.0	MC-11.9%
			SS	50/.4		0		
57.5'	BEDROCK - MEDIUM GRAY SHALE. THIN BEDDED. HARD. GYPSUM DEPOSITS INTERBEDDED 59.3-60.0 FT, 60.4-60.8 FT. & 70.3-71.0 FT. FRACTURED ALONG BEDDING PLANES. OCCASSIONAL DRILLING BREAKS. CRUSHED 58.0-58.5 FT.	1	RC			91		CORE RUN 1 57.5-64.0 FT. RQD-38/71 54%. RQD-ROCK QUALITY DESIGNATION
60								
65		2	RC			100		CORE RUN 2 64.0-68.5 FT. RQD-39/54 72%
70	BORING TERMINATED AT 68.5 FT.							
75								
80								
85								
90								
95								

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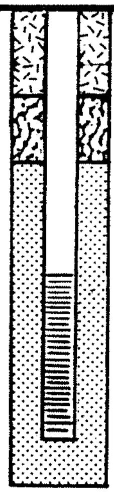
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-5S

PROJECT: Gratwick - Riverside Park	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R International	ELEVATION: 568.55

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 11/19/87
ST SHELBY TUBE		DATE FINISHED: 11/20/87
T SPLIT TUBE		DRILLER: Jim Rochford
RC ROCK CORE		DRILL RIG: CME-75
		LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS PER 6 INCHES	REC (%)		COMMENTS
	0		Boring advanced to 15.0 ft. No samples recovered. Log presumed same as GW-5D.						
	15		Boring terminated at 15.0 ft.						

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

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URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-5I

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 568.69
	DATE STARTED: 11/17/87
	DATE FINISHED: 11/20/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: AJL/JG

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	
T SPLIT TUBE	
RC ROCK CORE	

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	COMMENTS
0	BORING ADVANCED TO 12.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-5D.					
	FILL - REDDISH BROWN SILT.					
12.5'	FILL - DARK BLUE & BLACK GRANULAR MATERIAL	1	SS	10 16 41 50/.3	80	COMPOSITE 1 FOR CHEMICAL ANALYSIS
		2	SS	10 16 14 50	100	
		3	SS	13 8 7 3	80	
		4	SS	2 6 11 12	0	
20.0'	TILL	5	SS	5 13 13 15	60	COMPOSITE 2 FOR CHEMICAL ANALYSIS
		6	SS	9 11 15 19	40	
		7	SS	8 8 17 18	50	COMPOSITE 3 FOR CHEMICAL ANALYSIS
31.0'	BORING TERMINATED AT 31.0 FT.					

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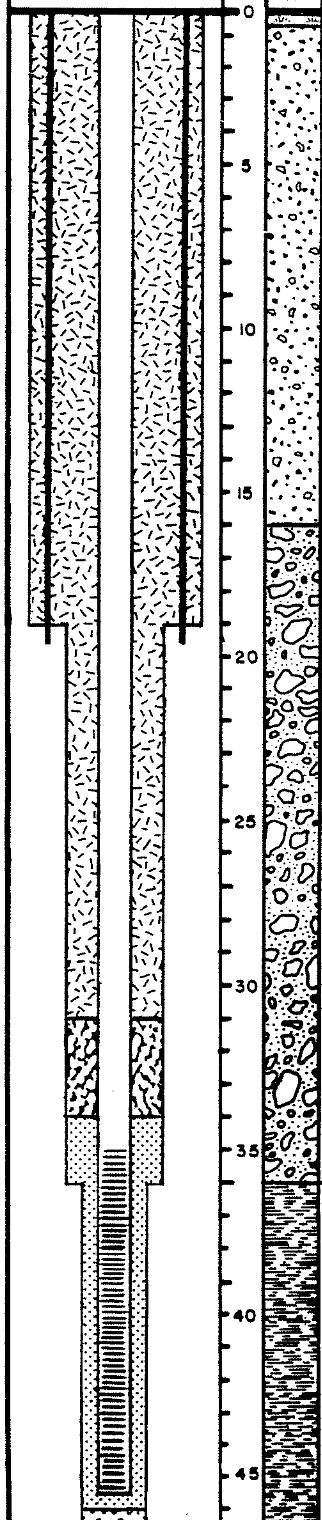
URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-6D

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R&R INTERNATIONAL	ELEVATION: 571.98
	DATE STARTED: 10/11/87
	DATE FINISHED: 11/15/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	TIP - ORGANIC VAPOR CONCENTRATION (PPM)
T SPLIT TUBE	MC - MOISTURE CONTENT, LL - LIQUID LIMIT
RC ROCK CORE	PL - PLASTIC LIMIT, PI - PLASTICITY INDEX

WELL CONSTRUCTION / DEPTH FEET / STRATA



DESCRIPTION

TOPSOIL - DARK BROWN ORGANIC CLAYEY SILT. MOIST. FIRM. LOOSE. 0.5'

FILL - ASSORTED GRANULAR DEBRIS. CULLET WITH BROWN CLAYEY SILT MATRIX. SOME BLACK APPARENT ASPHALT FRAGMENTS. SOME CONCRETE. MOIST. LOOSE. SOFT.

BECOMING SATURATED.

BECOMING BLACK, BLUE, DARK PURPLE GRANULAR MATERIAL. WET. LOOSE. STIFF TO HARD. 16.0'

TILL - REDDISH BROWN GRAVELLY CLAYEY SILT. MOIST. HARD. DENSE.

BECOMING SANDY.

MEDIUM SAND. SOME GRAVEL 28.0 - 29.5 FT. WET.

BECOMING SATURATED. SOME BROKEN SHALE FRAGMENTS. 36.0'

BEDROCK - MEDIUM GRAY SHALE. THIN BEDDED. HARD. FRACTURED ALONG BEDDING PLANES. MANY DRILLING BREAKS.

BORING TERMINATED AT 47.0 FT

SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	TIP	COMMENTS
1	SS	6 4 2 2	30	0.0	
2	SS	3 3	40	11.0	
3	SS	3 2 2 3	30	5.0	
4	SS	1 2	20	5.0	
5	SS	3 2 2 3	30	2.0	
6	SS	2 3	20	2.0	
7	SS	2 1 1 2	20	4.0	
8	SS	WOH 5	20	5.0	
9	SS	5 5 6 14	60	4.0	
10	SS	19 25 31 29	30	2.0	
11	SS	34 50/4	80	1.0	
12	SS	37 31 25 25	80	1.0	
13	SS	19 30 46 42	20	0.5	
14	SS	31 30 31 30	80	0.4	MC-8.2%, LL-NP, PL-NP, PI-NP
15	SS	20 26 17 34	60	0.3	NP - NOT PLASTIC
16	SS	17 17 22 31	30	0.1	
17	SS	16 9 13 20	80	0.0	MC-18.4%, LL-NP PL-NP, PI-NP
18	SS	50/4	100	0.0	
19	SS	16 50/4	90	0.0	MC-29.7%
20	SS	50/3	80	0.0	TIP READING INSIDE AUGER 0.0 EXPLOSIMETER 0.0
21	SS	50/1	100	0.0	
1	RC		60		CORE RUN 1 36.0 - 38.5 FT. RQD - 0/18 0%
2	RC		58		CORE RUN 2 38.5 - 40.5 FT. RQD - 0/14 0%
3	RC		80		CORE RUN 3 40.5 - 47.0 FT. RQD - 0/63 0%
					RQD - ROCK QUALITY DESIGNATION

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

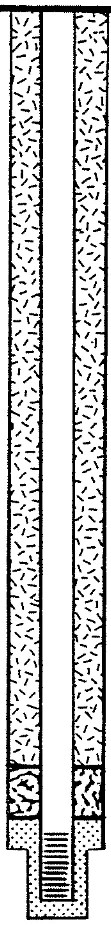
TEST BORING LOG

BORING NO. GW-6I

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 571.98
	DATE STARTED: 11/15/87
	DATE FINISHED: 11/17/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	
T SPLIT TUBE	
RC ROCK CORE	

WELL CONSTRUCTION



STRATA

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	COMMENTS
0	BOREHOLE ADVANCED TO 10.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-6D.						
10	FILL	1	SS	1 / 2	3 / 6	30	COMPOSITE 1 FOR CHEMICAL ANALYSIS
		2	SS	8 / 3	7 / 4	50	
15		3	SS	4 / 17	9 / 50	60	
15.5'	TILL	4	SS	32	50/.4	90	COMPOSITE 2
20		5	SS	25 / 30	34 / 32	60	COMPOSITE 3
		6	SS	19 / 27	28 / 37	60	
25		1	ST	PUSH		100	ST-1 25.0-25.5 FT. 3 INCH TUBE
		2	ST	PUSH		89	ST-2 26.0-26.9 FT. 2 INCH TUBE
28	BORING TERMINATED AT 28.0 FT.						

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URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-6I ABANDONED

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R&R INTERNATIONAL	ELEVATION:
SAMPLE TYPES / SYMBOLS AND DEFINITIONS	DATE STARTED: 11/15/87
SS SPLIT SPOON / REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 11/15/87
ST SHELBY TUBE	DRILLER: JIM ROCHFORD
T SPLIT TUBE	DRILL RIG: CME-75
RC ROCK CORE	LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	COMMENTS
	0–12	BOREHOLE ADVANCED TO 12.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-6D.					BOREHOLE ABANDONED DUE TO LOW RECOVERY ON FILL SAMPLES AND OBSTRUCTION IN HOLE AT 16.0 FT.
	12–14	FILL	1	SS	5 8 35 11	20	
	15.0'	TILL	2	SS	8 17 46 46	30	CHEMICAL ANALYSIS TOP OF TILL
	16.0	BORING TERMINATED AT 16.0 FT.					

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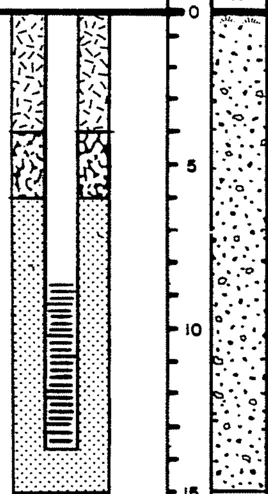
URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-6S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 572.56

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 11/14/87
ST SHELBY TUBE		DATE FINISHED: 11/16/87
T SPLIT TUBE		DRILLER: JIM ROCHFORD
RC ROCK CORE		DRILL RIG: CME-75
		LOGGED BY: AJL



DEPTH FEET	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	REC (%)	COMMENTS
0	BOREHOLE ADVANCED TO 15.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-6D.					
15	BORING TERMINATED AT 15.0 FT.					

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

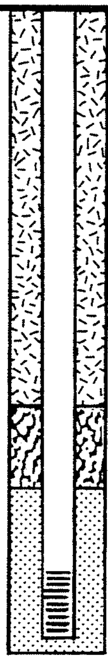
TEST BORING LOG

BORING NO. GW-7I

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 572.32

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 11/23/87
ST SHELBY TUBE	MC - MOISTURE CONTENT, LL - LIQUID LIMIT	DATE FINISHED: 11/24/87
T SPLIT TUBE	PL - PLASTIC LIMIT, PI - PLASTICITY INDEX	DRILLER: JIM ROCHFORD
RC ROCK CORE		DRILL RIG: CME-75
		LOGGED BY: JG

WELL CONSTRUCTION



STRATA

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	COMMENTS
0	FILL - BROWN CLAYEY SILT, LITTLE MEDIUM TO FINE SAND. TRACE FINE GRAVEL AND ASSORTED DEBRIS (GLASS, WOOD, SLAG, ETC.)	1	SS	5 8 9 14	60	
		2	SS	12 21 22 13	80	
5		3	SS	6 4 2 2	20	
		4	SS	3 3 4 4	20	
		5	SS	10 17 50	75	
10		6	SS	8 10 8 11	100	
12.0	REDDISH BROWN CLAY - SILTY CLAY.	7	SS	1 1 1 2	100	MC-41.2%, LL-45, PL-26, PI-19
15		8	SS	1 1 2 1	100	MC-40.4%
		9	SS	WOH WOH 1 2	100	
		10	SS	WOH 1 1 1	100	MC-38.7%
20	BORING TERMINATED AT 20.0 FT					
25						
30						
35						
40						
45						

A-2567 1 OF 3

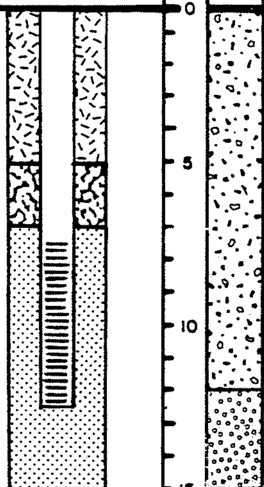
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-7S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R&R INTERNATIONAL	ELEVATION: 572.36
	DATE STARTED: 11/24/87
	DATE FINISHED: 11/25/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: JG

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	
T SPLIT TUBE	
RC ROCK CORE	



WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS PER 6 INCHES	REC (%)		COMMENTS
	0		BOREHOLE ADVANCED TO 15.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-7I.						
	5								
	10								
	15		BORING TERMINATED AT 15.0 FT.						
	20								
	25								
	30								
	35								
	40								
	45								

A-2567 1 OF 3

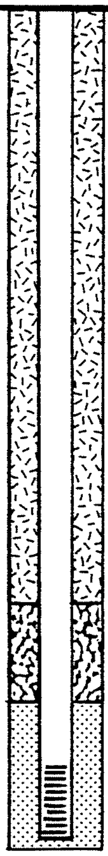
URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-8I	
PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 573.94
	DATE STARTED: 11/20/87
	DATE FINISHED: 11/22/87
	DRILLER: JIM ROCHFORD
	DRILL RIG: CME-75
	LOGGED BY: JG

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	MC - MOISTURE CONTENT, LL - LIQUID LIMIT,
T SPLIT TUBE	PL - PLASTIC LIMIT, PI - PLASTICITY INDEX
RC ROCK CORE	

WELL CONSTRUCTION



STRATA

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	COMMENTS
0	FILL - BROWN GRAY GRAVELLY SILT. SOME FINE SAND AND SLAG. SLIGHTLY MOIST.	1	SS	4 / 3	45 / 45	100	
		2	SS	4 / 3	4 / 4	60	
5		3	SS	6	50/.2	25	
		4	SS	50/.4		15	
		5	SS	50/.3		10	
10		6	SS	8 / 6	5 / 7	70	
	BECOMING WET.	7	SS	5 / 20	13 / 29	90	
14.0'	REDDISH TAN SILTY FINE SAND.	8	SS	3 / 4	3 / 4	80	
15		9	SS	4 / 11	3 / 11	90	MC-18.5%, LL-NP PL-NP, PI-NP
18.0'	RED TAN CLAY - SILTY CLAY	10	SS	1 / 1	1 / 1	100	MC-37.1%
20		1	ST	PUSH		100	Triaxial permeability
22.0'	TILL - BROWN CLAYEY SILT. TRACE FINE SAND & COARSE TO FINE GRAVEL.	11	SS	17 / 26	14 / 29	70	
25		12	SS	5 / 18	8 / 12	60	MC-9.2%
	BORING TERMINATED AT 26.0 FT.						
30							
35							
40							
45							

URS URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

BORING NO. GW-8S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 574.09

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
		DATE STARTED: 11/22/87
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 11/22/87
ST SHELBY TUBE		DRILLER: JIM ROCKFORD
T SPLIT TUBE		DRILL RIG: CME-75
RC ROCK CORE		LOGGED BY: JG

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	COMMENTS
0	BOREHOLE ADVANCED TO 8.0 FT. NO SAMPLES RECOVERED. LOG PRESUMED SAME AS GW-8I.					
				50/.1	0	
	FILL - GRAY & LIGHT BLUE GRAVEL. LITTLE SAND. TRACE SILT.	1	SS		20	COMPOSITE 1 FOR CHEMICAL ANALYSIS.
10		2	SS	3 4 6 8	25	
		3	SS	31 33 50/.4	70	
14.0	REDDISH TAN SILTY FINE SAND.	4	SS	3 4 7 8	60	
	BORING TERMINATED AT 16.0 FT					

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

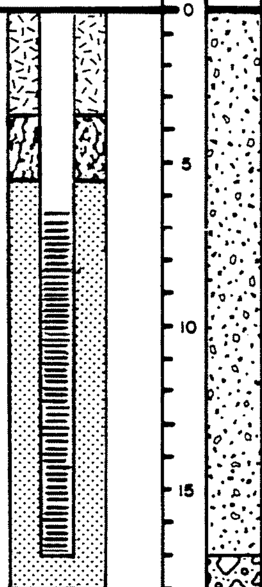
TEST BORING LOG

BORING NO. GW-9S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 572.51

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 10/13/87
ST SHELBY TUBE	TIP - ORGANIC VAPOR CONCENTRATION (PPM)	DATE FINISHED: 10/14/87
T SPLIT TUBE		DRILLER: JIM ROCHFORD
RC ROCK CORE		DRILL RIG: CME-75
		LOGGED BY: AJL

WELL CONSTRUCTION / DEPTH FEET / STRATA



DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	TIP	COMMENTS
FILL - DARK BROWN & REDDISH BROWN CLAYEY SILT. SOME GRAVEL & WOOD FRAGMENTS. MOIST. FIRM. LOOSE. BECOMING HARD AT 4.0 FT (WOOD FRAGMENTS).	1	SS	2, 3, 4, 3	30	0.0	
	2	SS	3, 5, 4, 21	20	0.0	
	3	SS	36, 50/3	20	0.0	
INCREASED GRAVEL CONTENT.	4	SS	3, 50/4	30	0.0	
BECOMING PREDOMINANTLY SLAG. LOOSE. VERY STIFF. SATURATED.	5	SS	13, 11, 14, 6	70	1.7	
	6	SS	10, 6, 5, 9	60	0.6	
PULVERIZED SLAG	7	SS	8, 10, 7, 9	70	1.3	
	8	SS	5, 5, 2, 2	60	0.2	
BECOMING BLACK SILT. TRACE CLAY. SOME WOOD FRAGMENTS. WET. SOFT. LOOSE. SANDY 16.0 - 17.0 FT. 17.0'	9	SS	4, 3, WOH, WOH	70	0.2	
TILL - REDDISH BROWN GRAVELLY SILTY CLAY. WTPL. VERY SOFT.						TIP READING INSIDE AUGER 0.9
BORING TERMINATED AT 18.0 FT.						TIP READING AROUND RIG 0.0

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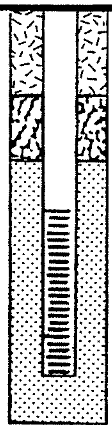
URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. GW-10S

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 572.05

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
		DATE STARTED: 10/14/87
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE FINISHED: 10/14/87
ST SHELBY TUBE	TIP - ORGANIC VAPOR CONCENTRATION (PPM)	DRILLER: JIM ROCHFORD
T SPLIT TUBE		DRILL RIG: CME-75
RC ROCK CORE		LOGGED BY: AJL

WELL CONSTRUCTION



STRATA

DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	TIP	COMMENTS
0	TOPSOIL - DARK BROWN ORGANIC CLAYEY SILT. MOIST. SOFT. LOOSE. 0.5'	1	SS	3, 2, 2, 1	40	0.1	
	FILL - ASSORTED DEBRIS. BROWN, TAN, REDDISH BROWN, BLACK GRANULAR & FINE MATERIAL. SOME BRICK FRAGMENTS. MOIST. STIFF. LOOSE.	2	SS	3, 4, 5, 3	70	0.1	
5		3	SS	5, 5, 4, 2	40	0.1	
		4	SS	3, 7, 46, 28	60	0.2	
	BECOMING PREDOMINANTLY SLAG 7.0FT. SATURATED. HARD. LOOSE.	5	SS	16, 7, 5, 6	70	0.5	
10	BECOMING BLACK SILTY SAND 9.2FT. SATURATED, STIFF, LOOSE. 11.5'	6	SS	6, 7, 2, 1	70	0.1	
	REDDISH BROWN SILTY CLAY. WTPL. SOFT. MASSIVE.						TIP READING AROUND RIG 0.0
15	BORING TERMINATED AT 13.0FT.						
20							
25							
30							
35							
40							
45							

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG

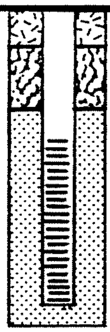
BORING NO. GW-11S

PROJECT: GRATWICK - RIVERSIDE PARK
CLIENT: NYSDEC
BORING CONTRACTOR: R & R INTERNATIONAL

SHEET NO. 1 OF 1
JOB NO.: 35149
ELEVATION: 574.32
DATE STARTED: 10/12/87
DATE FINISHED: 10/12/87
DRILLER: JIM ROCHFORD
DRILL RIG: CME-75
LOGGED BY: AJL

SAMPLE TYPES	SYMBOLS AND DEFINITIONS
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY
ST SHELBY TUBE	
T SPLIT TUBE	
RC ROCK CORE	

WELL CONSTRUCTION



DEPTH FEET	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES		REC (%)	TIP	COMMENTS
0	FILL - BROWN & GRAY GRAVELLY SILT. DRY TO MOIST. HARD. LOOSE. SOME BLUE SLAG FRAGMENTS. SANDY 2.7-2.9 FT	1	SS	6 / 50	27	60	0.0	
		2	SS	24	50/.3	90	0.4	
5		3	SS	12	50/.4	90	0.0	
		4	SS	50/.1		50	0.0	
	BECOMING WET 9.3'	5	SS	31 / 4	5 / 6	50	0.0	
10	REDDISH BROWN CLAYEY SILT MOIST. STIFF COMPACT.							
	BORING TERMINATED AT 10.0 FT.							
15								
20								
25								
30								
35								
40								
45								

URS **URS Company, Inc.**
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

TEST BORING LOG
BORING NO. TB-1

PROJECT: GRATWICK - RIVERSIDE PARK	SHEET NO. 1 OF 1
CLIENT: NYSDEC	JOB NO.: 35149
BORING CONTRACTOR: R & R INTERNATIONAL	ELEVATION: 580.85

SAMPLE TYPES	SYMBOLS AND DEFINITIONS	
SS SPLIT SPOON	REC (%) PERCENTAGE RECOVERY	DATE STARTED: 12/2/87
ST SHELBY TUBE	OVA - ORGANIC VAPOR CONCENTRATION (PPM)	DATE FINISHED: 12/2/87
T SPLIT TUBE		DRILLER: JIM ROCHFORD
RC ROCK CORE		DRILL RIG: CME-75
		LOGGED BY: AJL

WELL CONSTRUCTION	DEPTH FEET	STRATA	DESCRIPTION	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	REC (%)	OVA	COMMENTS
	0		FILL - DARK BROWN & REDDISH BROWN SILTY CLAY - CLAYEY SILT. SOME ROCK, CONCRETE & METAL FRAGMENTS. MOIST. SOFT.						NO SAMPLES RECOVERED 0.0 - 15.0 FT
	15		BECOMING SLAG. WET.	1	SS	38 19 5 2	20	100	
				2	SS	6 3 3 4	50	140	
	20.5		REDDISH BROWN CLAY. WTPL. SOFT. LOOSE.	3	SS	WOH 1 1 3	90	140	
			BORING TERMINATED AT 22.0 FT.						

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APPENDIX B.3

GEOTECHNICAL TESTING RESULTS

B.3.1 INTRODUCTION

Geotechnical laboratory testing was performed by Empire Soils Investigations, Inc. on selected soil samples recovered during the subsurface drilling operation. Analytical tests included grain size distribution, Atterberg limits, moisture content, and triaxial permeability tests. The Empire Soils Investigations, Inc. reports on results of geotechnical testing are presented in the following section. Sample identification numbers presented in this report correspond to the boring location and depth interval from which each sample was recovered.

B.3.2 EMPIRE SOILS INVESTIGATIONS INC.

GEOTECHNICAL TESTING REPORT

EMPIRE
SOILS INVESTIGATIONS INC.

PROJECT: Gratwick - Riverside Park

CLIENT: URS Corporation

DATE: December 29, 1987

PROJECT NO: BT-87-234

REPORT NO: L-1

- -

This report presents the results of laboratory testing performed on thirteen (13) separate soil samples from the above referenced project.

The samples were delivered to our laboratory in Hamburg, New York on November 16, 1987.

Sample identification and tests requested were specified by chain of custody record attached as part of this report.

It was indicated on the chain of custody record and verified by Mr. Guenther Funk, representing URS Company, Inc. that these samples were not considered as hazardous due to the fact that they were collected from an "off site control well".

A summary of test results is presented in the attached Table #1 with additional detailed data regarding the grain size distribution testing presented on their respective laboratory reports.

If you have any further questions, please feel free to contact our office.

Respectfully submitted,

EMPIRE SOILS INVESTIGATIONS, INC.

Charles C. Keipper

Charles C. Keipper
Manager Testing Services

Stanley J. Blas

Stanley J. Blas, Jr., C.E.
Manager - Western District

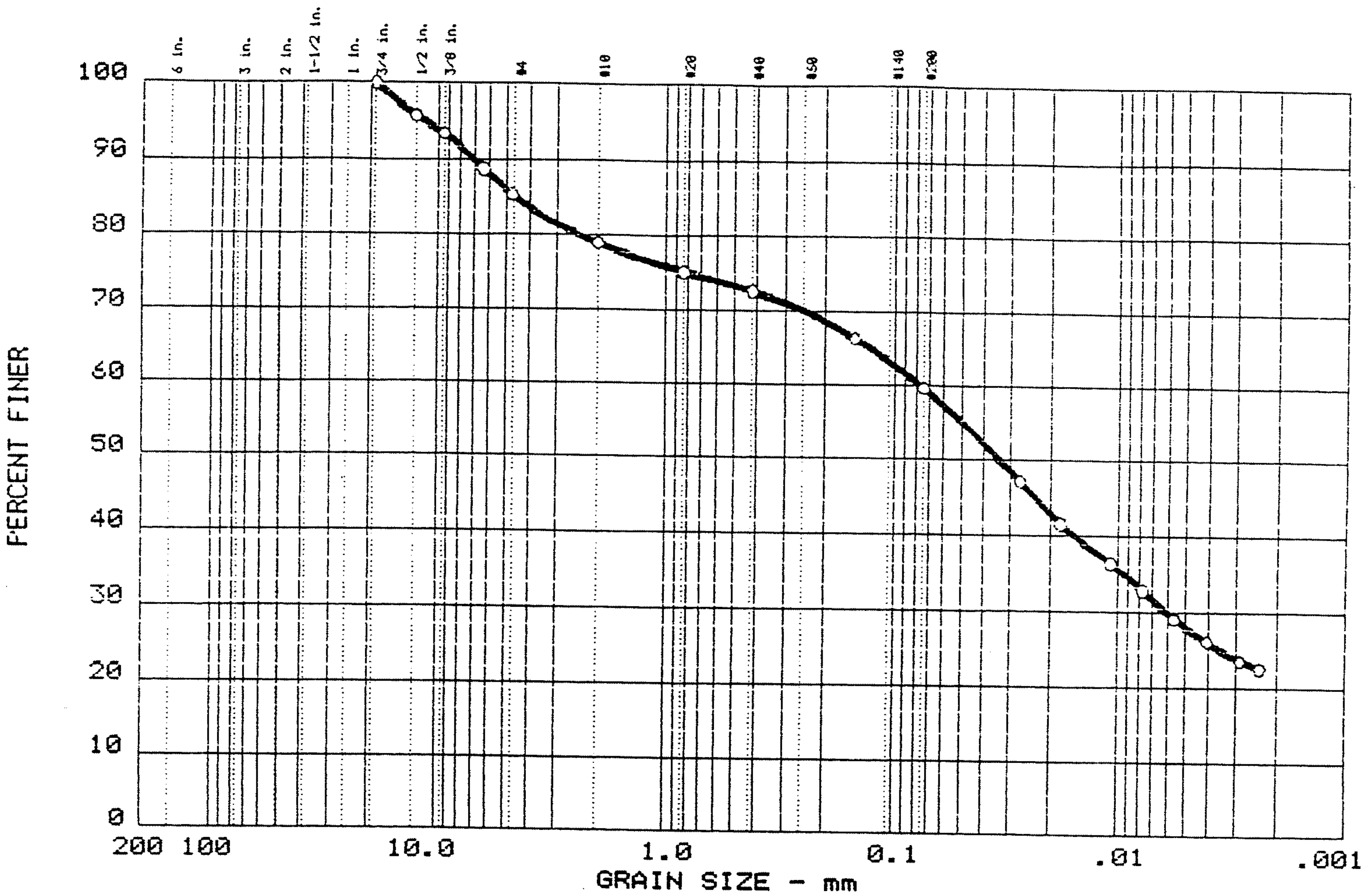
sll

GRATWICK RIVERSIDE PARK
SUMMARY OF TEST RESULTS

Sample ID	Moisture Content (Percent)	Atterberg Limits			Mechanical Analysis
		Liquid Limit	Plastic Limit	Plasticity Limit	
GRP-GW1-SB, 8'-10'	27.8	51	25	26	Note 1
GRP-GW1-SB, 10'-12'	30.8				
GRP-GW1-SB, 12'-14'	40.1				
GRP-GW1-SB, 14'-16	40.5				
GRP-GW1-SB, 20'-22'	35.1	45	23	22	Note 1
GRP-GW1-SB, 28'-30'	7.3				
GWP-GW1-SB, 30'-32'	5.6				Note 1
GRP-GW1-SB, 36'-36.9'	8.0				
GRP-GW-2-SB, 8'-10'	25.5				Note 1
GRP-GW-2-SB, 12'-14'	33.7				
GRP-GW-2-SB, 16'-16.8'	6.0				
GRP-GW-2-SB, 24'-26'	8.0	20	12	8	Note 1
GRP-GW-2-SB, 30'-31.7'	8.6	14	11	3	

Note #1: Mechanical Analysis with Hydrometer data is presented on the attached grain size distribution test and reports.

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	12	0.0	14.7	25.7	31.7	27.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	20	8	4.62	0.08	0.03	0.006				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME CLAY SOME SAND LITTLE GRAVEL	ML	

Project No.: BT-87-234

Project: GRATWICK RIVERSIDE PARK

○ Location: GRP-GW-2-SB, 24'-26' (S-15)

Date: 12-14-87

Remarks:

SAMPLE DELIVERED

11-16-87

MOISTURE CONTENT

AS REC'D = 8.0 %

REPORT NO: L-1E

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 05

EMPIRE
SOILS INVESTIGATIONS INC.

PROJECT: Gratwick - Riverside Park

CLIENT: URS Corporation

DATE: February 17, 1988

PROJECT NO: BT-87-234

REPORT NO: L-2

This report presents the results of laboratory testing performed on twenty (20) separate soil samples from the above referenced project.

The samples were delivered to our laboratory in Hamburg, New York on November 25, 1987.

Sample identification and tests requested were specified by chain of custody record attached as part of this report.

It was indicated on the chain of custody record that all samples were collected from on-site borings and should be considered as contaminated. All remaining samples not consumed in the testing process as well as any wastes produced as a result of testing procedures have been contained and will be returned to the Gratwick Park site at the completion of testing.

Shelby Tube Samples submitted for Permeability Analysis are presently being held at our laboratory in Groton, New York until results of chemical analysis are provided to us. Chemical test results are required to allow the proper protocol to be used in handling the samples so contamination of our apparatus will not occur.

It should be noted that sample #GW-8, S-12 did not contain enough material to properly perform the required Grain Size analysis testing, therefore, as discussed with Mr. Guenther Funk, representing URS Company, Inc., Sample #GW-8,S-10B was substituted.

EMPIRE SOILS INVESTIGATIONS INC.

A summary of test results is presented in the attached Table #1 with additional detailed data regarding the grain size distribution testing presented on their respective laboratory data reports.

Respectfully submitted,

EMPIRE SOILS INVESTIGATIONS, INC.

Charles C. Keipper

Charles C. Keipper
Testing Services Manager

Stanley J. Blas Jr.

Stanley J. Blas, Jr.
Vice President
Manager - Western District

mjm

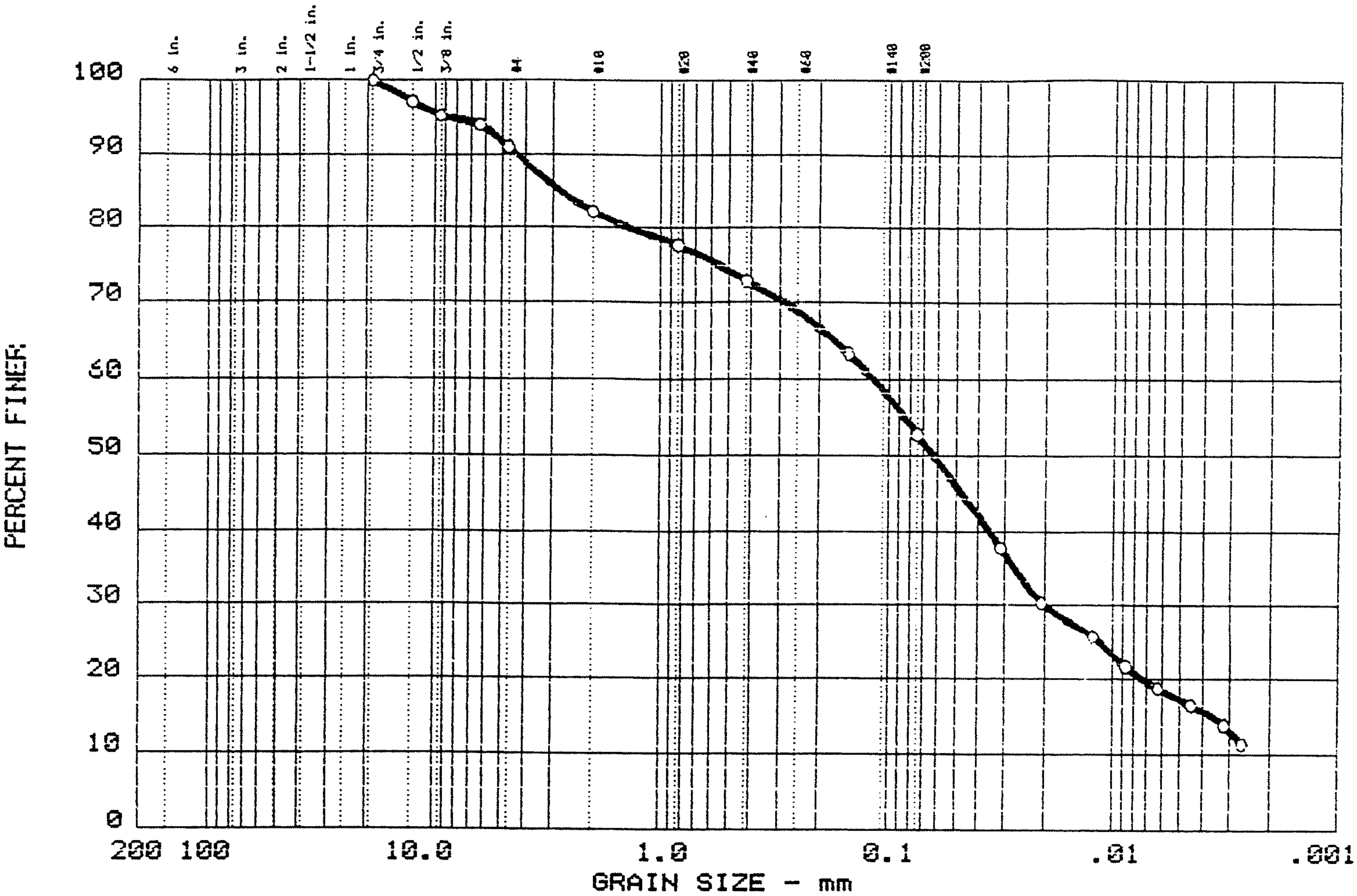
GRATWICK RIVERSIDE PARK
SUMMARY OF TEST RESULTS

Sample ID		Moisture Content (Percent)	Atterberg Limits Liquid Limit	Atterberg Limits Plastic Limit	Plasticity Index	Mechanical Analysis
GRP-GW5-SB, S-5	22' - 24'	18.6				
GRP-GW5-SB, S-6	24' - 26'	8.9	18	15	3	Note 1
GRP-GW5-SB, S-8	28' - 30'	8.2				
GRP-GW5-SB, S-10	32' - 34'	10.8				
GRP-GW5-SB, S-11	34' - 36'	8.7				
GRP-GW5-SB, S-13	38' - 38.4'	8.3	Note 2	Note 2	Note 2	
GRP-GW5-SB, S-15	42' - 43.9'	5.4				Note 1
GRP-GW5-SB, S-16	46' - 46.9'	5.9				
GRP-GW5-SB, S-17	48' - 49.2'	8.1	23	15	8	
GRP-GW5-SB, S-19	54' - 54.8'	11.9				Note 1
GRP-GW6-SB, S-14	22' - 24'	8.2	NP	NP	NP	Note 1
GRP-GW6-SB, S-15	24' - 26'	10.4				
GRP-GW6-SB, S-17	28' - 30'	18.4	NP	NP	NP	
GRP-GW6-SB, S-19	32' - 32.9'	29.7				Note 1
GRP-GW7-SB, S-7	12' - 14'	41.2	45	26	19	
GRP-GW7-SB, S-8	14' - 16'	40.4				
GRP-GW7-SB, S-10	18' - 20'	38.7				Note 1
GRP-GW8-SB, S-9	16' - 18'	18.5	NP	NP	NP	
GRP-GW8-SB, S-10B	18' - 20'	37.1				Note 1
GRP-GW8-SB, S-12	24' - 26'	9.2				Note 2

Note 1: Mechanical Analysis with hydrometer data is presented on the attached grain size distribution test reports.
Note 2: Insufficient sample provided to perform test
NP = Non-Plastic
Testing Methods Employed:

1) Moisture Content ASTM D-2216
2) Atterberg Limits ASTM D-4318
3) Mechanical Analysis ASTM D-422

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	9.1	38.1	35.6	17.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	3	2.79	0.12	0.06	0.020	0.0035			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILTY SAND LITTLE CLAY TRACE GRAVEL	ML	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW5-SB, S-6, 24.0' - 26.0'

Date: 02/05/88

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 8.9%

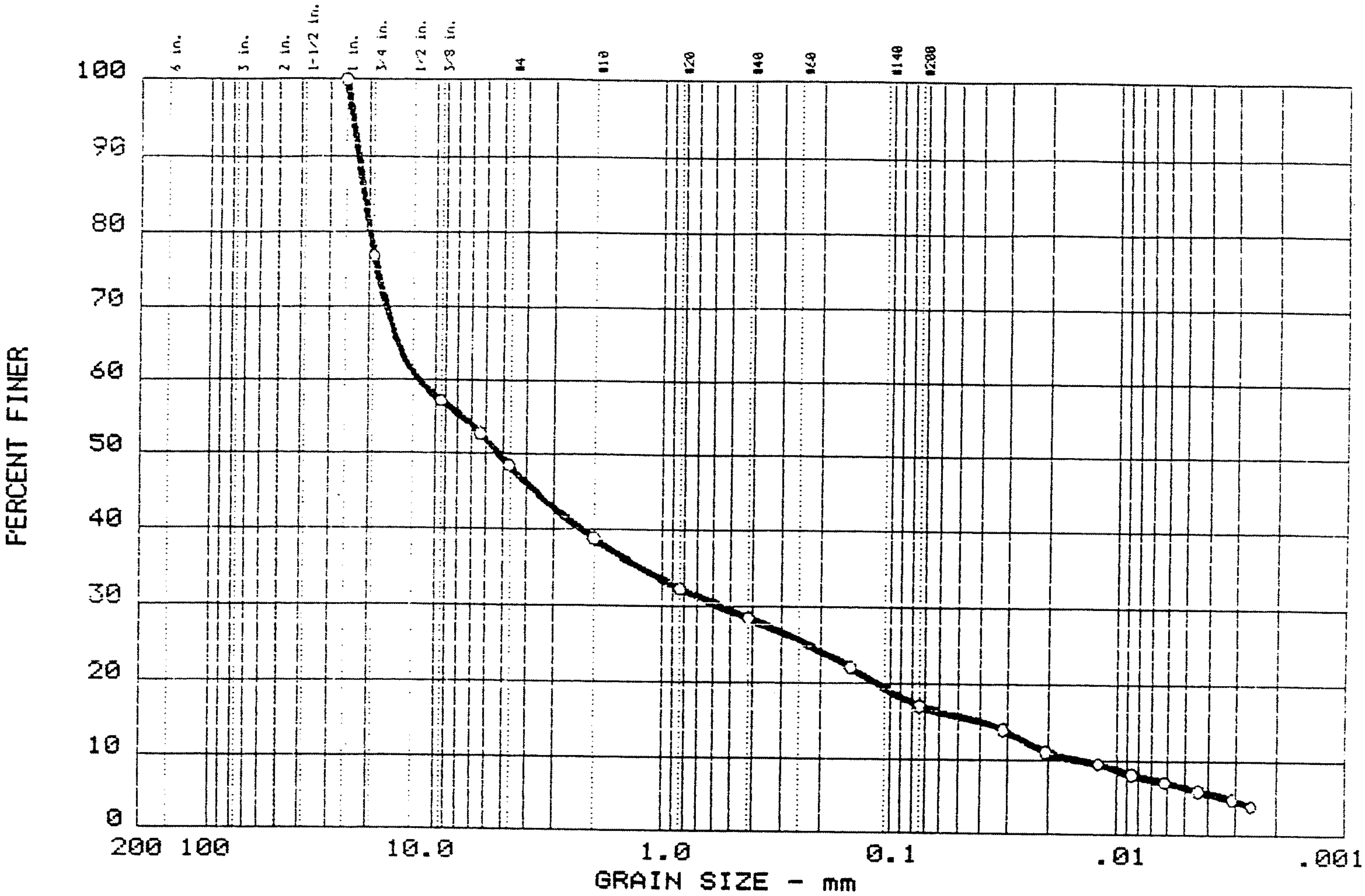
GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

REPORT NO: L-2A

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	2	0.0	51.6	31.3	10.7	6.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	N/A	N/A	21.28	11.97	5.22	0.560	0.0387	0.0142	1.84	841.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE SILT TRACE CLAY	GM	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW5-SB, S-15, 42.0' - 43.9'

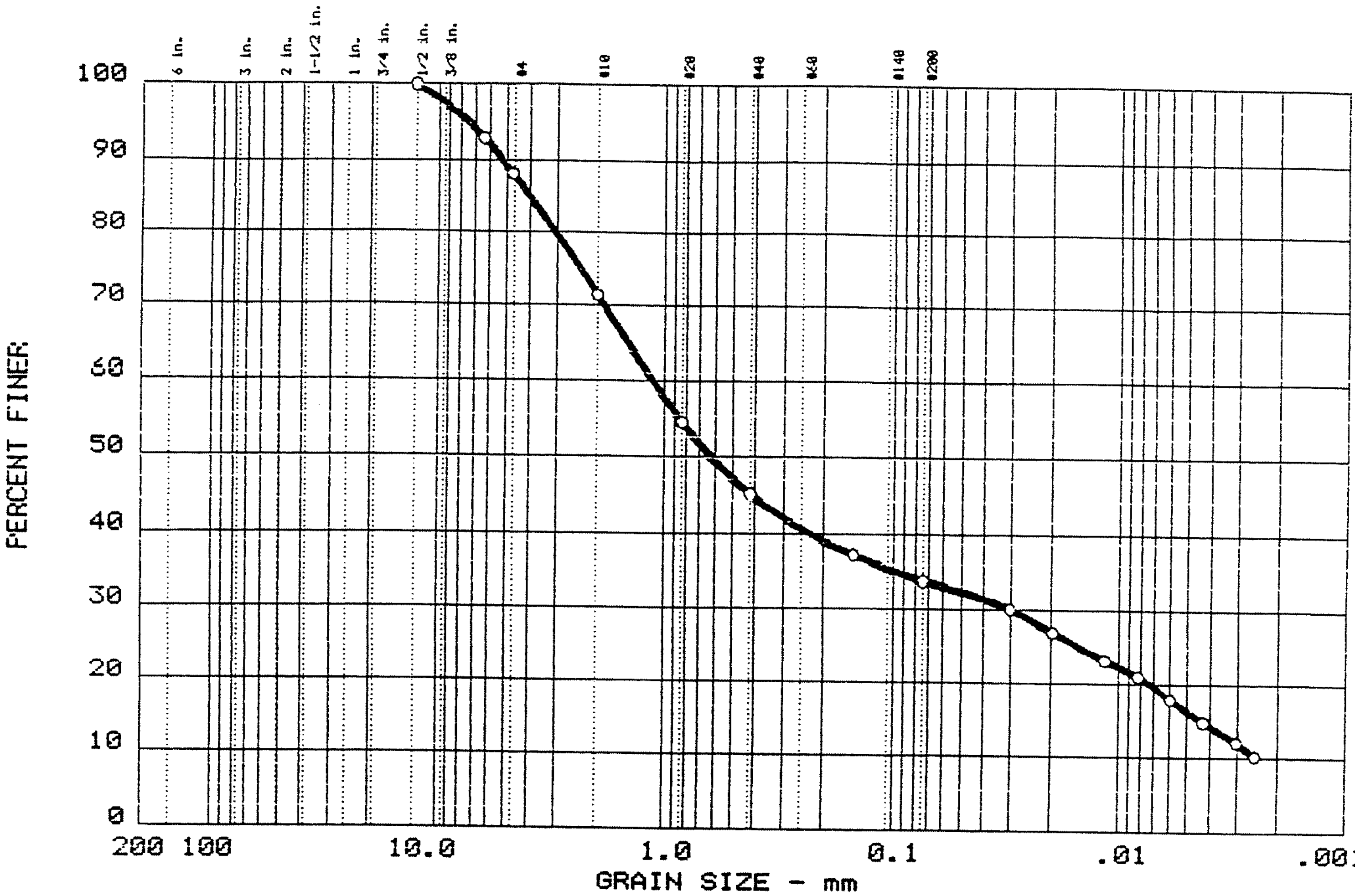
Date: 02/05/88

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 5.4 %

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

REPORT NO: L-2B
Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	11.9	54.4	17.6	16.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	N/A	N/A	3.98	1.12	0.62	0.030	0.0044			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND LITTLE SILT LITTLE CLAY LITTLE GRAVEL	SM	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW5-SB, S-19, 54.0' - 54.8'

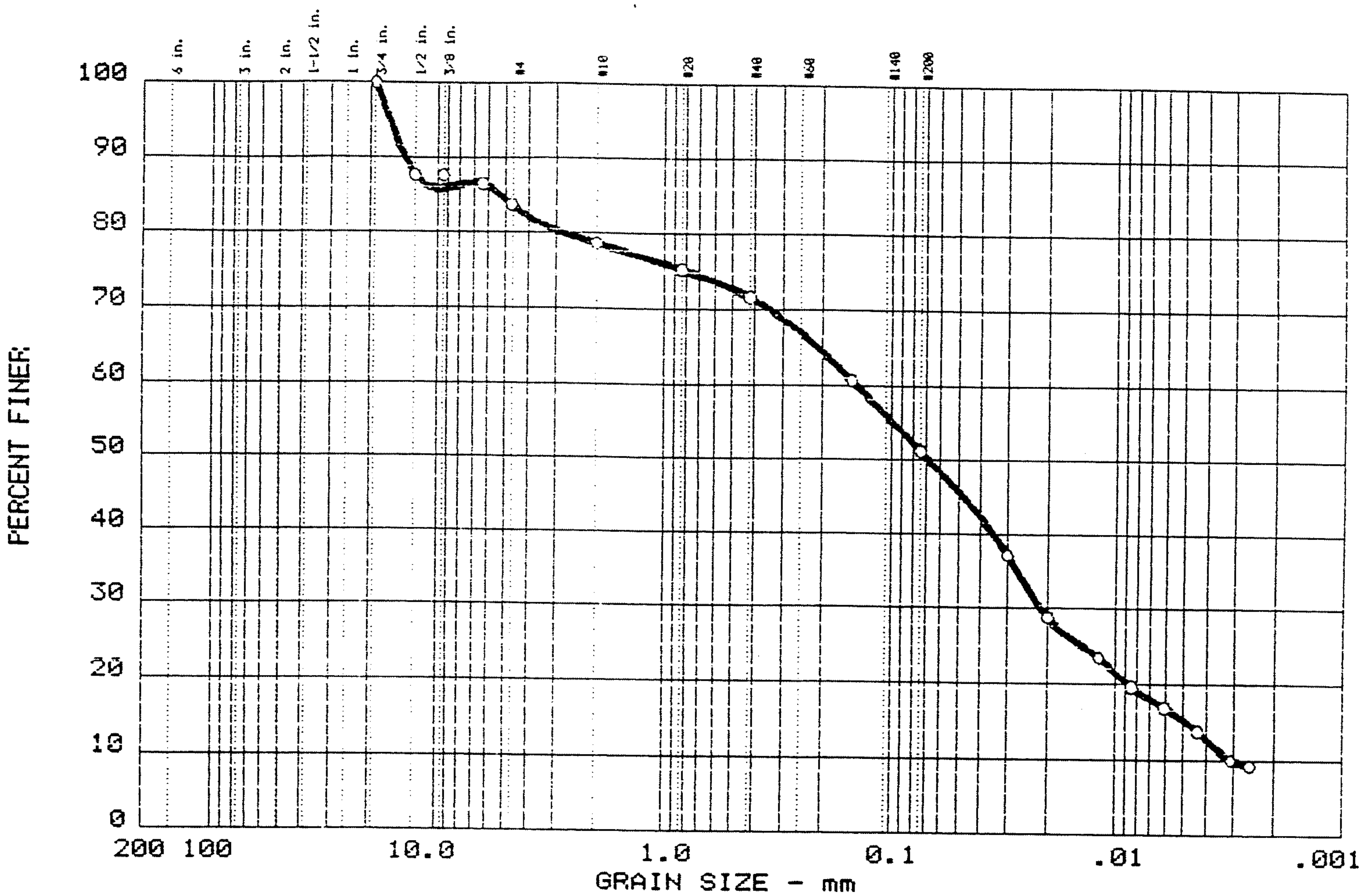
Date: 02/05/88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 11.9 %
REPORT NO: L-2C

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	16.3	32.5	36.0	15.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	5.31	0.14	0.07	0.022	0.0048	0.0031	1.08	46.2

MATERIAL DESCRIPTION	USCS	AASHTO
○ SANDY SILT LITTLE GRAVEL LITTLE CLAY	ML	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW6-SB, S-14, 22.0' - 24.0'

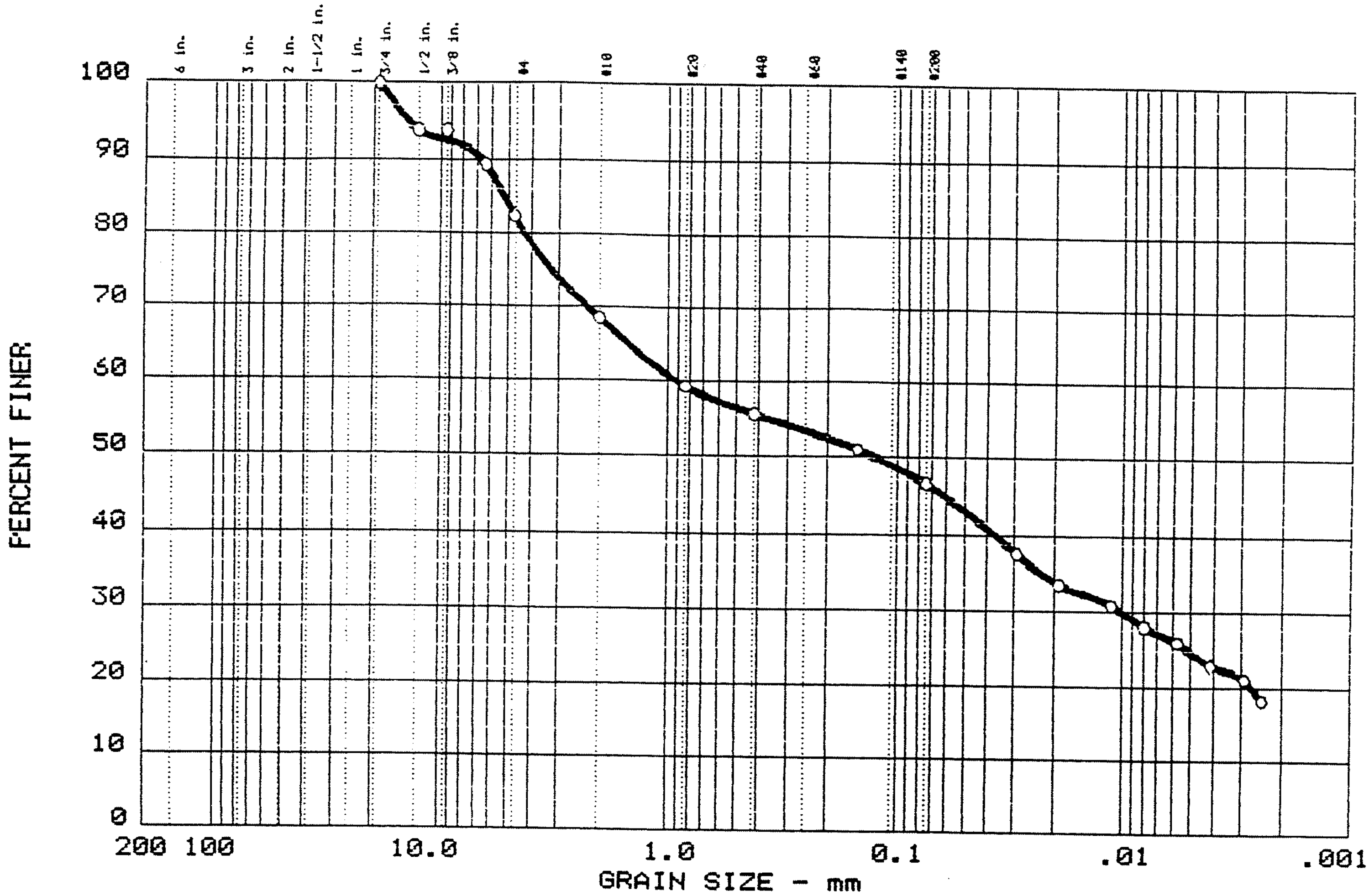
Date: 02/05/88

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 8.2 %
REPORT NO: L-2D

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	17.6	35.9	22.0	24.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	N/A	N/A	5.25	0.91	0.12	0.010				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME CLAY SOME SILT LITTLE GRAVEL	SM	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW6-SB, S-19, 32.0' - 32.9'

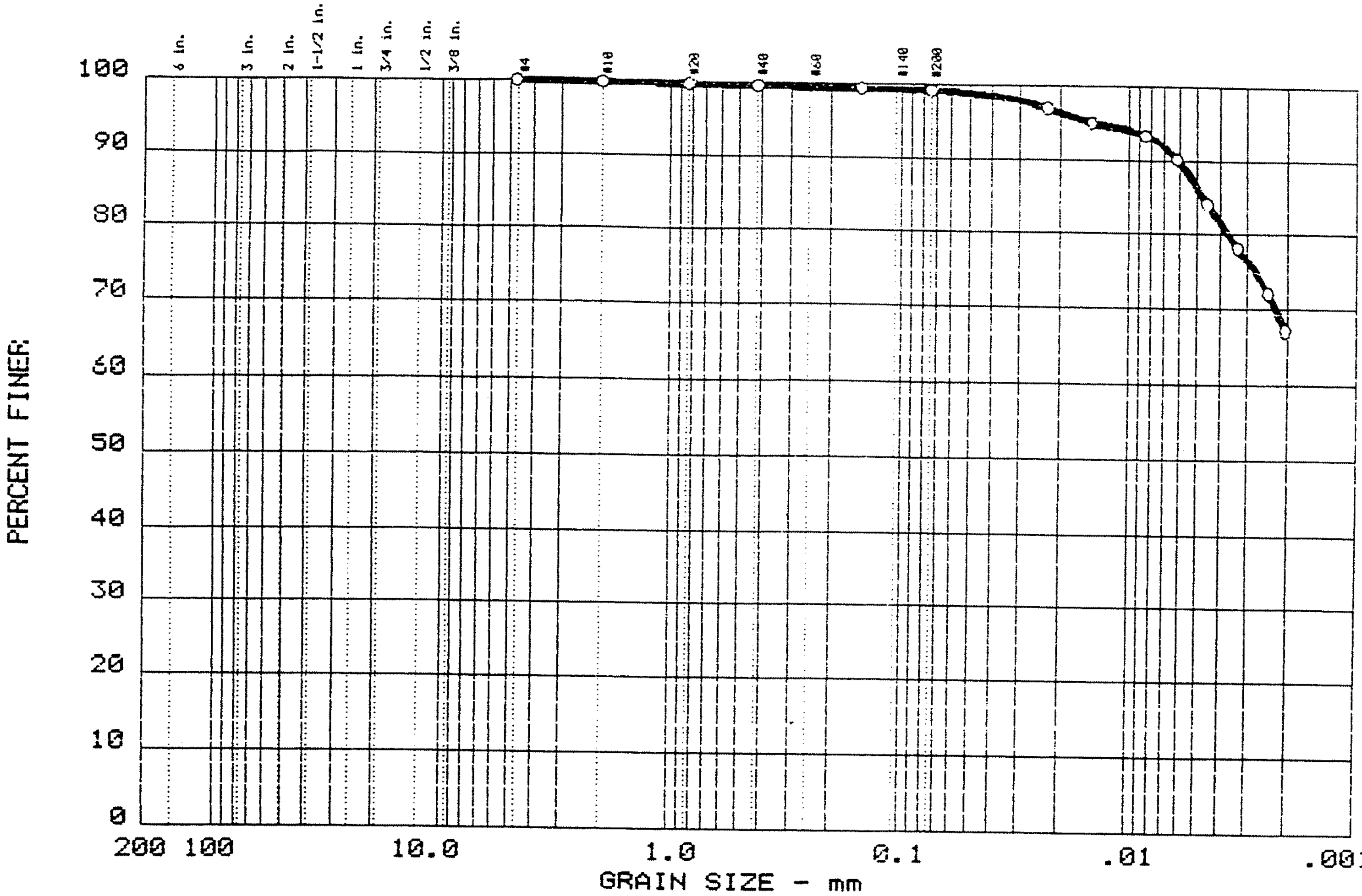
Date: 02/05/88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 29.7 %
REPORT NO: L-2E

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	0.0	0.8	13.1	86.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	N/A	N/A								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	ML	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW7-SB, S-10, 18.0'-20.0'

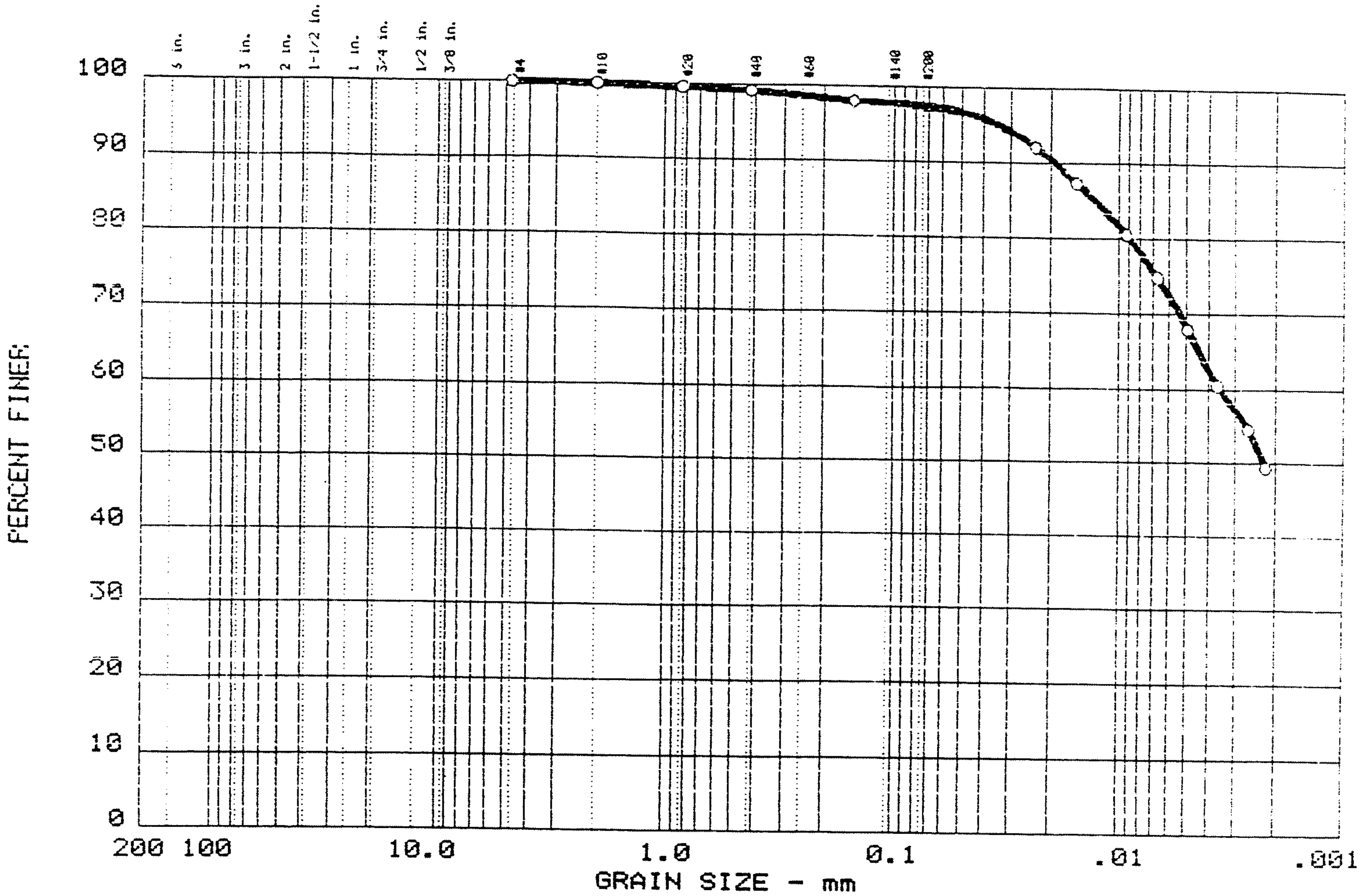
Date: 02/05/88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 38.7 %
REPORT NO: L-2F

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	0.0	2.5	29.3	68.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	N/A	N/A			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	ML	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW8-SB, S-10, 18.0' - 20.0'

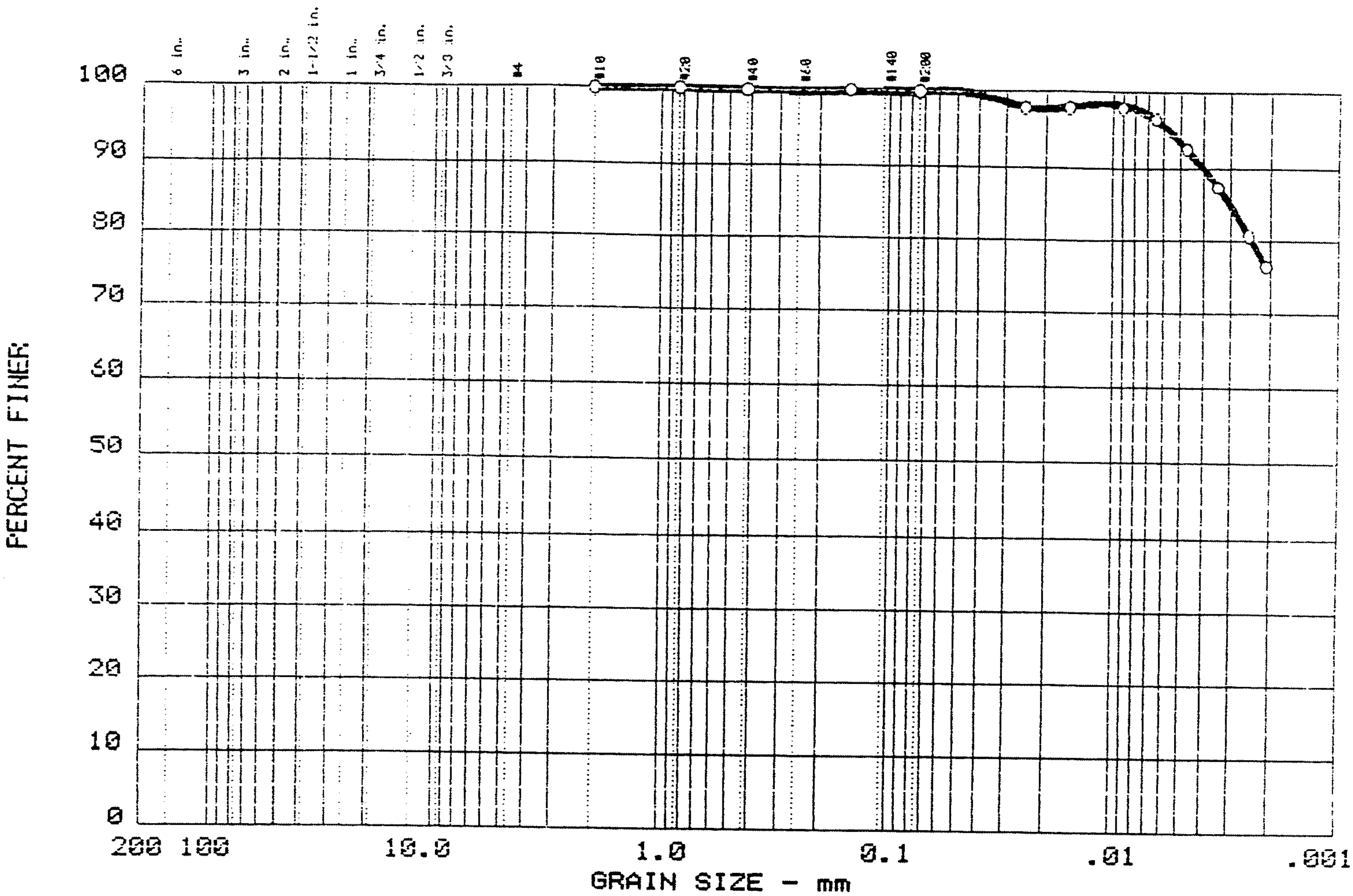
Date: 02/05/88

Remarks:
JAR SAMPLE
DELIVERED 11/25/87
NATURAL WATER
CONTENT = 37.1
REPORT NO: L-2G

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	0.0	0.2	6.4	93.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	51	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY TRACE SILT TRACE SAND	CH	

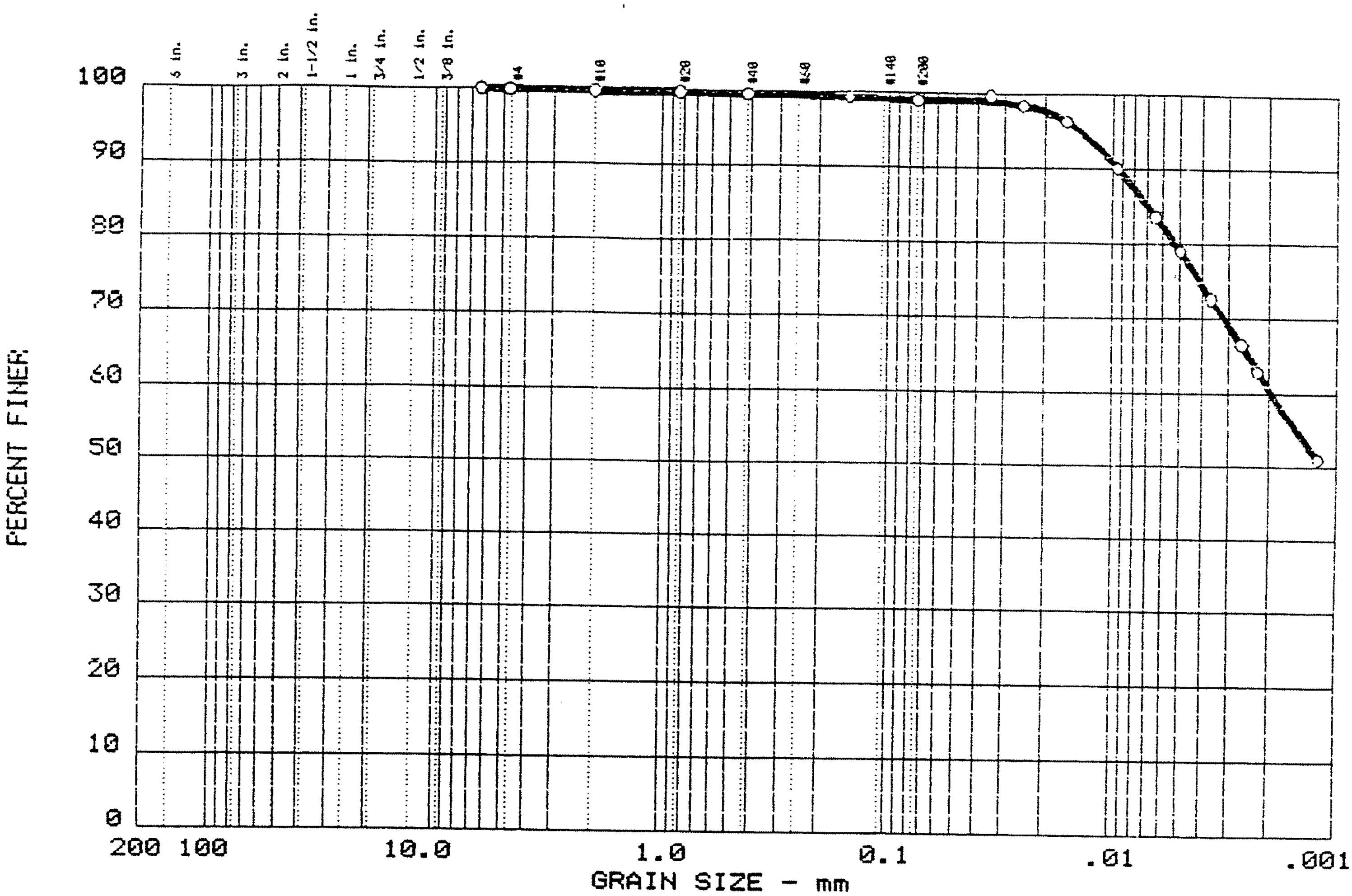
Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW1-SB 8'-10' (S-6)

Date: 12-14-87

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
SAMPLE DELIVERED
11-16-87
MOISTURE CONTENT
AS REC'D = 27.8 %
REPORT NO: L-1A
Fig. No. 01

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	0.1	0.9	20.0	79.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	45	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE GRAVEL	CL	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW1-SB 20'-22' (S-12)

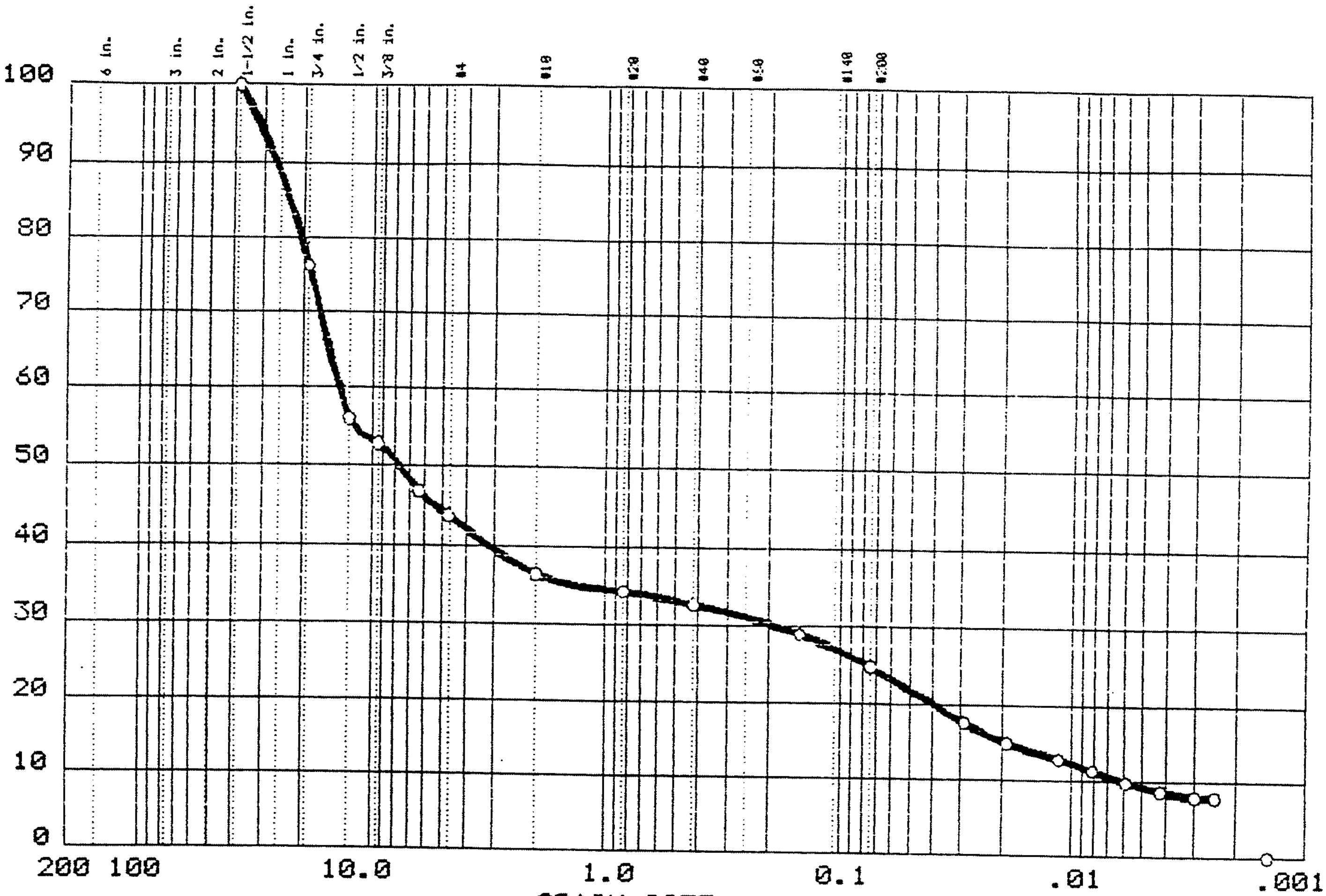
Date: 12-14-87

Remarks:
SAMPLE DELIVERED
11-16-87
MOISTURE CONTENT
AS REC'D = 35.1 %
REPORT NO: L-1B

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 01

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
10	0.0	56.3	18.9	15.6	9.2

LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
NA	NA	23.07	14.14	7.68	0.186	0.0193	0.0061	0.40	2317.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL LITTLE SAND LITTLE SILT TRACE CLAY	GM	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW-1-SB, 30'-32' (S-17)

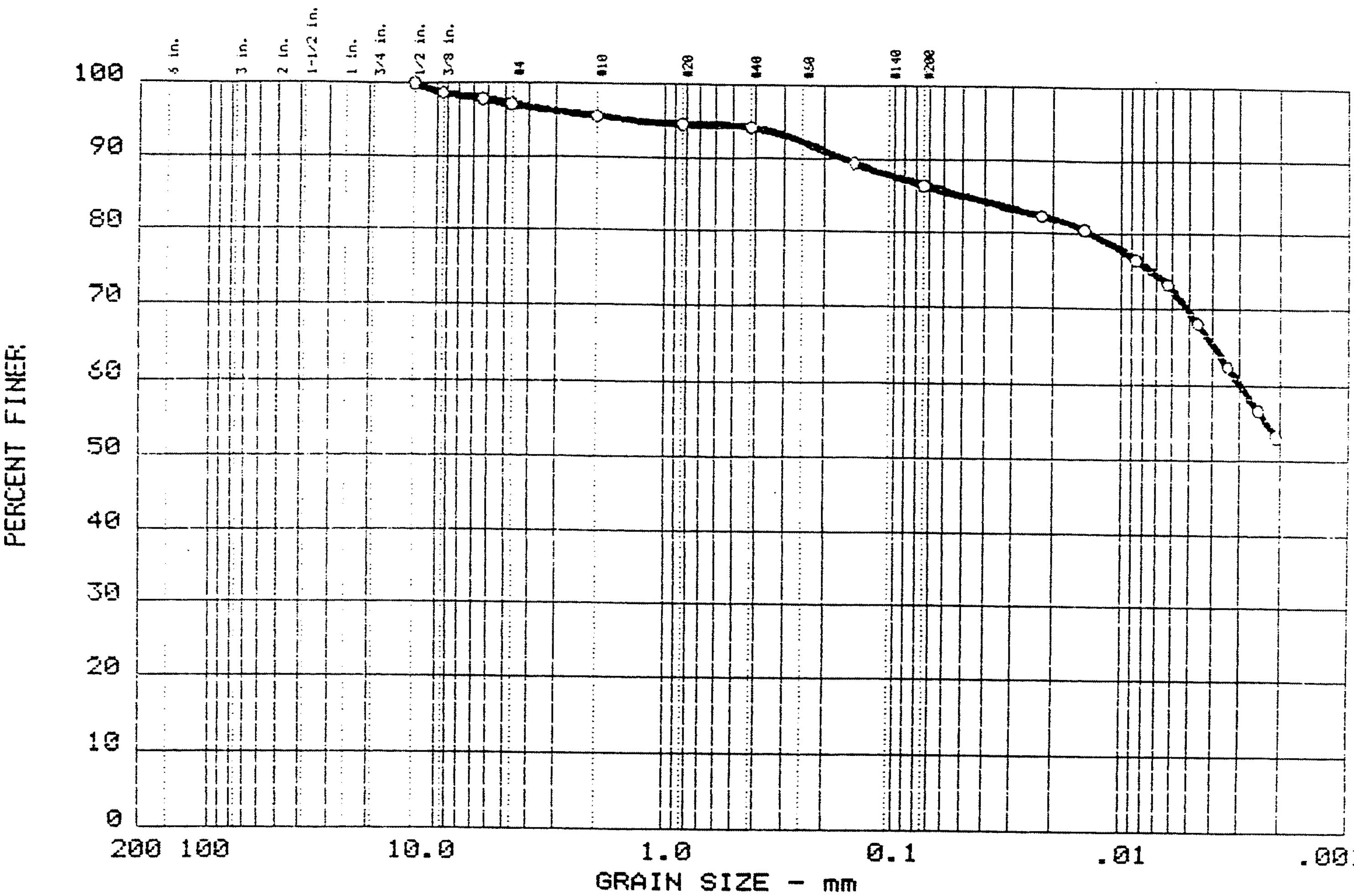
Date: 12-14-87

Remarks:
SAMPLE DELIVERED
11-16-87
MOISTURE CONTENT
AS REC'D = 5.6 %
REPORT NO: L-1C

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 03

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	2.8	10.8	16.9	69.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT LITTLE SAND TRACE GRAVEL	CL	

Project No.: BT-87-234
Project: GRATWICK RIVERSIDE PARK
○ Location: GRP-GW-2-SB, 8'-10' (S-5)

Date: 12-14-87

Remarks:
SAMPLE DELIVERED
11-16-87
MOISTURE CONTENT
AS REC'D = 25.5 %
REPORT NO: L-1D

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 04

URS Company, Inc.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 37149

SITE NAME: GRATWICK - RIVERSIDE PARK

SAMPLERS (SIGNATURE): [illegible] Menoth

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS	3" SHELBY TUBE	2" SHELBY TUBE	[illegible]			REMARKS
												ANALYSES
	11-2? 87				GRP-GWB(I)-SB-20-22'	1	1					TRIAXIAL PERM, VERT AND HORIZ (CALL FOR INSTRUCTIONS)
	11-16 87				GRP-GW6-SB-26-26.7'	1		1				VERT. PERM ONLY.
	11-30 87			S-5	GRP-GW5-SB-22-24'	1			1			MOISTURE CONTENT
				S-6	-24-26	3			3			MOISTURE ~~GRAINSIZE, ATTERBERG~~
				S-8	-28-30	1			1			MOISTURE
				S-10	-32-34'	1			1			
				S-11	-34-36'	1			1			
				S-13	-38-38.4'	2			2			MOISTURE, ~~ATTERBERG~~
				S-15	-42-43.9'	2			2			MOISTURE, ~~GRAIN SIZE~~
				S-16	-46-46.9'	1			1			MOISTURE,
	11-1 ??			S-17	-48-49.?	2			2			~~MOISTURE, ATTERBERG~~
				S-19	-54-54.8'	2			2			MOISTURE, GRAIN SIZE

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
[illegible] Menoth		[illegible]	Peter Armlovich GW8(G) AND GW6 ONLY	12-1-87 1220	Don Wheeler
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS: ALL [illegible] FROM WHITE [illegible] HANDLE AS [illegible]	

Distribution: Original accompanies shipment; copy to coordinator field files

URS Company, Inc.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 35149	SITE NAME: [illegible]
SAMPLERS (SIGNATURE): [signature]	

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	[illegible]						REMARKS
													ANALYSES
	11-11 87			S4	GRP-GW6-SB-22-24	3	3						[illegible]
				S15	24-26	1	1						[illegible]
	11-12 87			S-17	28-30	2	2						[illegible]
				S-19	32-329	2	2						[illegible]
	11-2 87			S-7	GRP-GW7-SB-12-14	1	1						[illegible]
				S-8	14-16	1	1						[illegible]
				S-10	18-20	1	1						[illegible]
	11-20 87			S9	GRP-GW8-SB-16-18	1	1						[illegible]
				~~S-10~~	GRP-GW8-SB-18-20	1	1						[illegible]
	11-[illegible] 87			S-12	GRP-GW8-SB-24-26	1	1						[illegible]

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
[signature]	11-25	[illegible]			
RELINQUISHED BY (SIGNATURE):	**DATE/TIME:**	**RECEIVED BY (SIGNATURE):**	**RELINQUISHED BY (SIGNATURE):**	**DATE/TIME:**	**RECEIVED BY (SIGNATURE):**
RELINQUISHED BY (SIGNATURE):	**DATE/TIME:**	**RECEIVED FOR LABORATORY BY (SIGNATURE):**	**DATE/TIME:**	**REMARKS:** [illegible]	

Distribution: Original accompanies shipment; copy to coordinator field files.

EMPIRE
SOILS INVESTIGATIONS INC.

PROJECT: Gratwick- Riverside Park

CLIENT: URS Corporation

DATE: December 7, 1988

PROJECT NO: BT-87-234

REPORT NO: L-3

REPORT OF MATERIAL TESTING

Material: A total of four (4) separate undisturbed, Shelby Tube, samples from the above referenced project delivered to our laboratory in Hamburg, New York in December of 1987. This work was requested by Mr. Guenther Funk, representing the URS Company. It should be noted that the samples could not be tested expediently due to the possibility of contamination. Testing was begun as soon as a suitable facility was developed.

The samples were identified only as follows.

#1 - GW4-SB-16'-18'
#2 - GW4-SB-18'-20'
#3 - GW8I-SB-20'-22'
#4 - GW6-SB-26'-26.9'

Constant Head Triaxial Permeability - Note #1.

Sample#	Permeability
1	2.99×10^{-8} cm/sec @ 4.9 psi. 3.23×10^{-8} cm/sec @ 9.7 psi.
2	Note #2
3	4.10×10^{-8} cm/sec @ 4.5 psi. 4.12×10^{-8} cm/sec @ 10.6 psi.
4	Note #2

EMPIRE
SOILS INVESTIGATIONS INC.

Note #1: For details regarding these tests, please see the attached laboratory data reports.

Note #2: Sample not tested as per Clients direction. All samples tested or not tested will be returned to the URS Company for their disposal.

If you have any further questions, please feel free to contact our office.

Respectfully submitted,

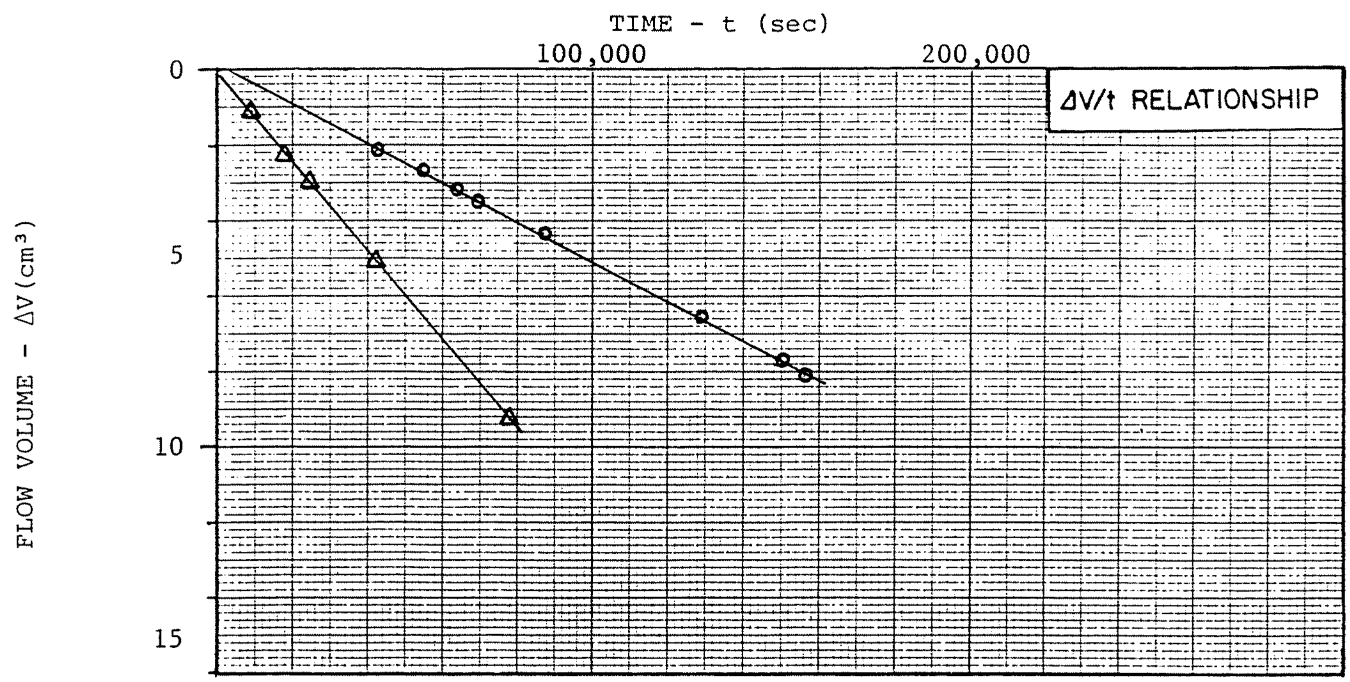
EMPIRE SOILS INVESTIGATIONS, INC.

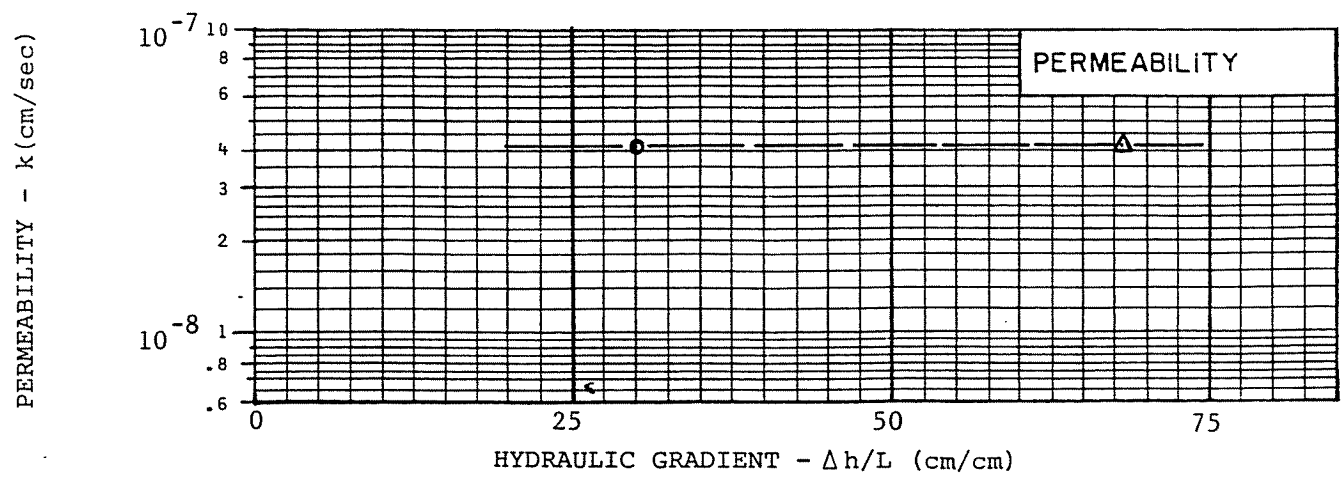
Charles C. Keipper
Manager Testing Services

Edward J. Barbiero
Civil/Materials Engineer

sll

TEST DATA:			SAMPLE DATA:
Specimen Height (cm):		11.21	Sample Identification: GW8(I)-SB
Specimen Diameter (cm):		7.33	20.0' - 22.0'
Dry Unit Weight (pcf):		98.0	Visual Description: Brown Clay, some
Moisture Content Before Test (%):		27.9	sand, trace gravel
Moisture Content After Test (%):		23.6	Remarks:
Cell Confining Pressure (psi):		95.0	
Test Pressure (psi):	84.5	90.6	Maximum Dry Density
Back Pressure (psi):	80.0	80.0	(ASTM D) (pcf):
Differential Head (psi):	4.5	10.6	Optimum Moisture Content (%):
Flow Rate ($\Delta V/t$)(cm^3/sec)	O 5.19×10^{-5}	Δ 1.18×10^{-4}	Percent Compaction:
Permeability (cm/sec):	O 4.10×10^{-8}	Δ 4.12×10^{-8}	Permeameter Type: Flexible wall





EMPIRE SOILS INVESTIGATIONS INC.

PERMEABILITY TEST REPORT

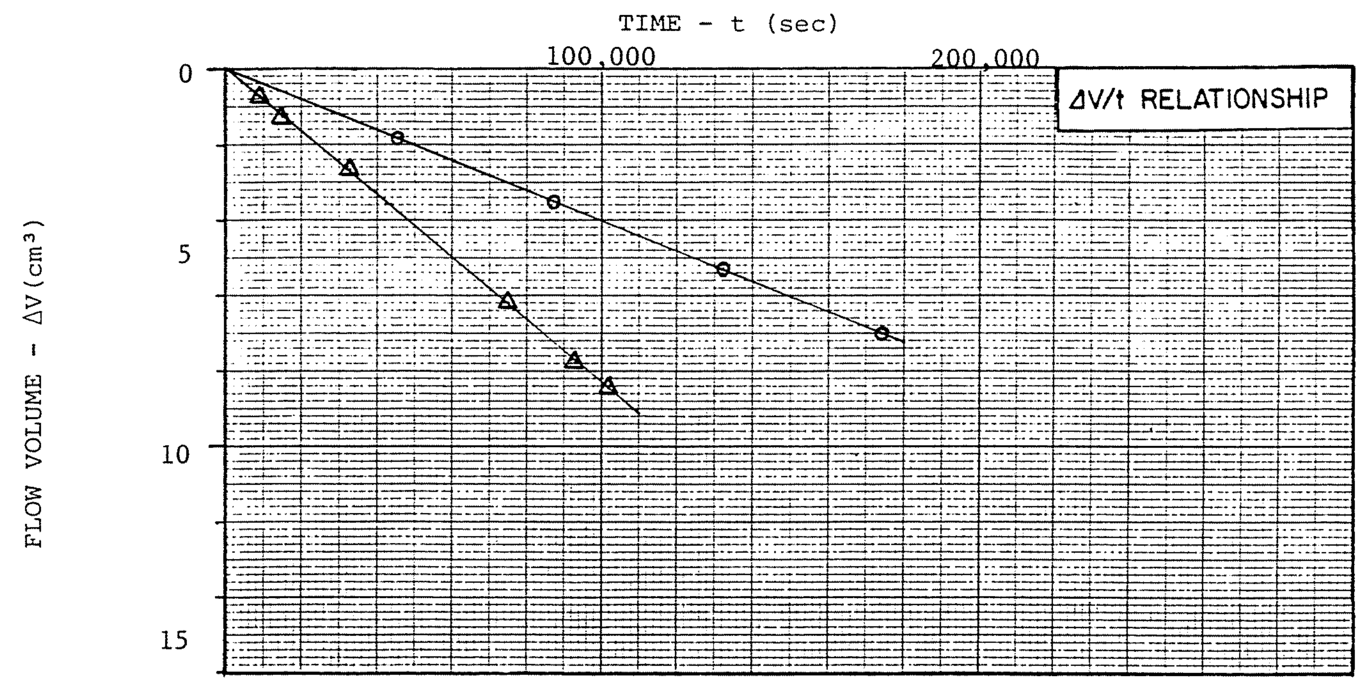
Gratwick Riverside Park
Niagara Falls, New York

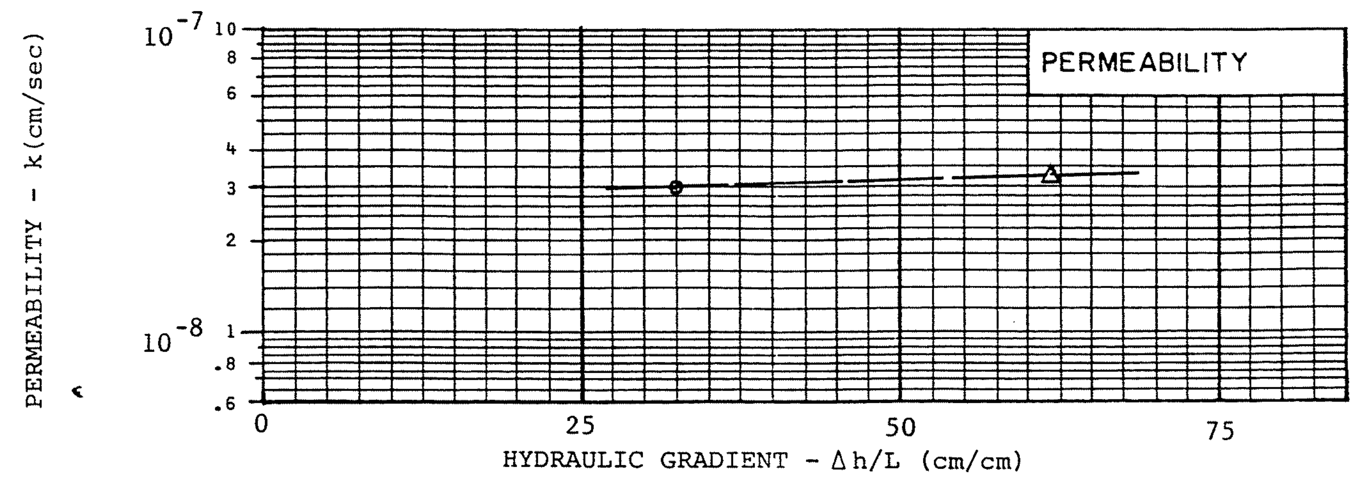
REPORT NO: L-3A

DR BY: JFC	CK'D. JFC	DATE: Sept. 1988	PROJ.NO. BT-87-234

JFC

TEST DATA:			SAMPLE DATA:
Specimen Height (cm):		11.32	Sample Identification: GW4-SB
Specimen Diameter (cm):		7.29	16.0' - 18.0'
Dry Unit Weight (pcf):		84.0	Visual Description: Brownish-red clay,
Moisture Content Before Test (%):		37.2	trace silt & gravel, moist, soft
Moisture Content After Test (%):		33.6	Remarks:
Cell Confining Pressure (psi):		95.0	
Test Pressure (psi):	85.2	89.7	Maximum Dry Density
Back Pressure (psi):	80.3	80.0	(ASTM D) (pcf):
Differential Head (psi):	4.9	9.7	Optimum Moisture Content (%):
Flow Rate(ΔV/t)(cm³/sec)	○ 4.03×10^{-5}	Δ 8.33×10^{-5}	Percent Compaction:
Permeability (cm/sec):	○ 2.99×10^{-8}	Δ 3.23×10^{-8}	Permeameter Type: Flexible wall





EMPIRE SOILS INVESTIGATIONS INC.

PERMEABILITY TEST REPORT

Gratwick Riverside Park
Niagara Falls, New York

REPORT NO: L-3B

DR BY: JFC	CK'D. JFC	DATE: Sept. 1988	PROJ.NO. BT-87-234

JFC

APPENDIX B.4

BOREHOLE LOGS - PREVIOUS INVESTIGATIONS

B.4.1 INTRODUCTION

Previous drilling and monitoring well installations were performed at the Gratwick-Riverside Park site by Earth Dimensions Inc. and Ecology and Environment, as preliminary investigations leading to the present RI/FS. Additional drilling was performed by Pittsburgh Testing Laboratory to assess the suitability of a small portion of the site for construction. The following section presents brief descriptions of previous programs conducted at the site as well as available subsurface boring logs and monitoring well construction information.

B.4.2 RECRA RESEARCH, INC. MONITORING WELL INSTALLATION PROGRAM

Five wells were installed in June 1979 for RECRA Research, Inc. by Earth Dimensions, Inc. and Ecology and Environment (E&E) as part of a City of North Tonawanda program to ascertain the impact of a number of sites on local groundwater quality. Four of the five borehole logs prepared by Earth Dimensions, Inc. are presented in this Appendix; well completion details are summarized below. No information was available for MW-14 which was installed by E&E. Wells were completed using 2-inch ID carbon steel casing and 2-inch Johnson well screen (0.02 slot size).

	ELEVATION (ft)		DEPTH (ft)	
Well #	Top of Casing	Ground Surface	Screened Interval	Sand Pack
10	576.37	572.70	10-12	9.0-14.0
11	575.49	571.90	17.5-19.5	15.5-21.0
12	574.84	572.40	17.0-19.0	16.0-20.0
13	575.62	573.80	14.0-16.0	12.0-17.8
14	577.72	575.50	No information available	

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

WELL NO. 10 SURF. ELEV. ______

79 PROJECT Monitoring well installation City of North Tonawanda LOCATION 200 ft. SW of River Rd., approximately 1000 ft. SE of Whitmer Rd.

CLIENT Recra Research, Inc. DATE STARTED 6/1/79 COMPLETED 6/1/79

DEPTH (Feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	1 DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	2	2	3	3		Moist black silt loam (CLAYEY-SILT) fill, slightly plastic 1.5	2 in. carbon steel pipe; Bentonite	Soil fill to 1.5 ft. over mostly slag fill to 10.5 ft. over original soil consisting of a thin mantle of sand over clayey lake sediments.
	2	6	3	2	2				
	3	2	4	7	12		Moist mixed black (SANDY-SILT), fill with chunks of wood, slag fragments becoming alternating layers of mostly slag, below six feet, slag is loose.		Moderate odors noted in samples #3 - 6.
5									
	4								Split spoon sampler advanced below 14.0 to 16.0 ft. to secure sample #9.
	5							9.0	
10								10.0	
	6	14	2	2	1		10.5		
	7						Wet black loamy medium size sand (SAND), loose 11.0	Well Screen; Sand pack	
	8						Extremely moist brown SILTY-CLAY, thinly laminated clays, firm becoming soft with depth, plastic, sticky	12.0	
		2	1	2	1				
	9						14.0		
15							Boring completed to 14.0 feet.		Water table six ft. below surface at completion.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

Well NO. ~~11~~ SURF. ELEV. ______

:79 PROJECT ~~Monitoring well installation~~
~~City of North Tonawanda~~

LOCATION ~~80 ft. East northeast of storm~~ sewer ~~outlet at southern end of park.~~

CLIENT ~~Recra Research, Inc.~~

DATE STARTED ~~6/1/79~~ COMPLETED 6/4/79

DEPTH (Feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	2	3	3	2		Moist black cinders, silt size, very friable	2 inch carbon steel pipe; Bentonite seal	Strong odors noted in samples #2-5, moderate odors in samples #6-9.
	2	2	2	2	2		4.0		
5	3	2	4	5	2		Moist partially decomposed paper 5.5		
	4	2	12				Wet black highly decomposed organic material, soft 7.0		Sample #4 crosses abrupt boundary.
10	5	6	21	23	5		Wet gray and dark gray slag, angular size gravel, partially cemented in place		Cinder, partially decomposed paper and other organic debris and partially cemented sla to 18.5 ft. over clayey lake sediments.
	6	3	4	3	4				
	7	5	5	10	10				
15	8	5	6	8	9			Sand pack	15.5
		4	3	2	2				17.5

W N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist

SHEET 1 OF 2

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

Well NO. 11, continued SURF. ELEV. ______

:79 PROJECT Monitoring well installation City of North Tonawanda

LOCATION 80 ft. East northeast of storm sewer outlet at southern end of park.

CLIENT Recra Research, Inc.

DATE STARTED 6/1/79 COMPLETED 6/4/79

DEPTH (Feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
									17.5
	9						Partially cemented slag 18.5	Well Screen; Sand pack	
20		1/18			1		Wet grayish pink SILTY-CLAY, thinly laminated clays, soft, plastic, sticky		19.5
	10						21.0		
							Boring completed at 21.0 feet.		Sample #9 crosses abrupt boundary. A one inch thick wet black very fine sandy loam (SILTY-SAND) lens rested on top of the SILTY-CLAY.
25									2 foot stickup
									Water table 6 ft. below surface at completion.

:W N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist SHEET 2 OF 2

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

Well NO. 12 SURF. ELEV. ____

279

PROJECT: Monitoring well installation City of North Tonawanda

LOCATION: 400 ft. NW of Well #11, 290 ft. of Niagara River.

CLIENT: Recra Research, Inc.

DATE STARTED: 6/5/79 COMPLETED: 6/5/79

DEPTH (Feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N
	1	3	2	3	1	
	2	3	4	3	1	
	3	4	3	3	3	
5						
	4	50/3"				
	5	50/3"				
10						
	6	40	10	4	6	
	7	12	8	9	10	
		6	6	7	2	
15						
	8					
	9	3	4	2	2	

DESCRIPTION & CLASSIFICATION

Moist dark brown and grayish brown CLAYEY-SILT fill, friable, slightly plastic — 2.0

Moist brown and black mixed cinder, household metal garbage, wood fragments — 6.0

Moist cemented gray slag — 10.5

Wet dark gray and black partially cemented slag — 15.5

Wet dark gray loamy fine sand (SAND), loose

WELL

2 inch carbon steel pipe

Bentonite

16.0

Sand

WATER TABLE & REMARKS

Slight odor from samples #3-6, moderate odor fr samples #7-9.

Mixed fill to 6.0 ft. over cemented slag to 10.5 ft. over partially cemented slag to 15.5 ft. over water sorted sands to 18.5 ft. over clayey lake sediment.

Sample #8 crosses abrupt boundary.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist

SHEET 1 OF 2

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

Well NO. ~~12, continued~~ SURF. ELEV. ______

:79 PROJECT ~~Monitoring well installation~~
~~City of North Tonawanda~~

LOCATION ~~400 ft. NW of Well #11, 290 ft. of Niagara River.~~

CLIENT ~~Recra Research, Inc.~~

DATE STARTED 6/5/79 COMPLETED 6/5/79

DEPTH (Feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
		1	18		1		Wet SAND, continued 18.5	Well Screen / Sand pack	Water table 6.5 ft. below surface
20	10						Wet grayish pink SILTY-CLAY, finely laminated clays, soft, sticky 20.0		
									Sample #10 may have been contaminated from above through the sampling method.
									Split spoon was overdriven below 20 ft. to secure sample #10 of the soft SILTY-CLAY.
									Well stick-up was 3 ft. above surface.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist

SHEET 2 OF 2

EARTH DIMENSIONS, INC.
Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

Well NO. 13

SURF. ELEV. ______

E79

PROJECT Monitoring well installation City of North Tonawanda

LOCATION Gratwick - Riverside Park 150 ft. northwest of flagpole

CLIENT Becra Research, Inc.

DATE STARTED 6/5/79 COMPLETED 6/5/79

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	4	3	3	5		Moist dark brown (CLAYEY-SILT) fill, friable 2.0	2 inch carbon steel pipe; Bentonite	Samples #2-4 & 7 had a moderate odor, samples #5 & 6 had strong odors.
	2	7	6	4	3		Moist black cinders, with household metal garbage		Soil fill to 2.0 ft. over mixed fill to 8.0 ft. over partially cemented slag to 15.0 ft. over very dense loamy glacial till.
5	3	5	6	6	5				
	4	5	6	6	5		8.0		
	5	7	9	11	12		Wet partially cemented dark gray and black slag		
10	6	14	13	14	16				12.0
	7	4	10	40	37				14.0
		4	10	40	37		15.0		
15	8						Moist reddish brown loam (SAND-SILT-CLAY) with 10-15% subangular dolomitic gravel, extremely firm, massive soil structure	Well Screen; Sand pack	16.0
		33	34	42	100				
17.8	9						17.8		

Boring completed at 17.8 feet.

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 6 " WITH 300 lb. WT. FALLING 30 " PER BLOW.

LOGGED BY Donald W. Owens, Soil Scientist

SHEET 1 OF 1

B.4.3 USGS MONITORING WELL INSTALLATION PROGRAM

The USGS installed a monitoring well (USGS-1) in July 1982 as part of a program to evaluate select waste disposal sites located along the Niagara River. Two additional monitoring wells (USGS-SA-5 and SA-5a) were installed in November 1982 to evaluate the regional geology/ hydrogeology/groundwater quality as part of the same program. A description of the borehole logs for two of the wells as presented in the EPA report which summarizes the program (USEPA, 1985), follow. No information is available on the materials used in construction of these wells or on the log for well SA-5a.

Borehole Log USGS-1

Depth (ft)	Description
0 - 4.5	Topsoil, fill, dark
4.5 - 5.5	Debris, pottery tile
5.5 - 9.0	Soil, dark, black, wet
9.0 - 11.5	Gravel, little or no return, bricks
11.5 - 16.0	No return
16.0 - 21.5	Clay, sandy, gravel, wet hard drilling

Borehole Log USGS-SA-5

Depth (ft)	Description
0 - 6.5	Roadfill, rubble
6.5 - 19.0	Clay, pink
19.0 - 24.5	Sand
24.5	Bedrock

B.4.4 PITTSBURGH TESTING LABORATORY BOREHOLES

In September 1984, the Pittsburgh Testing Laboratory, on behalf of a private client, advanced three boreholes in the central portion of the park adjacent to River Road for the purpose of evaluating the area as a location for a proposed restaurant. The borehole logs prepared by Pittsburgh Testing Laboratory are presented in this Appendix. The boreholes were abandoned upon completion.

.407-5 (REV. 12/5/59) From Document 6 1984

PITTSBURGH TESTING LABORATORY

LOG OF BORING

Job No. BF-9827

Client Ronald C. Shiesley, Ransomville, New York
Project Gratwick Park, No. Tonawanda, NY

Location of Boring: As Directed by Others	
Water Level	-9.5'
Time	Completion of Boring
Date	9-13-84

Boring No. 1 Date 9-21-84 Sheet 1 of
Type of Boring H. Stmc Rig B40L #2
Casing used - Size - Drilling mud used -
Boring begun 9-13-84 Boring completed 9-13-84
Ground Elevation Grade referred to ______ Da
Field Party: Doak & Burgard

PENETRATION TESTS

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
							0		
	1	0.0 – 1.5	92	55/6	50/6	42/6	1		Mixed Fill
	2	1.5 – 3.0	130	14/6	105/6	25/6	2–3		Slag
	3	3.0 – 4.5	119	105/6	57/6	62/6	4		
	4	4.5 – 6.0	147	107/6	95/6	52/6	5–6		Traces
							7		Of
	5	6.0 – 7.5	52	35/6	27/6	25/6	8		Cinders
	6	7.5 – 9.0	41	5/6	26/6	15/6	9	-9.1'	(Moist) (Wet)
							10		Wet Loose Grey Brown Medium Silty Sand, Little Gravel
	7	9.0 – 10.5	10	3/6	5/6	5/6	11	-10.6'	Medium Brown Silty Clay
	8	10.5 – 12.0	9	2/6	4/6	5/6	12	-12.0'	Traces of Grey Silt Seams
							13		Boring Terminated
							14		
							15		
							16		
							17		
							18		
							19		
							20		

Engineer ______

PITTSBURGH TESTING LABORATORY

LOG OF BORING

REV. 12/5/5?

No. BF-9827

Client Ronald C. Shiesley, Ransomville, New York
Project Gratwick Park, No. Tonawanda, NY

Location of Boring: As Directed by Others

Water Level	-10.9'
Time	Completion of Boring
Date	9-13-84

Boring No. 2 Date 9-21-84 Sheet 1 of
Type of Boring H. Stem Rig B40L #2
Casing used - Size - Drilling mud used -
Boring begun 9-13-84 Boring completed 9-13-84
Ground Elevation Grade referred to
Datum
Field Party: Doak & Burgard

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
		PENETRATION TESTS					0		
							1		Mixed Fill Clay
	1	0.0 1.5	10	3/6	5/6	5/6			Foundry Sand
	2	1.5 3.0	8	2/6	5/6	3/6	2 3		Silt Slag Cinder
							4		
	3	3.0 4.5	76	18/6	24/6	52/6	5		
	4	4.5 6.0	100/.10	No Sample	Penetration		6		No Sample Obtain in Split Spoon
							7		
	5	6.0 7.5	100/.15	No Sample	Penetration		8		Sample Taken From Augers 4.5' - 7.5'
	6	7.5 9.0	231	95/6	106/6	125/6	9		
							0		
	7	9.0 10.5	45	150/6	20/6	25/6	1		
	8	10.5 12.0	64	24/6	18/6	46/6	2	-12.0'	
							3		~~Boring Terminated~~
							4		
							5		
							6		
							7		
							8		
							9		
							0		

Engineer

PITTSBURGH TESTING LABORATORY

LOG OF BORING

Job No. BF-9827

Client Ronald C. Shiesley, Ransomville, New York
Project Gratwick Park, No. Tonawanda, NY

Location of Boring: As Directed by Others	
Water Level	-10.9'
Time	Completion of Boring
Date	9-13-84

Boring No. 3 Date 9-13-84 Sheet 1 of
Type of Boring H. Stem Rig B40L #2
Casing used - Size - Drilling mud used -
Boring begun 9-13-84 Boring completed 9-13-84
Ground Elevation Grade referred to ______ Da
Field Party: Doak & Burgard

PENETRATION TESTS

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
	1	0.0 – 1.5	48	8/6	12/6	36/6	1		Mixed Fill Clay on Top
	2	1.5 – 3.0	100 / 6.0"		35/6	100/6	2		~~Cinder Slag Grass~~
							3		~~Dense Slag Cannot~~ Get Full Penetration
	3	3.0 – 4.5		150 / 0.20			4		Took Sample off Auger
	4	4.5 – 6.0	234	45/6	98/6	136/6	5		Could Not Penetrat Took Sample off Augers
	5	6.0 – 7.5		100 / .10 BLOWS			7		Took Some Sample Off Augers
	6	7.5 – 9.0		100 / 15			8		
	7	9.0 – 10.5		150 / .20			10		
	8	10.5 – 12.0	42	7/6	18/6	24/6	11		-12.0'
							12		Boring Terminated

PITTSBURGH TESTING LABORATORY

J.C. Burruano

J.C. Burruano, Manager
Buffalo District

Engineer ______

B.5 TEST PIT LOGS

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYSDEC
PROJECT: GRATWICK - RIVERSIDE PARK
SITE: -
CONTRACTOR: CECOS

JOB NO.: 35149
TEST PIT NO.: 4 (A)
SHEET 1 OF 1
STARTED: 5/9/89
FINISHED: 5/9/89

LOCATION
LATITUDE: SEE COMMENTS BELOW
DEPARTURE:
BEARING:

ELEVATIONS
DATUM: -
GROUND SURFACE: -

BOTTOM OF PIT: 5 FEET
WATER TABLE: BELOW 5 FEET

DEPTH (FT.)	Description
1 2 3 4	0" - 8" - DARK ORGANIC RICH SOIL 8" - 5' - MISC. FILL DEBRIS IN A GRAY SANDY MATRIX - FILL INCLUDES:

GENERAL
- TRUCK AND AUTOMOBILES TIRES
- BRICK PRODUCT (RED)
- FOUNDARY SAND (BLACK)
- WOOD, TILE, RUG
- BOTTLES + CANS
- PAPER

METAL OBJECTS
- LARGE TRUCK MUFFLER
- METAL STRAPPING
- TWISTED METAL OBJECT (2' by 1')
- COARSE SCREEN MATERIAL (1' by 1')
- SQUASHED BARREL REMAINS @ 5'
- HOUSE GUTTER

DRUMS
① - DISINTEGRATED FIBER DRUM @ 3½' - INSIDE IS HARD YELLOW TO BRICK RED RESIN LIKE SUBSTANCE
② - DISINTEGRATED FIBER DRUM @ ~4' - INSIDE IS HARD YELLOW RESIN LIKE SUBSTANCE
③ - SQUASHED METAL DRUM w/ APPROXIMATELY 3/4 OF MASS REMAINING @ 5'

NO DISCERNABLE ORIENTATION

★ MINOR AMOUNT OF WATER NOTED @ 5 ft.

Comments LOCATION: P-baseline 40+18 78L
40+30 79L

A-2937

INSPECTOR:
LOGGED BY: BRUCE J. PRZYBYL
APPROVED:
DATE:

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYS DEC

PROJECT: GRATWICK - RIVERSIDE PARK

SITE: -

CONTRACTOR: CECOS

JOB NO.: 35149

TEST PIT NO.: 5 (B)

SHEET 1 OF 1

STARTED: 5/10/89

FINISHED: 5/10/89

LOCATION

LATITUDE: SEE COMMENTS BELOW

DEPARTURE:

BEARING:

ELEVATIONS

DATUM: -

GROUND SURFACE: -

BOTTOM OF PIT: 5 FEET

WATER TABLE: BELOW 5 FEET

DEPTH (FT.)	Description
	0" - 8" - DARK BROWN ORGANIC RICH SOIL
	8" - 5' - MISC. FILL DEBRIS IN A LT. BROWN SANDY MATRIX
	- FILL INCLUDES:

GENERAL

- 6" LAYER OF FOUNDARY SAND (BLACK) AT 8"
- BRIGHT BLUE/GREEN SPONGY SOLID AND POWDER MATERIAL @ 2' (★)
- GENERAL TRASH INCL. BOTTLES, PAPER, + PLASTIC

METAL OBJECTS

- MISC. SCRAP METAL
- REMAINS OF DRUMS INCL TOPS + BOTTOMS AND METAL STRAPPING
- 1/2" STEEL CABLE (4' LONG)

DRUMS

- MANGLED REMAINS OF AT LEAST 2 AND AS MANY AS 4. FIBER DRUMS - ONLY TOPS AND BOTTOMS INTACT
- INSIDE DRUMS IS HARD YELLOW TO ORANGE RED RESIN LIKE SUBSTANCE (★★)

NO DISCERNABLE ORIENTATION

DRUMS LOCATED FROM 3-5 ft.

Comments LOCATION: P-baseline 41+87 76 L
41+99 78 L

(★) ANALYTICAL SAMPLE 5-1 (TP-B-1)

(★★) ANALYTICAL SAMPLE 5-2 (TP-B-2)

INSPECTOR:

APPROVED:

LOGGED BY: BRUCE J PRZYBYL

DATE:

A-2937

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYS DEC
PROJECT: GRATWICK - RIVERSIDE PARK
SITE: -
CONTRACTOR: CECOS

JOB NO.: 35149
TEST PIT NO.: 10 (C)
SHEET 1 OF 1
STARTED: 5/10/89
FINISHED: 5/10/89

LOCATION
LATITUDE: SEE COMMENTS BELOW
DEPARTURE:
BEARING:

ELEVATIONS
DATUM: -
GROUND SURFACE: -

BOTTOM OF PIT: 2 FEET
WATER TABLE: BELOW 2 FEET

DEPTH (FT.)	Description
1	0" - 8" - DARK BROWN ORGANIC RICH SOIL 8" - 2' - MISC. FILL DEBRIS INCLUDING:

GENERAL
- BLACK SILTY FOUNDARY SAND WITH BRICK FRAGMENTS

METAL OBJECTS
- VERY NEAR SURFACE WAS 3/4" TANGLED STEEL CABLE (50' LONG)
- TOPS + BOTTOMS OF TWO DRUMS AND ASSOCIATED METAL STRAPPING

DRUMS
- @ 1½' - 2' DEPTH - 2 DRUMS ORIENTED WITH LONG AXIS PARALLEL TO RIVER. BOTH DRUMS WERE NOT INTACT BUT TOPS AND BOTTOMS, TORN FIBER BODYS, AND METAL STRAPPING WRAPPED AROUND THE DRUMS WERE READILY DISCERNABLE.
- INSIDE DRUMS IS HARD YELLOW TO PINK RESIN LIKE SUBSTANCE

FIBER BODY OF ONE DRUM REVEALED THE FOLLOWING: 1) DOW 2) EYE IRRITANT 3) BUTYL-PHENOL P-TERT

Comments LOCATION: P-baseline 44+14 23 L
44+25 23 L

A-2937

INSPECTOR:
LOGGED BY: BRUCE J. PRZYBYL
APPROVED:
DATE:

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYSDEC

PROJECT: GRATWICK - RIVERSIDE PARK

SITE: -

CONTRACTOR: CECOS

JOB NO.: 35149

TEST PIT NO.: 7 (D)

SHEET 1 OF 1

STARTED: 5/11/89

FINISHED: 5/11/89

LOCATION

LATITUDE: SEE COMMENTS BELOW

DEPARTURE:

BEARING:

ELEVATIONS

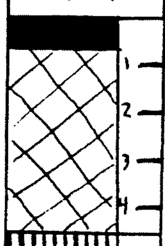
DATUM: -

GROUND SURFACE: -

BOTTOM OF PIT: 4.5 FEET

WATER TABLE: BELOW 4.5 FEET

DEPTH (FT.)	Description



0" - 8" - DARK BROWN SOIL

8" - 4.5' - MISC. FILL DEBRIS
8"-2' BROWN SOIL MATRIX
2'-4.5' CHARCOAL GREY MATRIX

- FILL INCLUDES

GENERAL
- PAPER, PLASTIC, TRASH
- SMALL AMOUNT OF WHITE RUBBERY COMPOUND

METAL OBJECTS
- ABUNDANT SCRAP METAL
- BED SPRINGS
- AUTOMOBILE HYDRAULIC JACK
- SQUASHED TRASH CAN

DRUMS
NO DRUMS AT THIS LOCATION

4.5' + FLAT INPENETRABLE LAYER OF SLAG LIKE MATERIAL. BLUISH-WHITE IN COLOR.

Comments LOCATION: P-baseline 44+10 207 R
44+11 219 R

INSPECTOR:

LOGGED BY: BRUCE J. PRZYBYL

APPROVED:

DATE:

A-2937

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYSDEC

PROJECT: CHATWICK - RIVERSIDE PARK

SITE: -

CONTRACTOR: CECOS

JOB NO.: 35149

TEST PIT NO.: 17 (E)

SHEET 1 OF 1

STARTED: 5/11/89

FINISHED: 5/11/89

LOCATION

LATITUDE: SEE COMMENTS BELOW

DEPARTURE:

BEARING:

ELEVATIONS

DATUM: -

GROUND SURFACE: -

BOTTOM OF PIT: 6.5 FEET

WATER TABLE: BELOW 6.5 FEET

DEPTH (FT.)	Description
1 2 3 4 5 6	0"-8" - DARK BROWN SOIL 8"-6.5' - MISC. FILL DEBRIS INCLUDING:

GENERAL	METAL OBJECTS	DRUMS
8"-3' BLACK FOUNDRY SAND - RELATIVELY HOMOGENEOUS 3'-6½' BLACK MATRIX w/ VARIOUS GARBAGE INCLUDING TRUCK AND AUTOMOBILE TIRES, PAPER, AND PLASTIC - ALSO WHITE RUBBERY COMPOUND IN A 2' DIAMETER MASS	NO MAJOR METALLIC OBJECTS AT THIS LOCATION	NO DRUMS AT THIS LOCATION

6.5'+ FLAT INPENETRABLE LAYER OF SLAGLIKE MATERIAL. BLUEISH WHITE IN COLOR.

* MINOR AMOUNTS OF WATER NOTED @ 6.5 FT.

Comments

LOCATION: P- baseline 42+09 54 R
41+97 54 R

A-2937

INSPECTOR:

LOGGED BY: BRUCE J PRZYBYL

APPROVED:

DATE:

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYSDEC

PROJECT: GRATWICK - RIVERSIDE PARK

SITE: –

CONTRACTOR: CECOS

JOB NO.: 35149

TEST PIT NO.: 3 (F)

SHEET 1 OF 1

STARTED: 5/12/89

FINISHED: 5/12/89

LOCATION

LATITUDE: SEE COMMENTS BELOW

DEPARTURE:

BEARING:

ELEVATIONS

DATUM: –

GROUND SURFACE: –

BOTTOM OF PIT: 3 FEET

WATER TABLE: BELOW 3 FEET

DEPTH (FT.)	Description
1, 2	0" - 2" DARK BROWN SOIL AND SOD
	2" - 3' MISC. FILL DEBRIS IN A WHITE ASH TO BLACK SANDY MATRIX, - FILL INCLUDES:
	GENERAL: - PAPER, PLASTIC, WOOD; - LARGE AMOUNT OF RED BRICK MATERIAL
	METAL OBJECTS: - ABUNDANT METAL DEBRIS RANGING FROM A FEW INCHES TO A FEW FEET ACROSS - INCLUDES CAR MUFFLERS AND MANGLED METAL OBJECTS; - EMPTY 55-gal DRUM
	DRUMS: - 55 GALLON METAL DRUM @ 8" DEPTH; - RUSTED WITH SEVERAL HOLES; - EMPTY; - NO DISTINGUISHING MARKS
	3' + UNDULATING LAYER OF SLAGLIKE MATERIAL. BLUISH WHITE IN COLOR.

Comments: LOCATION: P-baseline 40+20 200 R
40+19 188 R

A-2937

INSPECTOR:

LOGGED BY: BRUCE J PRZYBYL

APPROVED:

DATE:

URS CONSULTANTS

TEST PIT LOG

CLIENT: NYSDEC
PROJECT: GRATWICK - RIVERSIDE PARK
SITE: –
CONTRACTOR: CECOS

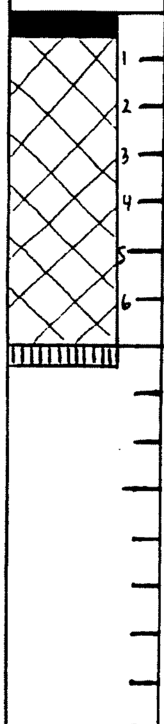
JOB NO.: 35149
TEST PIT NO.: 18 (G)
SHEET 1 OF 1
STARTED: 5/12/89
FINISHED: 5/12/89

LOCATION
LATITUDE: SEE COMMENTS BELOW
DEPARTURE:
BEARING:

ELEVATIONS
DATUM: –
GROUND SURFACE: –

BOTTOM OF PIT: 7 FEET
WATER TABLE: BELOW 7 FEET

DEPTH (FT.)	Description



0 - 6" - DARK BROWN SOIL

6" - 7' - MISC. FILL DEBRIS IN A DARK BROWN MATRIX

- FILL INCLUDES:

GENERAL	METAL OBJECTS	DRUMS
- PAPER, PLASTIC, WOOD - @ 5' - WHITE POWDERY MATERIAL ~ 1-5 GAL WORTH	~ METAL 55 gal DRUM - FIBER DRUM WITH NEST OF METAL STRAPPING @ 1½ - 3'	① MANGLED FIBER DRUM w/ METAL STRAPPING - INSIDE DRUM IS HARD RED RESIN LIKE SUBSTANCE ② METAL 55 GALLON DRUM ORIENTED WITH LONG AXIS PARALLEL TO RIVER - INSIDE DRUM IS HARD RED RESIN LIKE SUBSTANCE

7'+ UNDULATING LAYER OF SLAGLIKE MATERIAL. BLUISH WHITE IN COLOR.

Comments LOCATION: P-Baseline 40+18 48 R
40+19 60 R

A-2937

INSPECTOR:
LOGGED BY: BRUCE J PRZYBYL

APPROVED:
DATE:

APPENDIX C

PHYSICAL HYDROGEOLOGY

APPENDIX C
PHYSICAL HYDROGEOLOGY

TABLE OF CONTENTS

APPENDIX C.1
MONITORING WELL AND PIEZOMETER CONSTRUCTION

C.1.1 INTRODUCTION

The construction details presented in the forms included in Appendix C.1.1, provide a graphic illustration of each monitoring well and piezometer, as well as construction dimensions and depth. Construction materials are also specified on these forms and the user is provided with a generalized log of the subsurface lithology at each construction location. Well identification numbers are noted at the top of each form and correspond with well and piezometer locations presented on the site plan. Well identification numbers are followed by a letter designating relative well/piezometer depths at each location (i.e., shallow (s), intermediate (i), or deep (D)).

C.1.2 URS MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS

DRILLING SUMMARY

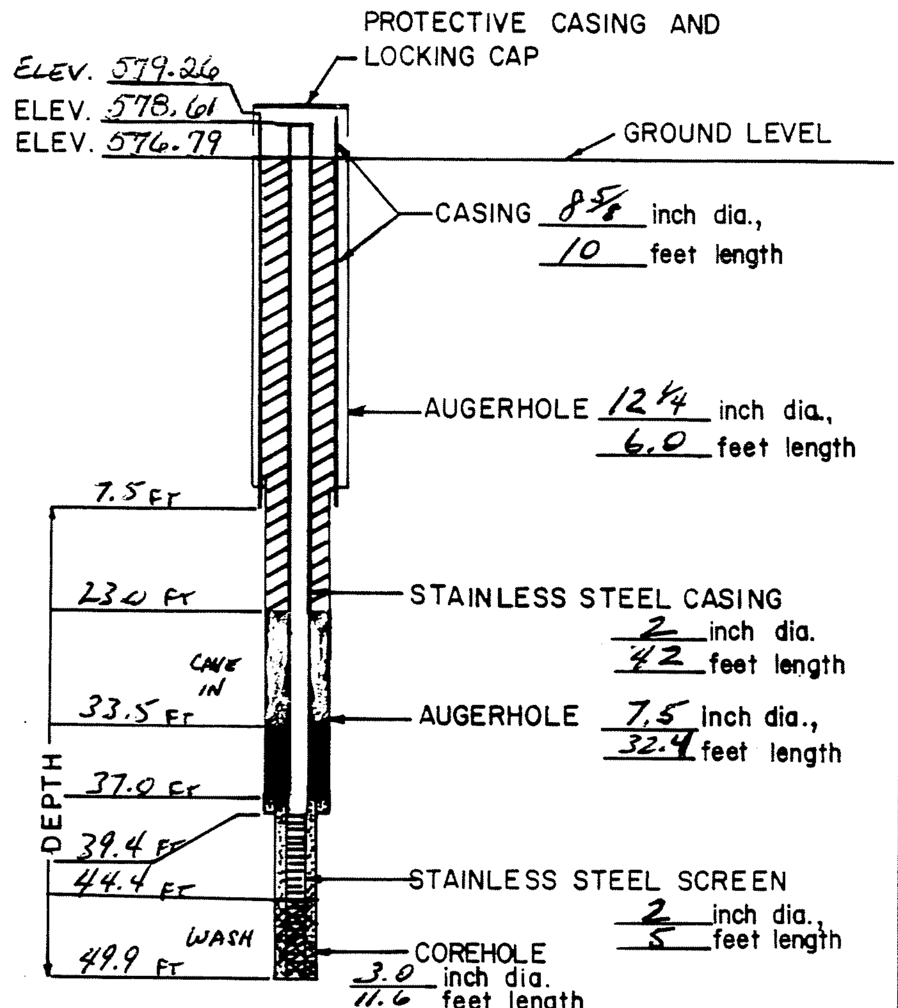
Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME - 75

Date : OCT 23, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.4	TOPSOIL
0.4 - 1.7	FILL
1.7 - 5.8	SILTY FINE SAND
5.8 - 25.7	SILTY CLAY
25.7 - 38.4	TILL
38.4 - 49.9	SHALE

WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 8 5/8" ID STEEL	Type : 304 STAINLESS STEEL	Type : #4 Q ROCK SAND Setting : 37.0 - 45.0 FT
Monitor : 304 STAINLESS STEEL	Slot Size : .010 IN	SEAL MATERIAL Type : "PIEZOMETER" BENTONITE PELLETS Setting : 33.5 - 37.0

COMMENTS :

DRILL CUTTINGS & WASH IN BASE OF BORE HOLE 45.0 - 49.9 FT

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK-RIVERSIDE PARK	Project No : 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	DEEP MONITORING WELL CONSTRUCTION DETAILS	Well No : GW - 1(D)

A-2375

DRILLING SUMMARY

Supervising Geologist : ANDRE LAPRES

Drilling Company: R & R INTERNATIONAL

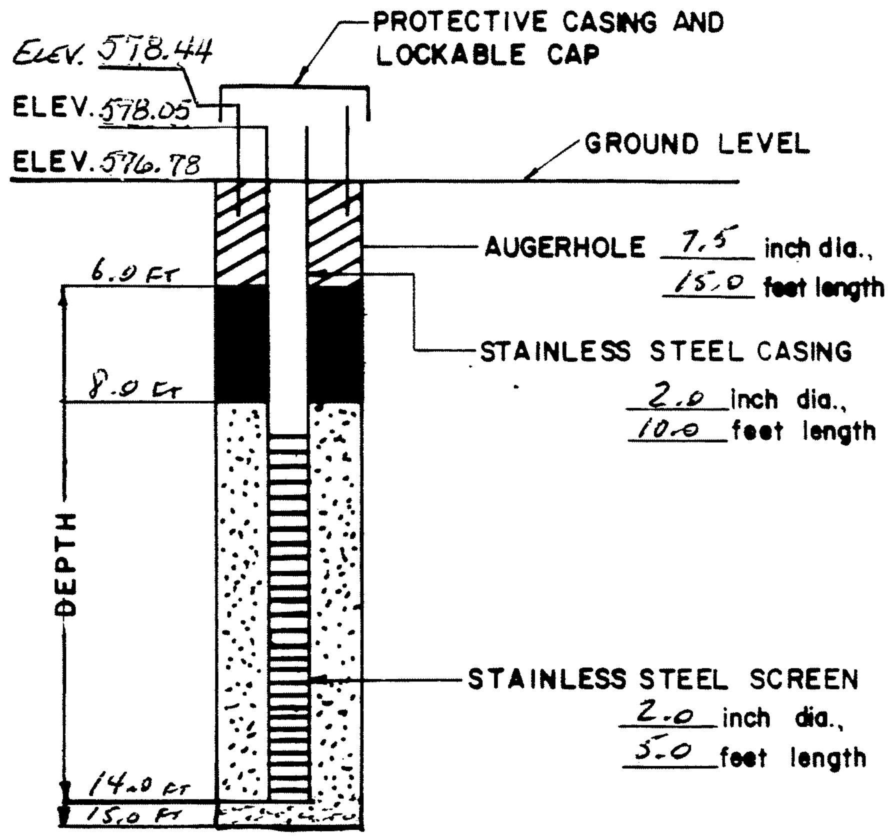
Drillers : JIM ROCKFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME - 75

Date : OCT 23, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.4	TOPSOIL
0.4 - 1.7	FILL
1.7 - 5.8	SILTY FINE SAND
5.8 - 15.0	SILTY CLAY



WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 IN STEEL PROTECTOR	Type : 304 STAINLESS STEEL	Type : #4 Q ROCK SAND Setting : 8.0 - 15.0 FT
Monitor : 304 STAINLESS STEEL	Slot Size : .010 IN	SEAL MATERIAL Type : "PIEZOMETER" BENTONITE PELLETS Setting : 6.0 - 8.0 FT

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK - RIVERSIDE PARK	Project Nº : 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL Nº : GW - 1(S)

A-2398

DRILLING SUMMARY

Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers: JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

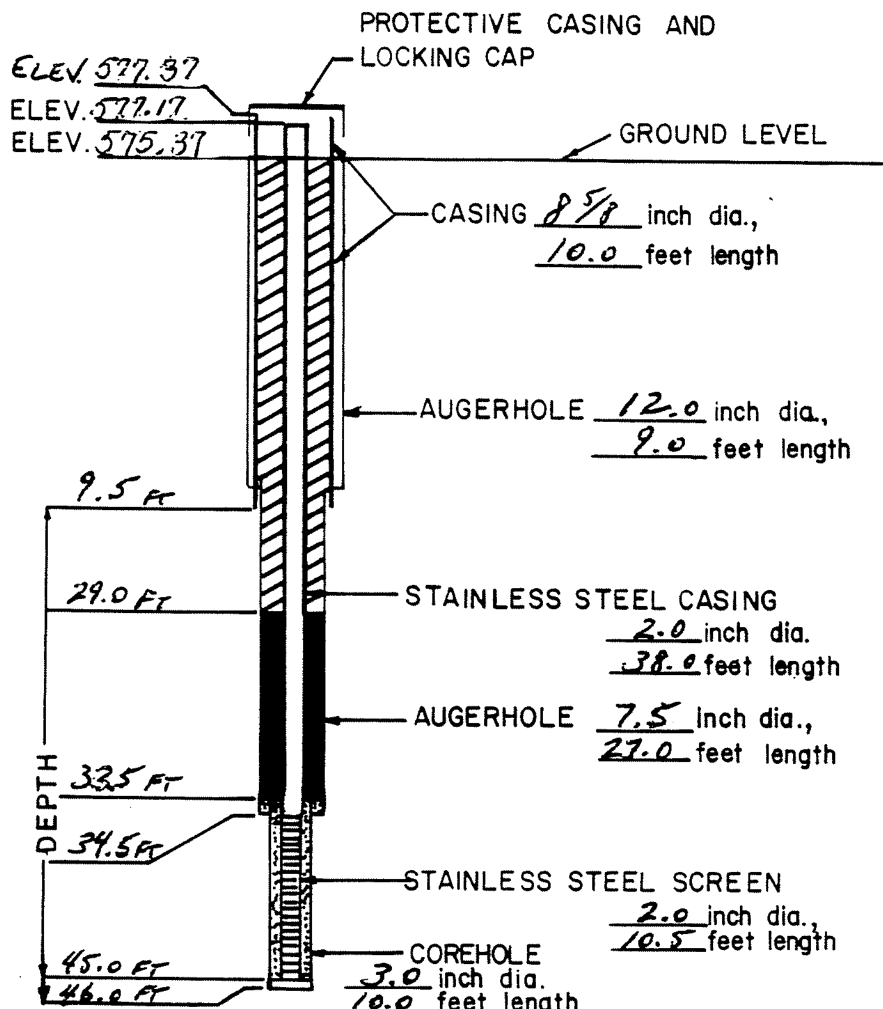
Rig make / model: CME-75

Date : OCT 28, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 1.7	FILL
1.7 - 2.5	CLAYEY SILT
2.5 - 3.8	SILTY SAND
3.8 - 15.0	SILTY CLAY
15.0 - 34.5	TILL
34.5 - 46.0	SHALE

WELL DESIGN



CASING MATERIAL

Surface: 4 IN ID STEEL

Monitor: 304 STAINLESS STEEL

SCREEN MATERIAL

Type : 304 STAINLESS STEEL

Slot Size: .010 INCH

FILTER MATERIAL

Type : #4 Q ROCK SAND Setting : 33.5 - 46.0 FT

SEAL MATERIAL

Type : PIEZOMETER BENTONITE PELLETS Setting : 29.0 - 34.5 FT

COMMENTS:

LEGEND

CEMENT . BENTONITE GROUT

BENTONITE SEAL

SILICA SANDPACK

Client : NYSDEC

Location: GRATWICK - RIVERSIDE PARK

Project Nº : 35149

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

DEEP MONITORING WELL CONSTRUCTION DETAILS

Well Nº : GW-2(D)

A-2375

DRILLING SUMMARY

Supervising Geologist :
ANDRE LAPRES

Drilling Company:
R&R INTERNATIONAL

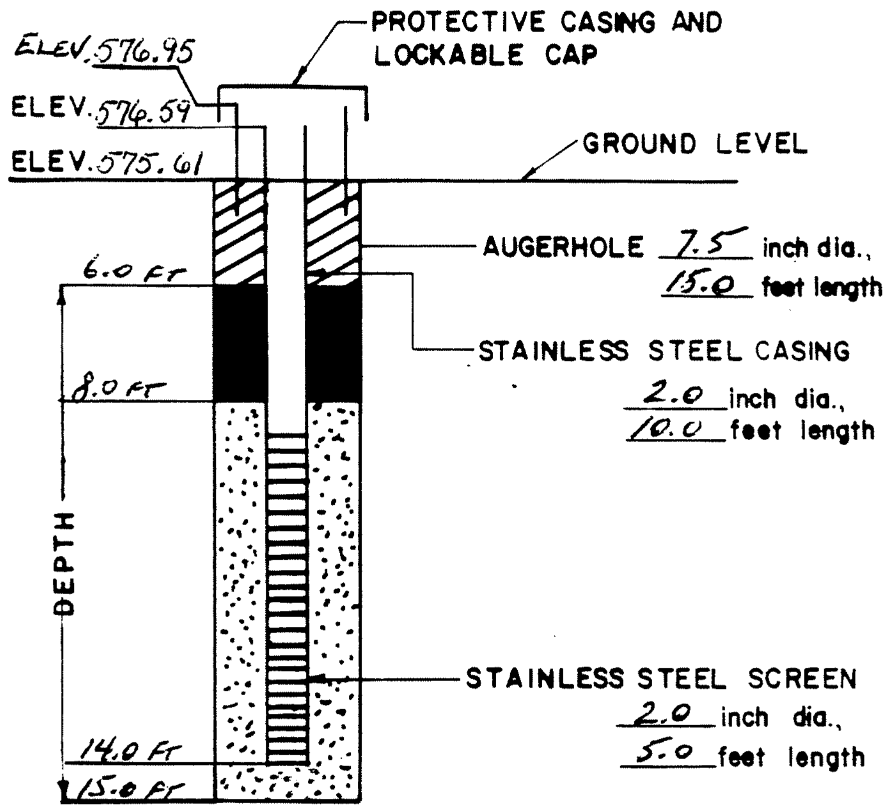
Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

Rig make / model :
CME - 75

Date : OCT 29, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 1.0	FILL
1.0 - 15.0	CLAYEY SILT



WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 IN STEEL	Type : 304 STAINLESS STEEL	Type : #4 Q ROCK SAND Setting : 8.0 - 15.0 FT
Monitor : 304 STAINLESS STEEL	Slot Size : .010 INCH	SEAL MATERIAL "PIEZOMETER" Type : BENTONITE PELLETS Setting : 6.0 - 8.0 FT

COMMENTS :

LEGEND
CEMENT . BENTONITE GROUT
BENTONITE SEAL
SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK - RIVERSIDE PARK	Project Nº : 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL Nº : GW-2(S)

A-2398

DRILLING SUMMARY

Supervising Geologist: ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

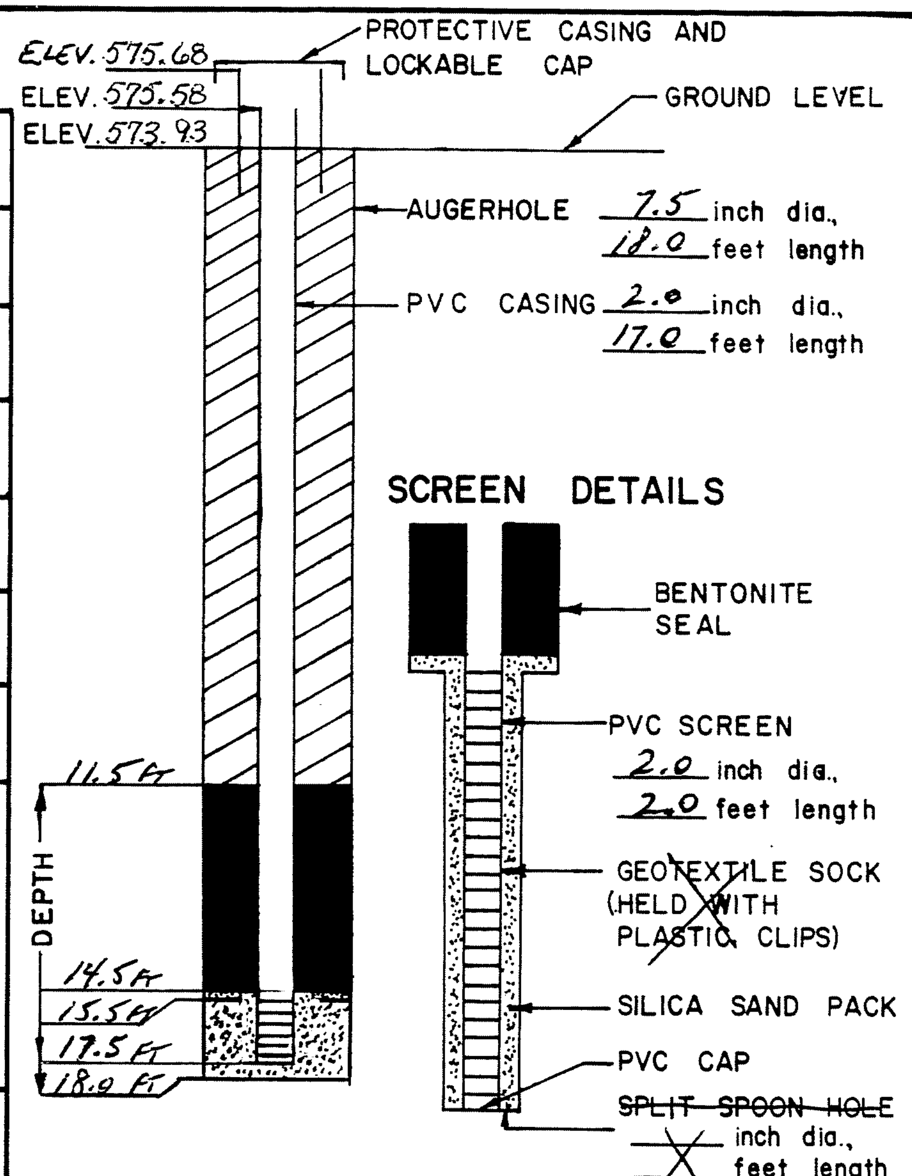
Drillers: JIM ROCKFORD
CHUCK BEAMER
BILL MARKS

Rig make / model: CME-75

Date: DEC 2, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	TOPSOIL
0.5 - 12.0	FILL
12.0 - 18.0	TILL



WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface: 4 IN STEEL	Type: SCH 40 PVC	Type: #4 Q ROCK SAND Setting: 14.5 - 18.0 FT
Monitor: 2 IN SCH 40 PVC	Slot Size: .010 IN	SEAL MATERIAL Type: "PIEZOMETER" BENTONITE PELLETS Setting: 11.5 - 14.5 FT

COMMENTS:

LEGEND

CEMENT . BENTONITE GROUT

BENTONITE SEAL

SILICA SANDPACK

Client: NYSDEC	Location: GRATWICK - RIVERSIDE PARK	Project Nº: 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	PIEZOMETER CONSTRUCTION DETAILS	Well Nº: GW-3(I)

A-2400

DRILLING SUMMARY

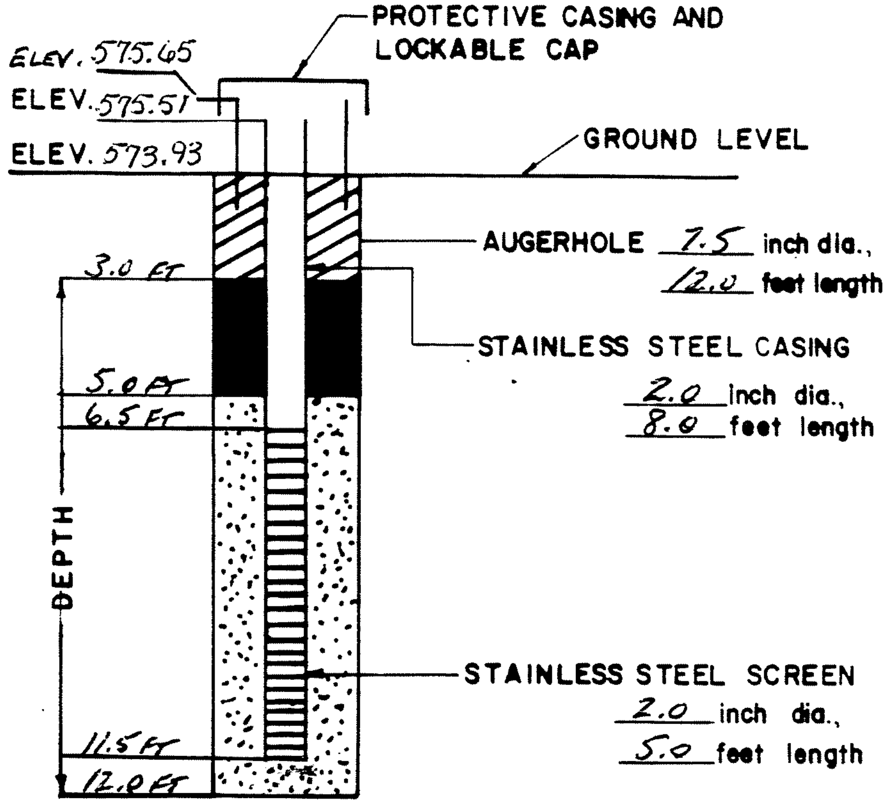
Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCKFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME-75

Date : DEC 2, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	TOPSOIL
0.5 - 12.0	FILL

WELL DESIGN

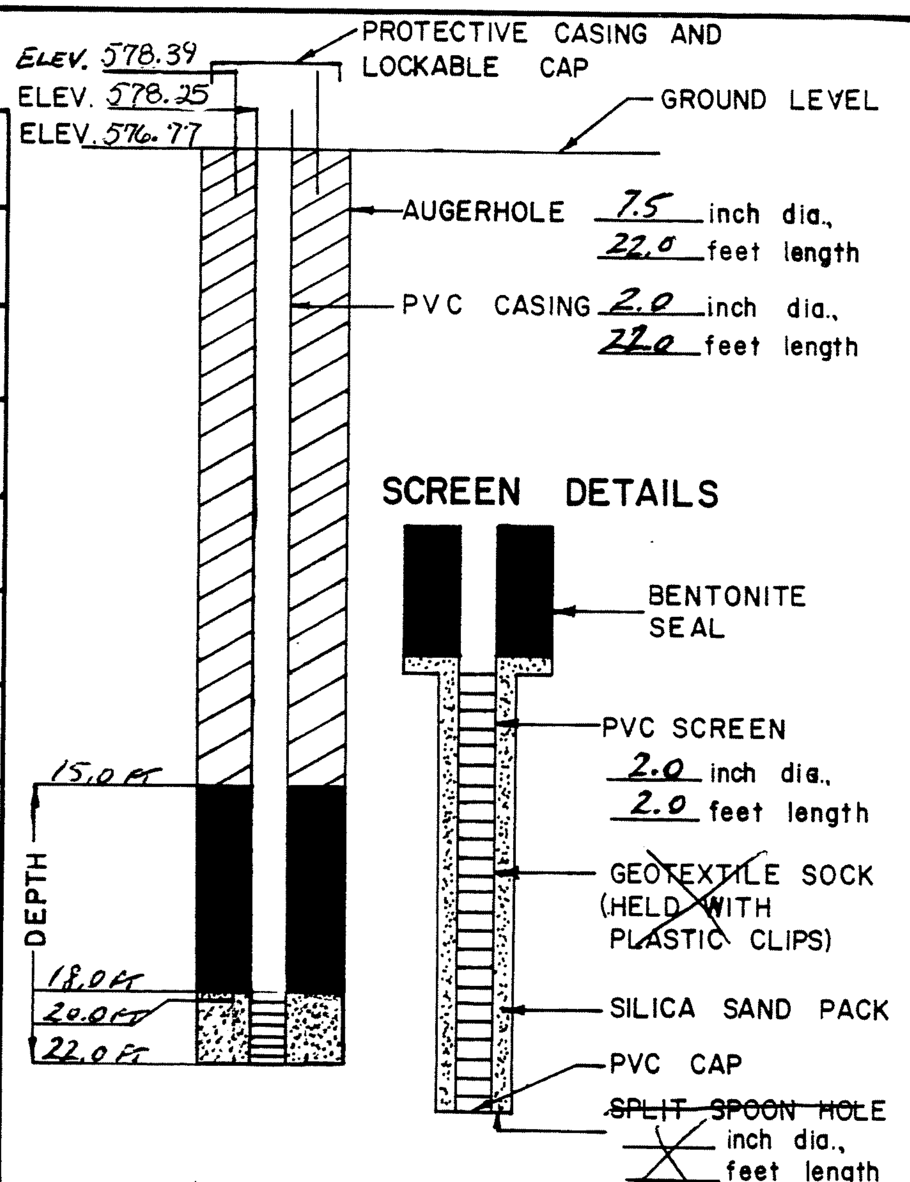
CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 IN STEEL	Type : 304 STAINLESS STEEL	Type : #4 Q ROCK SAND Setting : 5.0 - 12.0 FT
Monitor : 2 IN 304 STAINLESS STEEL	Slot Size : .010 IN	SEAL MATERIAL "PIEZOMETER" Type : BENTONITE PELLETS Setting : 3.0 - 5.0 FT

COMMENTS :

LEGEND
- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSPEC	Location : GRATWICK - RIVERSIDE PARK	Project Nº : 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL Nº : GW-3(S)

A-2398



DRILLING SUMMARY

Supervising Geologist: ANDRE LAPRES

Drilling Company: R & R INTERNATIONAL

Drillers: JIM ROCHFORD, CHUCK BEAMER, BILL MARKS

Rig make / model: CME-75

Date: Dec 1, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 1.0	TOPSOIL
1.0 - 14.2	FILL
14.2 - 21.8	CLAY
21.8 - 22.0	TILL

WELL DESIGN

CASING MATERIAL
Surface: 4 IN STEEL
Monitor: 2 IN SCH 40 PVC

SCREEN MATERIAL
Type: 2 IN SCH 40 PVC
Slot Size: .010 IN

FILTER MATERIAL
Type: #4 Q ROCK SAND Setting: 18.0 - 22.0 FT

SEAL MATERIAL
Type: "PIEZOMETER" BENTONITE PELLETS Setting: 15.0 - 18.0 FT

COMMENTS:

LEGEND
CEMENT. BENTONITE GROUT
BENTONITE SEAL
SILICA SANDPACK

Client: NYSDEC

Location: GRATWICK - RIVERSIDE PARK

Project Nº: 35149

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

PIEZOMETER CONSTRUCTION DETAILS

Well Nº: GW-4(I)

A-2400

DRILLING SUMMARY

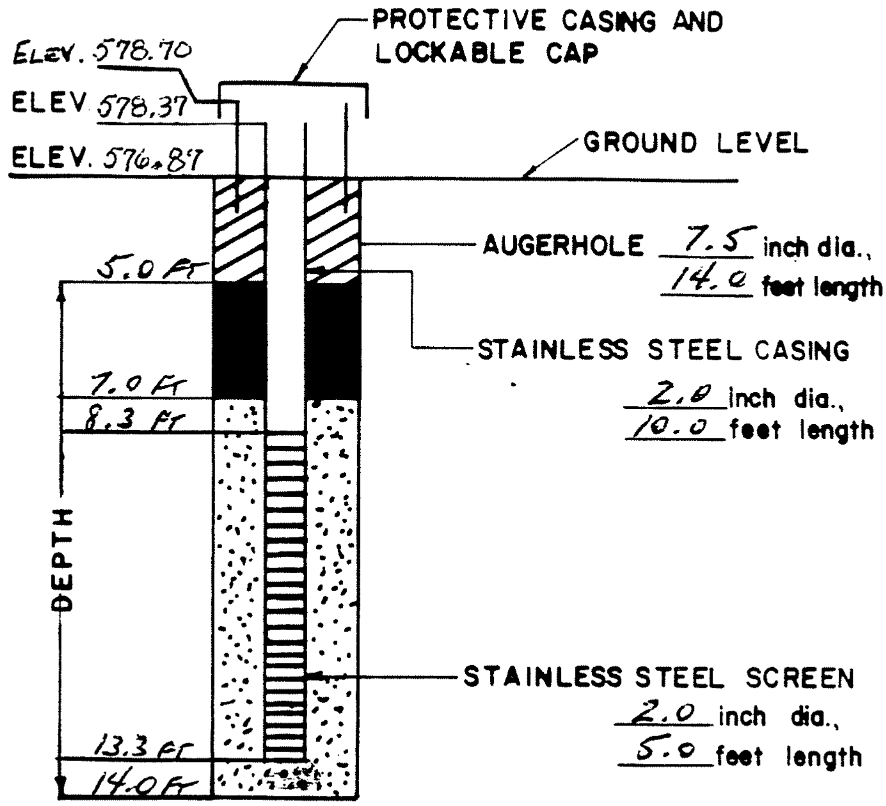
Supervising Geologist : ANDRÉ LAPRÉS

Drilling Company: R & R INTERNATIONAL

Drillers : JIM ROCKFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME-75

Date : DEC 1, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 1.0	TOPSOIL
1.0 - 14.0	FILL

WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4IN STEEL	Type : 2IN 304 STAINLESS STEEL	Type : #4 Q ROCK SAND Setting : 7.0 - 14.0 FT
Monitor : 2 IN 304 STAINLESS STEEL	Slot Size : .010 IN	SEAL MATERIAL "PIEZOMETER" Type : BENTONITE PELLETS Setting : 5.0 - 7.0 FT

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK-RIVERSIDE PARK	Project Nº : 35149
URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL Nº : GW-4(S)

A-2398

DRILLING SUMMARY

Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

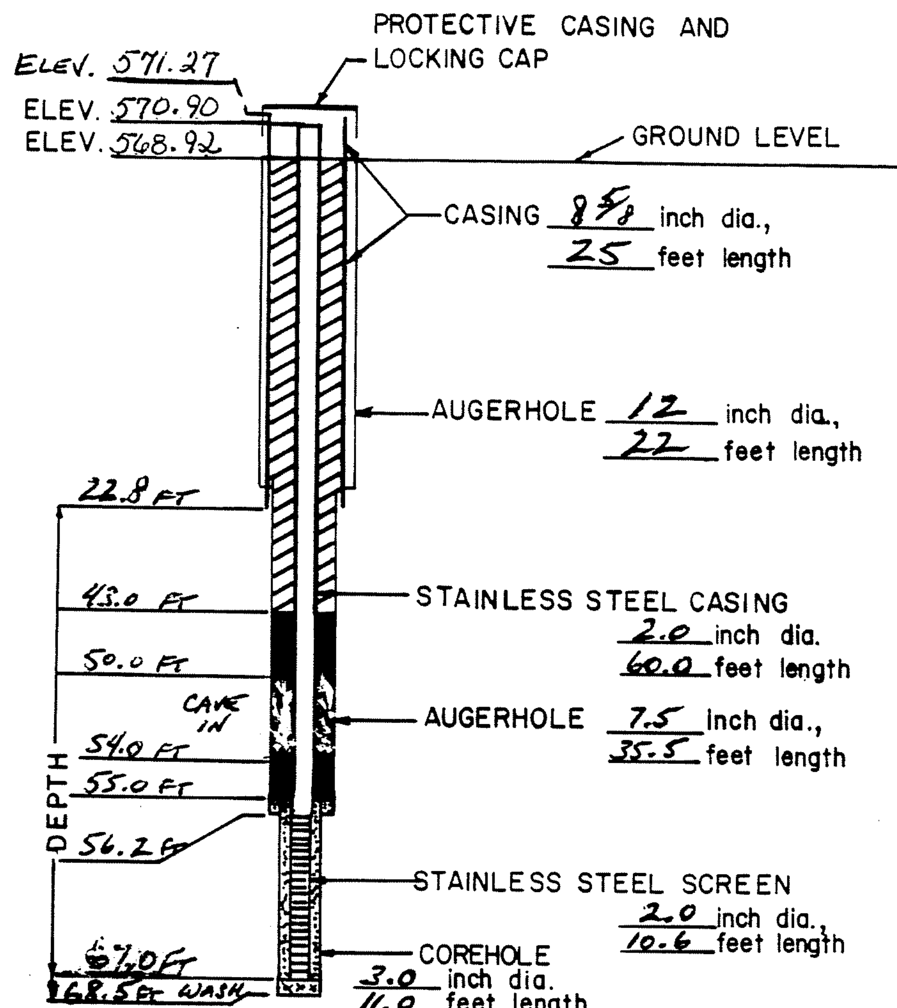
Rig make / model : CME-75

Date : NOV 4, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 19.0	FILL
19.0 - 57.5	TILL
57.5 - 68.5	SHALE

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 IN. STEEL	Type : 304 STAINLESS STEEL	Type : #4 & ROCK SAND Setting : 55.0 - 67.4
Monitor : 304 STAINLESS STEEL	Slot Size : .010 INCH	SEAL MATERIAL Type : "PIEZOMETER" BENTONITE PELLETS Setting : 54.0 - 55.0 & 43.0 - 50.0 FT

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK - RIVERSIDE PARK	Project Nº : 35149
URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	DEEP MONITORING WELL CONSTRUCTION DETAILS	Well Nº : GW-5(D)

A-2375

DRILLING SUMMARY

Supervising Geologist: Jeff Goldenberg

Drilling Company: R&R International

Drillers: Jim Rochford, Chuck Beamer, Bill Marks

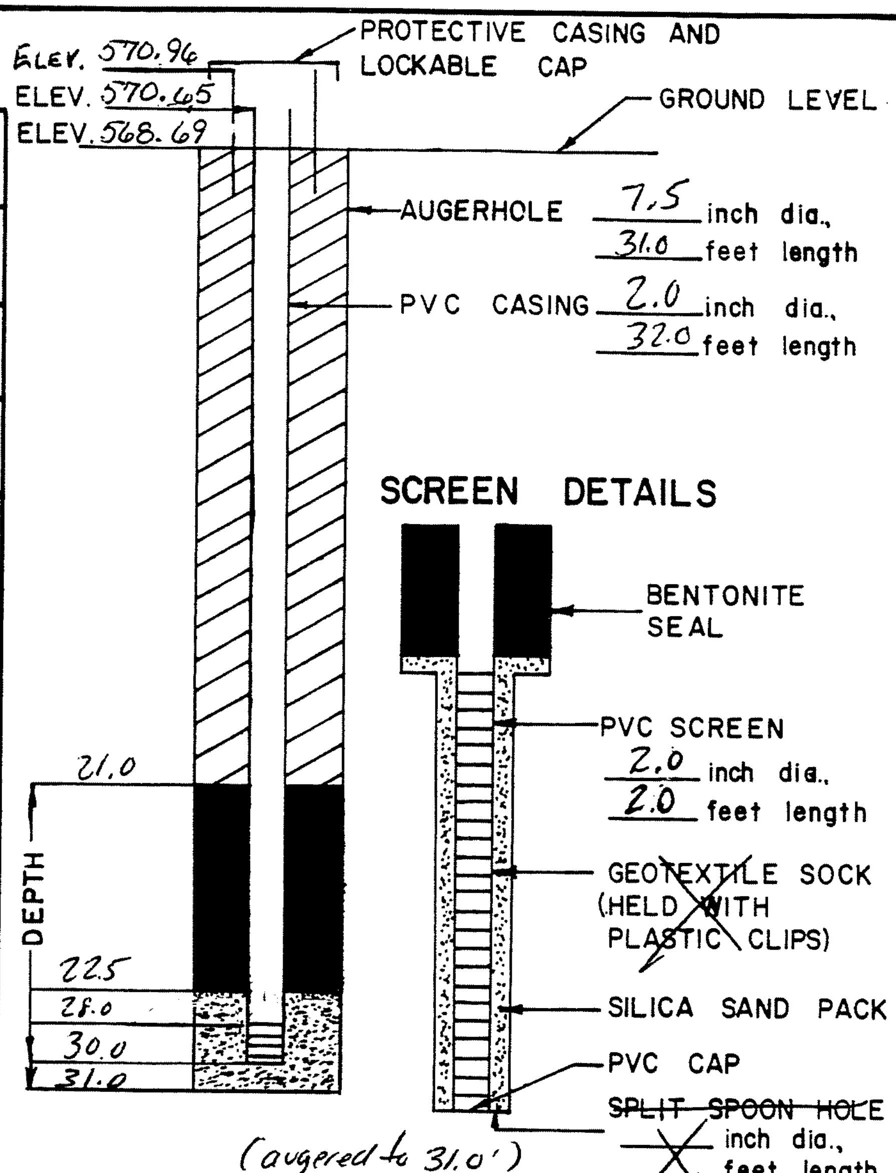
Rig make / model: CME-75

Date: 11/19/87

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 20.0	Fill
20.0 - 31.0	Till

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface: 4 in. Steel	Type: Sch 40 PVC	Type: #4 Q-rock sand Setting: 22.5'-31'
Monitor: 2" Sch 40 PVC	Slot Size: .010 inch	SEAL MATERIAL Type: "Piezometer" Bentonite Pellets Setting: 21.0'-22.5

COMMENTS:

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client: NYSDEC

Location: Gratwick Riverside Park

Project No: 35149

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

PIEZOMETER CONSTRUCTION DETAILS

Well No: GW-5 (I)

A-2400

DRILLING SUMMARY

Supervising Geologist : Jeff Goldenberg

Drilling Company: R + R International

Drillers : Jim Rockford, Chuck Beamer, Bill Marks

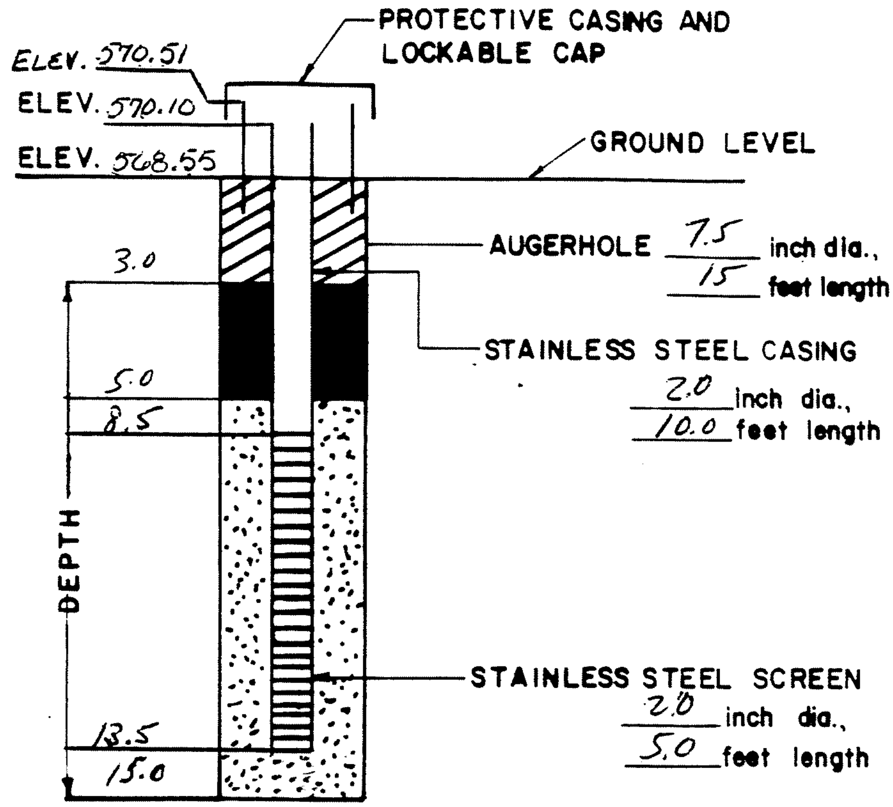
Rig make / model : CME - 75

Date : Nov 20, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 15.0	Poorly graded gravel fill (clean; traprock)

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 in. steel	Type : 304 Stainless steel	Type : #4 Q rock sand Setting : 15.0 - 5.0
Monitor : 304 Stainless steel	Slot Size : .010 inch	SEAL MATERIAL "Piezometer" Type : Bentonite pellets Setting : 3.0 - 5.0'

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC

Location : Gratwick - Riverside Park

Project No : 35149

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

SHALLOW MONITORING WELL CONSTRUCTION DETAILS

WELL No : GW - 5 (S)

A-2398

DRILLING SUMMARY

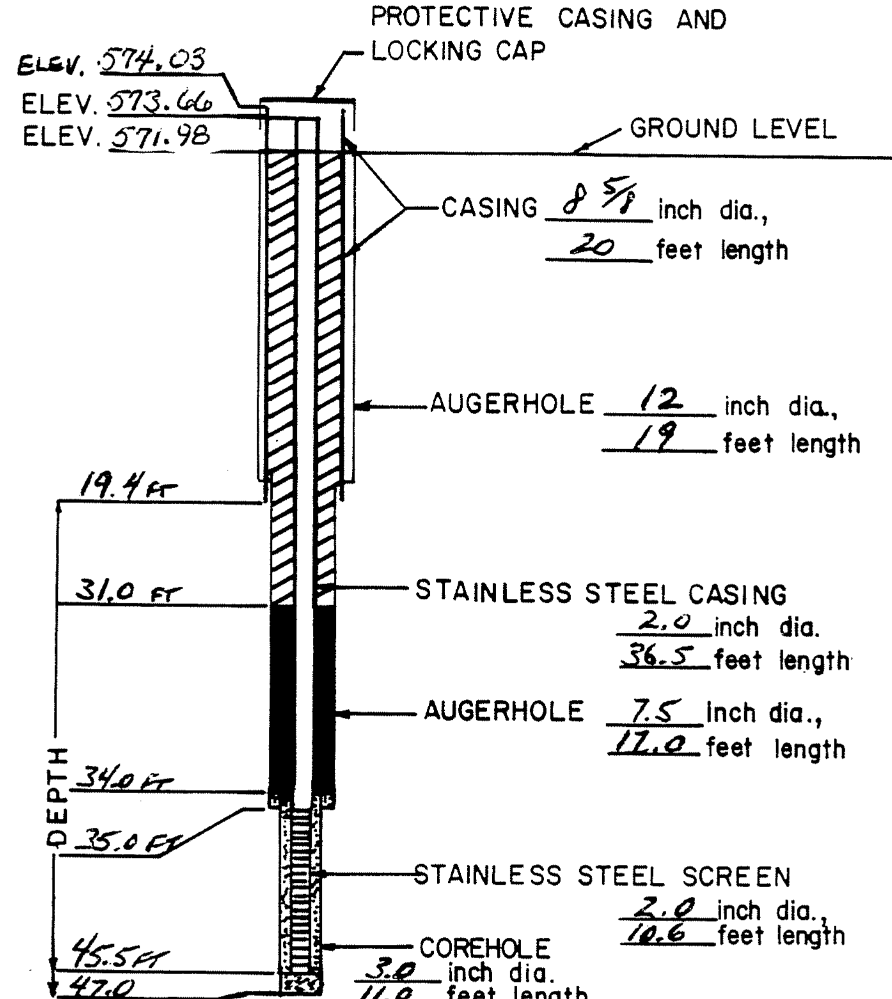
Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME-75

Date : Nov 15, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	TOPSOIL
0.5 - 16.0	FILL
16.0 - 36.0	TILL
36.0 - 47.0	SHALE

WELL DESIGN

CASING MATERIAL

Surface : 4 IN STEEL

Monitor : 304 STAINLESS STEEL

SCREEN MATERIAL

Type : 304 STAINLESS STEEL

Slot Size : .010 INCH

FILTER MATERIAL

Type : #4 Q ROCK SAND Setting : 34.0 - 47.0 FT

SEAL MATERIAL

Type : PIEZOMETER BENTONITE PELLETS Setting : 31.0 - 34.0 FT

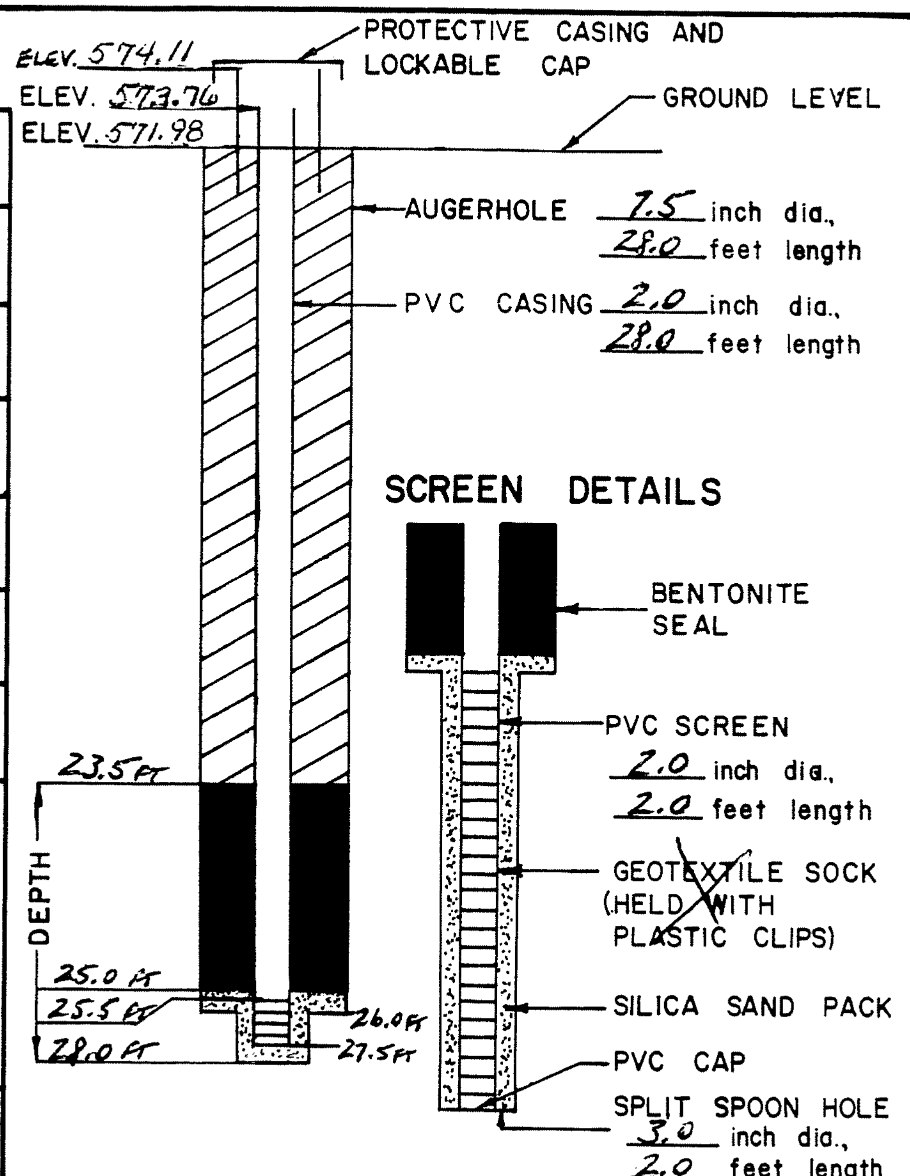
COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK - RIVERSIDE PARK	Project No : 35149
URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	DEEP MONITORING WELL CONSTRUCTION DETAILS	Well No : GW-6(D)

A-2375



DRILLING SUMMARY

Supervising Geologist: ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers: JIM ROCHFORD, CHUCK BEAMER, BILL MARKS

Rig make / model: CME-75

Date: Nov 17, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	TOPSOIL
0.5 - 15.5	FILL
15.5 - 28.0	TILL

WELL DESIGN

CASING MATERIAL

Surface: 4 IN STEEL

Monitor: 2 IN SCH 40 PVC

SCREEN MATERIAL

Type: 2 IN SCH 40 PVC

Slot Size: .010 IN

FILTER MATERIAL

Type: #4 Q ROCK SAND Setting: 25.0 - 28.0

SEAL MATERIAL

Type: PIEZOMETER BENTONITE PELLETS Setting: 23.5 - 25.0

COMMENTS:

LEGEND

- CEMENT. BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client: NYSDEC

Location: GRATWICK - RIVERSIDE PARK

Project No.: 35149

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

PIEZOMETER CONSTRUCTION DETAILS

Well No.: GW-6(I)

A-2400

DRILLING SUMMARY

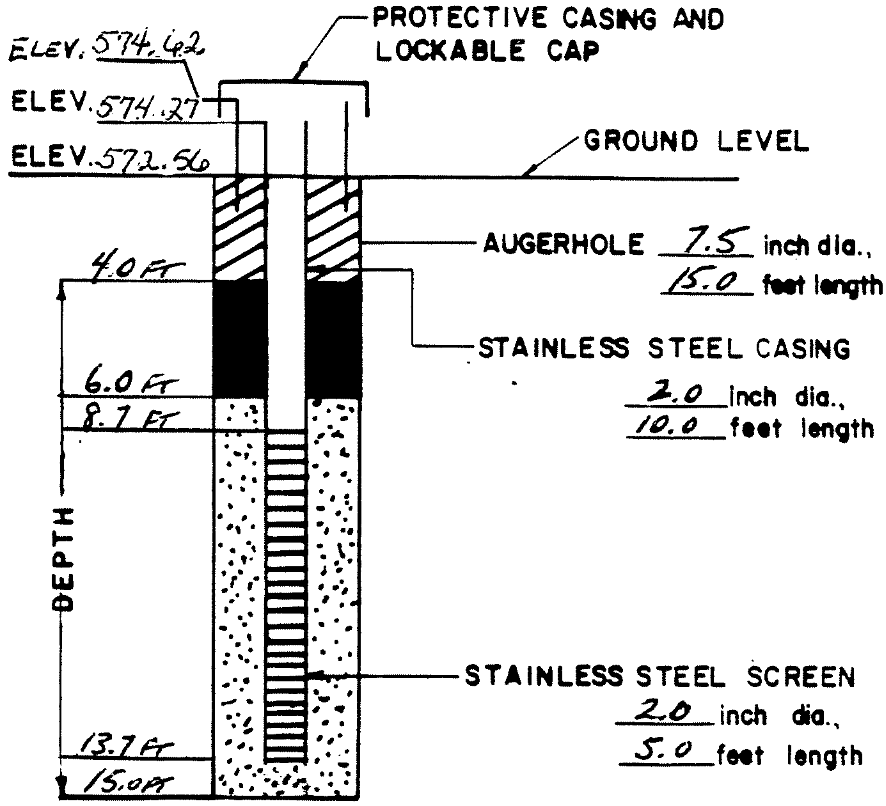
Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

Rig make / model : CME-75

Date : NOV 16, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	TOPSOIL
0.5 - 15.0	FILL

WELL DESIGN

CASING MATERIAL

Surface: 4IN STEEL

Monitor: 2IN 304 STAINLESS STEEL

SCREEN MATERIAL

Type : 2IN 304 STAINLESS STEEL

Slot Size: .010 IN

FILTER MATERIAL

Type : #4 Q ROCK SAND Setting : 6.0 - 15.0 FT

SEAL MATERIAL

Type : "PIEZOMETER" BENTONITE PELLETS Setting: 4.0 - 6.0 FT

COMMENTS:

LEGEND

CEMENT . BENTONITE GROUT

BENTONITE SEAL

SILICA SANDPACK

Client : NYSDEC

Location : GRATWICK - RIVERSIDE PARK

Project Nº : 35149

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

SHALLOW MONITORING WELL CONSTRUCTION DETAILS

WELL Nº : GW-6(S)

A-2398

DRILLING SUMMARY

Supervising Geologist : Jeff Goldenberg

Drilling Company: R & R International

Drillers : Jim Rochford, Chuck Beamer, Bill Marks

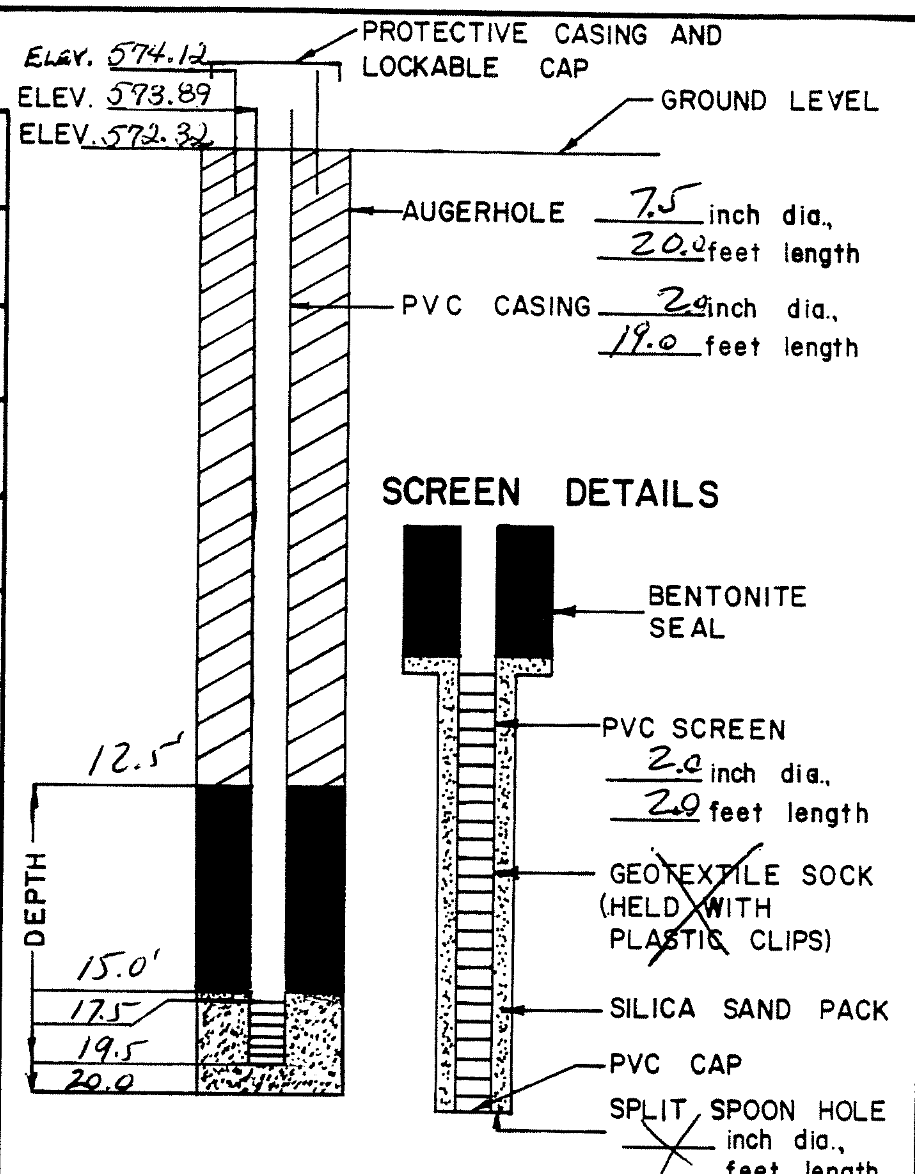
Rig make / model : CME - 75

Date : 11/23/87

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 12.0	Fill (granular)
12.0-20.0	Clay - Silty Clay

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4" steel	Type : Sch 40 PVC	Type : #4 q rock sand Setting : 15.0' - 20.0'
Monitor : 2" sch 40 PVC	Slot Size : .010 inch	SEAL MATERIAL Type : Piezometer Bentonite Pellets Setting : 12.5' - 15.0'

COMMENTS:

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC

Location : Gratwick - Riverside Park

Project Nº : 35749

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

PIEZOMETER CONSTRUCTION DETAILS

Well Nº : GW-7(I)

A-2400

DRILLING SUMMARY

Supervising Geologist : Jeff Goldenberg

Drilling Company: R+R International

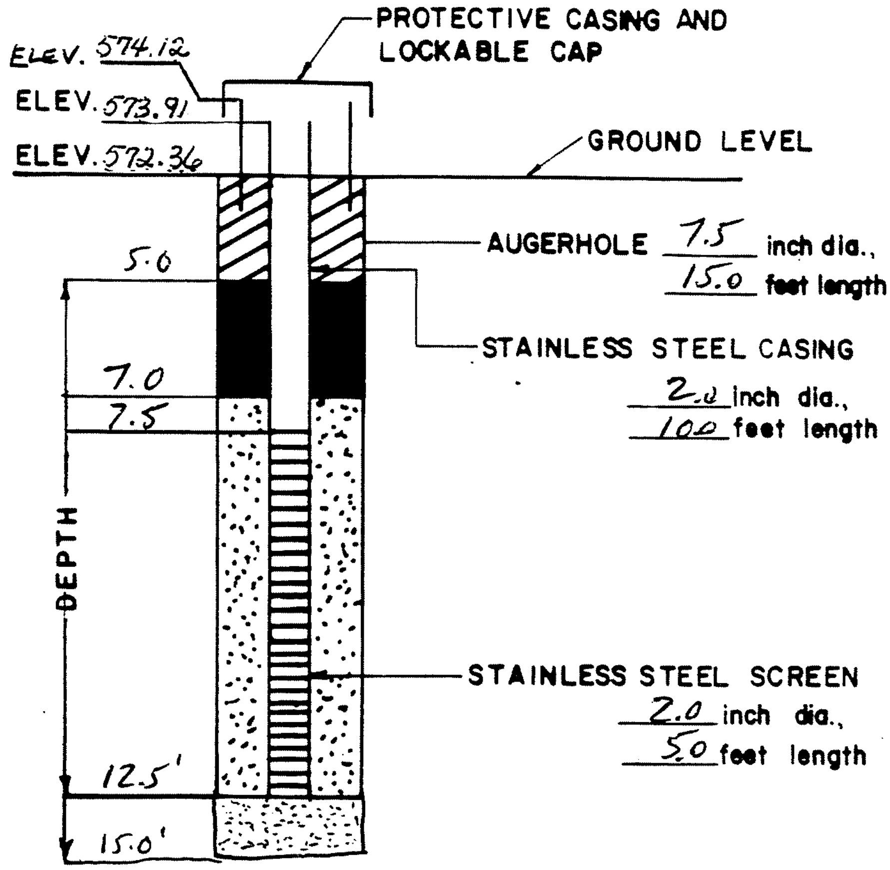
Drillers : Jim Rachford, Chuck Beaman, Bill Marks

Rig make / model : CME - 75

Date : 11/24/87

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 12.0	Fill (granular, loose to dense)
12.0 - 15.0	Clay - Silty Clay



WELL DESIGN

CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4" Steel	Type : 304 stainless steel	Type : #4 rock sand Setting : 15.0 - 7.0
Monitor : 304 stainless steel	Slot Size : .010 inch	SEAL MATERIAL Type : Bentonite "Piezometer" pellets Setting : 7.0 - 5.0

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : GRATWICK - RIVERSIDE PARK	Project No : 35149
URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL No : GW - 7(S)

A-2398

DRILLING SUMMARY

Supervising Geologist: Jeff Goldenberg

Drilling Company: R+R International

Drillers: Jim Rockefield, Chuck Beamer, Bill Marks

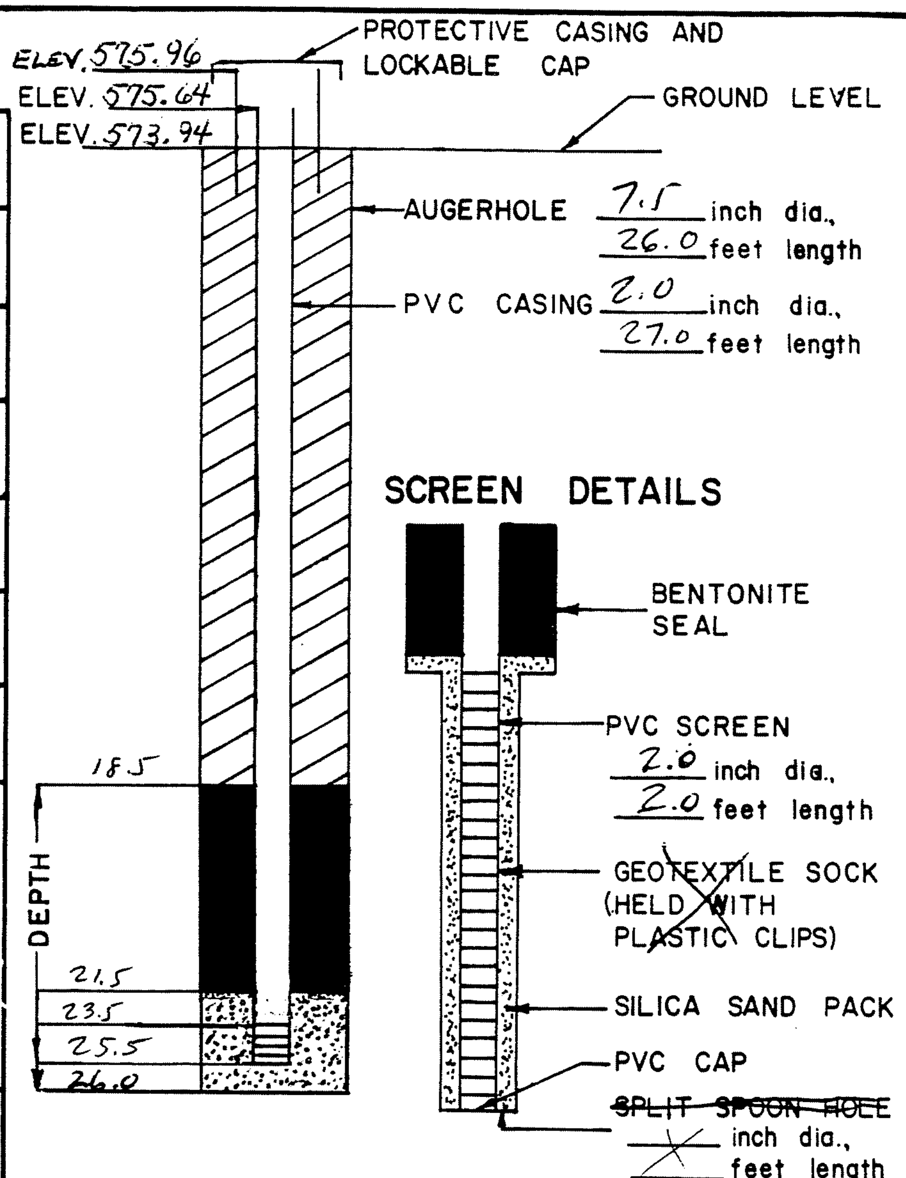
Rig make / model: CME-75

Date: 11/20/87

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 14.0	Fill - granular
14.0 - 18.0	Silty fine Sand
18.0 - 22.0	Clay - Silty Clay
22.0 - 26.0	Till - clayey silt, tr. sand & gravel

WELL DESIGN



CASING MATERIAL

Surface: 4 in. steel

Monitor: 2" Sch 40 PVC

SCREEN MATERIAL

Type: Sch 40 PVC

Slot Size: .010 inch

FILTER MATERIAL

Type: #4 q rock sand Setting: 21.5 - 26.0 FT

SEAL MATERIAL

Type: Piezometer Bent. pellets Setting: 18.5' - 21.5'

COMMENTS: Shelby tube 20-22'
24" recovery
Clay - silty clay

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client: NYSDEC

Location: Gratwick Riverside Park

Project No: 35149

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

PIEZOMETER CONSTRUCTION DETAILS

Well No: GW-8 (I)

A-2400

DRILLING SUMMARY

Supervising Geologist : Jeff Goldenberg

Drilling Company: R+R International

Drillers : Jim Rochford, Chuck Beamer, Bill Marks

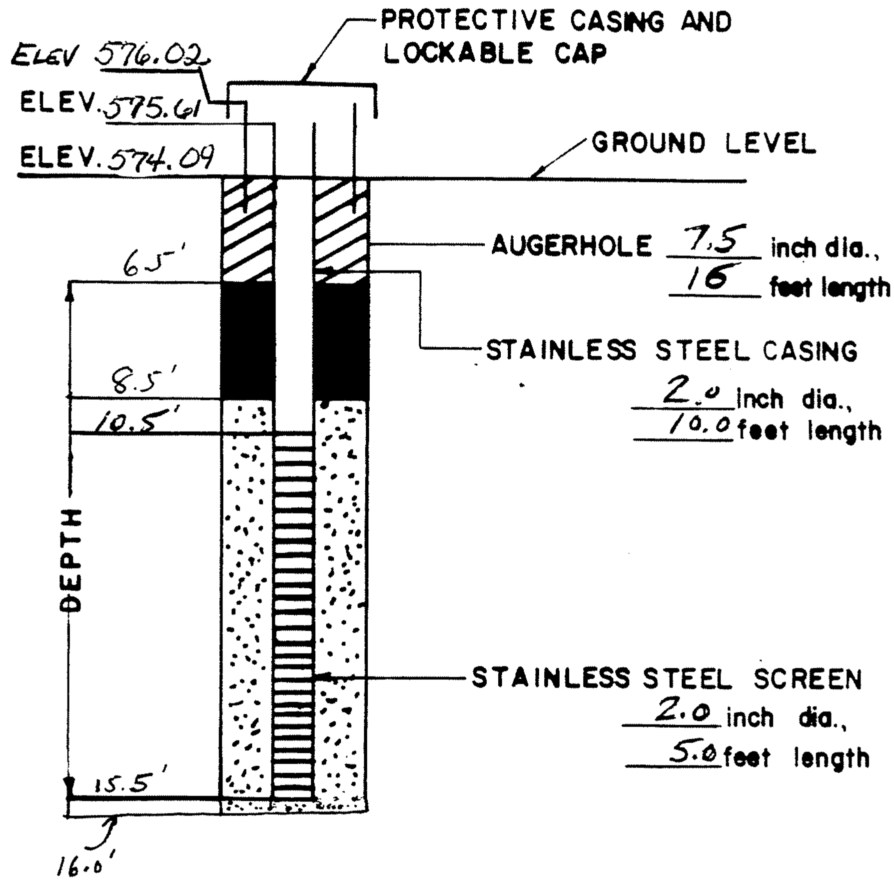
Rig make / model : CME - 75

Date : 11/22/87

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 14.0	Fill grey + blue-green cmf Gravel, l/t silt, sand
14.0 - 16.0	Silty Fine Sand

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4" steel	Type : 304 stainless steel	Type : #4 Q rock sand Setting : 8.5' - 16.0'
Monitor : 304 stainless steel	Slot Size : .010 inch	SEAL MATERIAL Type : "Piezometer" Bentonite Pellets Setting : 6.5' - 8.5'

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC

Location : Gratwick - Riverside Park

Project Nº : 35749

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

SHALLOW MONITORING WELL CONSTRUCTION DETAILS

WELL Nº : GW-8(S)

A-2398

DRILLING SUMMARY

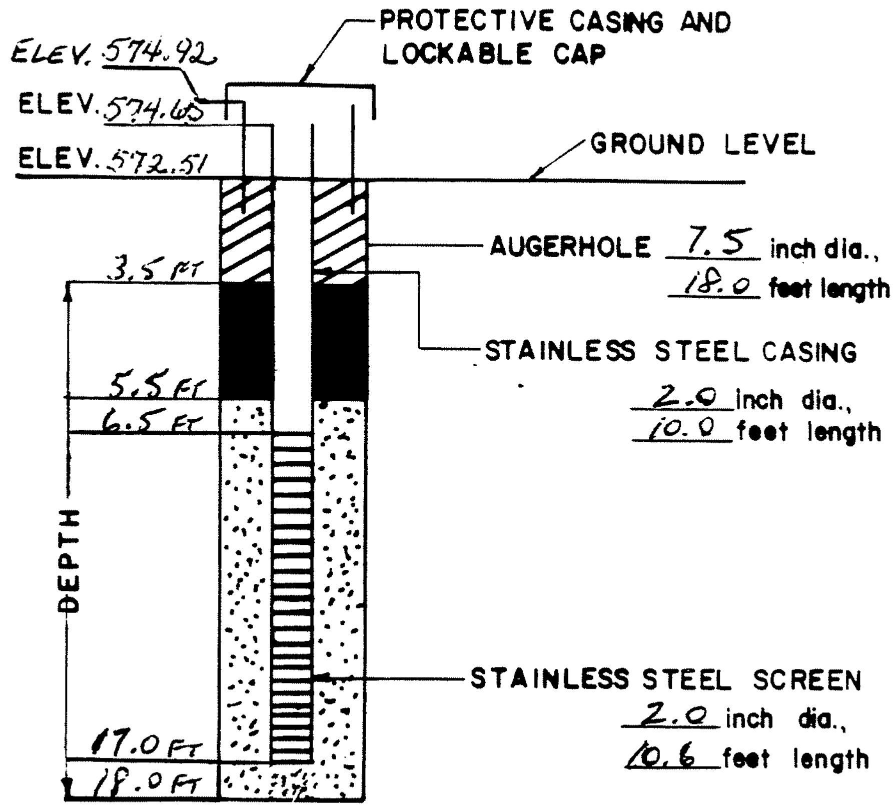
Supervising Geologist: ANDRE LAPRES

Drilling Company: R & R INTERNATIONAL

Drillers: JIM ROCKFORD, CHUCK BEAMER, BILL MARKS

Rig make / model: CME-75

Date: Oct 14, 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 17.0	FILL
17.0 - 18.0	TILL

WELL DESIGN

CASING MATERIAL

Surface: 4 IN STEEL PROTECTOR

Monitor: 304 STAINLESS STEEL

SCREEN MATERIAL

Type: 304 STAINLESS STEEL

Slot Size: .010 IN

FILTER MATERIAL

Type: "BEST" #4 SILICA SAND   Setting: 5.5 - 18.0 FT

SEAL MATERIAL

Type: "PIEZOMETER" BENTONITE PELLETS   Setting: 3.5 - 5.5 FT

COMMENTS:

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client: NYSDEC

Location: GRATWICK - RIVERSIDE PARK

Project Nº: 35149

URS   URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

SHALLOW MONITORING WELL CONSTRUCTION DETAILS

WELL Nº: GW-9(S)

A-2398

DRILLING SUMMARY

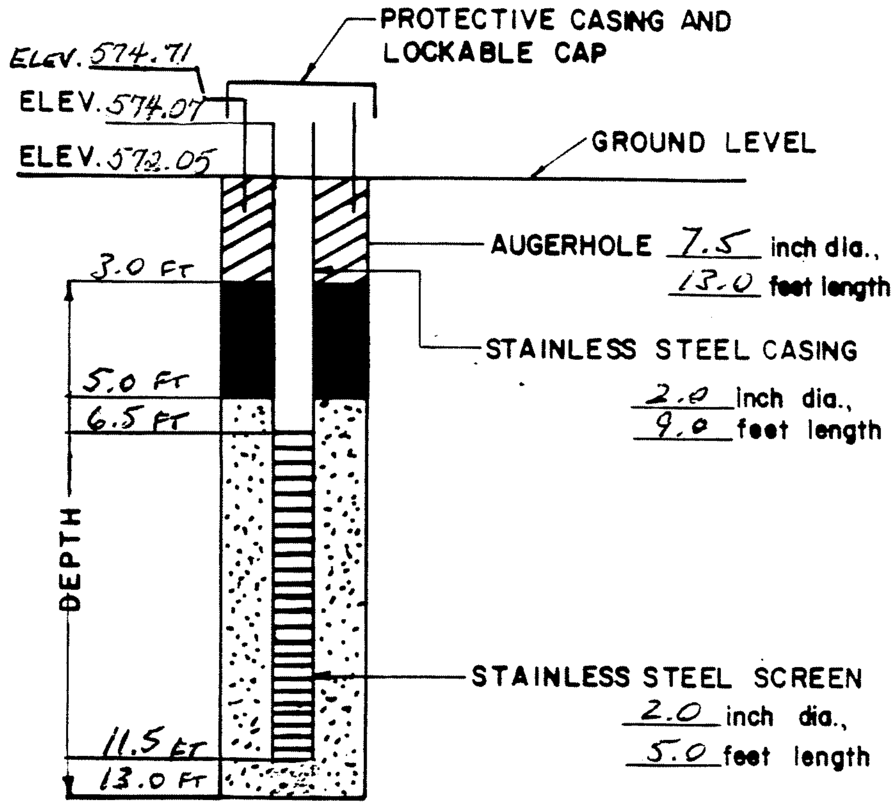
Supervising Geologist : Andre LaPres

Drilling Company: R&R International

Drillers : Jim Rochford
Chuck Beamer
Bill Marks

Rig make / model : CME - 75

Date : Oct 14 1987



GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 0.5	Topsoil
0.5 - 11.5	Fill
11.5 - 13.0	Silty Clay

WELL DESIGN

CASING MATERIAL

Surface : 4 in Steel Protector

Monitor : 304 Stainless Steel

SCREEN MATERIAL

Type : 304 Stainless Steel

Slot Size : .010 in

FILTER MATERIAL

Type : "Best" #4 Silica Sand Setting : 5.0-13.0 Ft

SEAL MATERIAL

Type : "Piezometer" Bentonite Pellets Setting : 3.0 - 5.0 Ft

COMMENTS :

LEGEND

- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC	Location : Gratwick - Riverside Park	Project No : 35149
URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	SHALLOW MONITORING WELL CONSTRUCTION DETAILS	WELL No : GW-10(S)

A-2398

DRILLING SUMMARY

Supervising Geologist : ANDRE LAPRES

Drilling Company: R&R INTERNATIONAL

Drillers : JIM ROCHFORD
CHUCK BEAMER
BILL MARKS

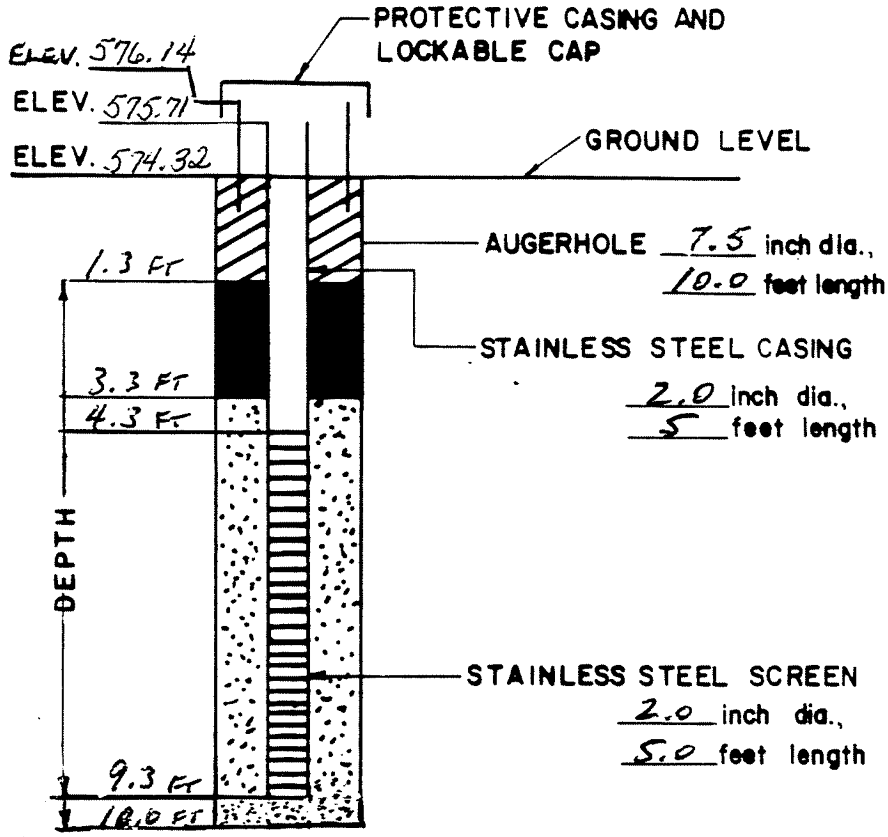
Rig make / model: CME-75

Date : OCT 12, 1987

GEOLOGIC LOG

depth (ft.)	lithology
0.0 - 9.3	FILL
9.3 - 10.0	CLAYEY SILT

WELL DESIGN



CASING MATERIAL	SCREEN MATERIAL	FILTER MATERIAL
Surface : 4 IN STEEL	Type : 304 STAINLESS STEEL	Type : "BEST" SILICA SAND Setting : 3.3 - 10.0 FT
Monitor : 304 STAINLESS STEEL	Slot Size : .010 INCH	SEAL MATERIAL Type : "PIEZOMETER" BENTONITE PELLETS Setting : 1.3 - 3.3 FT

COMMENTS:

LEGEND
- CEMENT . BENTONITE GROUT
- BENTONITE SEAL
- SILICA SANDPACK

Client : NYSDEC | Location : GRATWICK - RIVERSIDE PARK | Project No : 35149

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

SHALLOW MONITORING WELL CONSTRUCTION DETAILS

WELL No : GW-11(S)

A-2398

APPENDIX C.2
MONITORING WELL AND PIEZOMETER DEVELOPMENT

C.2.1 INTRODUCTION

The well development/purging logs which follow present data recorded during well development. The form was used by field staff to calculate the volume of standing water within each well and to record measured values for pH, conductivity and turbidity of the discharge water as the well was evacuated. Development of each well was continued until the discharge water was judged to be relatively sediment free (turbidity value of <100 NTU).

C.2.2 URS WELL DEVELOPMENT/PURGING LOGS

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11/2/87

WELL NO.: GW-1S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.08'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 8.90'

④ VOLUME OF WATER IN CASING (GAL.) 1.22

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	3	4	5							
pH	7.79	7.86	7.60	7.87							
Conductiv.	680	770	770	770							
Turbidity	22	OS	OS	OS							

COMMENTS:

5.5 gal removed
Pumped dry, slow recharge

A-2347

OS = Off Scale

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35749

STAFF: RAF/KSK

DATE: 11/11/87

WELL NO.: GW-1S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.08'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 11.96'

④ VOLUME OF WATER IN CASING (GAL.) 0.7 gal

V = 0.0408 (②)^2 x (① - ③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	4							
pH	7.67	7.79	7.72	7.72							
Conductivity	820	810	810	790							
Coloration	yellowish	clear	slightly clear	yellow tint							
H2O lev. after volume rem.	11.96'	13.12'	14.22'	Dry							

COMMENTS:

No turbidity meter.
3.0 gal removed.
Pumped dry, slow recharge.

A-2347

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 12-10-87

WELL NO.: 1S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.08'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 4.93'
④ VOLUME OF WATER IN CASING (GAL.) ~~[illegible]~~ 1.9 gal

$V = 0.0408\,(②)^2 \times (①-③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3							
pH	7.34	7.57	7.46	7.62							
Conduc.	1140	1180	1150	1160							
Appear.	orange	clear		tan							
Turbidity	OS	17	34	OS							

COMMENTS:
Pumped dry with ISCO after 3 well volumes (5.75 gal).
Slow recharge.

A-2347

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11/2/87

WELL NO.: GW-1D

① TOTAL CASING AND SCREEN LENGTH (FT.): 48.58'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 14.92'

④ VOLUME OF WATER IN CASING (GAL.) 5.72

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4						
pH	9.07	8.92	8.79	8.27	8.38						
Conductiv.	1980	2120	2150	2160	2170						
Turbidity	OS	58	14	6.8	16						

COMMENTS:
20 gal removed
Immediate recharge

A-2347

OS = off scale

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11/3/87

WELL NO.: GW-1D

① TOTAL CASING AND SCREEN LENGTH (FT.): 48.58'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 14.72'

④ VOLUME OF WATER IN CASING (GAL.) 5.76

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	0	1	2	3	4	5	6			
pH	11.43	8.49	7.93	7.32	7.27	8.01	8.79			
Conductivity	3670	2150	2140	2170	2170	2190	2190			
Turbidity	74	15	20	6	5	14	58			
Water Level After Vol. Removed	14.72	14.76	14.78	14.77	14.72	14.74	14.70			

COMMENTS:

35 gal removed

Immediate recharge

Tubing was moved up higher in the well casing after each volume was removed.

A-2347

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35749

STAFF: RAF/KSK

DATE: 11/3/87

WELL NO.: GW-2S

1. TOTAL CASING AND SCREEN LENGTH (FT.): 16.00'
2. CASING INTERNAL DIAMETER (in.): 2"
3. WATER LEVEL BELOW TOP OF CASING (FT.) 4.99'
4. VOLUME OF WATER IN CASING (GAL.) 1.87

$V = 0.0408\,(2)^2 \times (1 - 3) =$ ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4						
pH	7.26	7.80	7.29	7.31	7.27						
Conductivity	1700	1710	1950	1910	1870						
Turbidity	—	—	—	—	—						
Water Level After Vol. Rem.	4.99	9.32	12.33	14.04	Dry						

COMMENTS:
7.5 gal removed
Slow recharge
Tubing moved up during evacuation, then down.
Turbimeter - Battery dead

A-2347

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Grotwick-Riverside Park

PROJECT NO.: 35149

STAFF: LAF/KSK

DATE: 11-4-87

WELL NO.: GW-2S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.00'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 5.43'

④ VOLUME OF WATER IN CASING (GAL.) 1.80

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4						
pH	7.27	7.27	7.30	7.37	7.52						
Conductivity	1970	1910	1940	1940	1980						
Turbidity	all	off	scale	→							
Water Level After Vol. Rem.	5.43'	11.21'	12.84'	14.31'	Dry						

COMMENTS:
Moved tubing up, then down well casing.
Evacuated to dryness
Elevation - 7.42' - 2½ hr. after last evacuation.
Removed 7.2 gal.

A-2347

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: KSK

DATE: 11-9-87

WELL NO.: 2S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.00

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 5.20'

④ VOLUME OF WATER IN CASING (GAL.) 1.83 gal

V = 0.0408 (②)^2 x (① - ③) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4						
PH	6.91	7.02	6.94	6.99	6.92						
Conductivity	1900	1870	1920	1880	1900						
Turbidity	OS	62	OS	OS	OS						
water Left Aft. Vol Remov	5.20'	11.12'	12.66'	14.15'	Dry						

COMMENTS:

Removed 8 gallons to dryness

1 hour 50 min later pumped 5 gallons to dryness

A-2347

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Bratwick Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 12-10-87

WELL NO.: 2S

1. TOTAL CASING AND SCREEN LENGTH (FT.): 16.00'
2. CASING INTERNAL DIAMETER (in.): 2"
3. WATER LEVEL BELOW TOP OF CASING (FT.) 5.72'
4. VOLUME OF WATER IN CASING (GAL.) 1.75 gal

V = 0.0408 (2)^2 x (1 - 3) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
pH	—	—									
Conduc.	—	—									
Turbidity	5.1	2.1									
Appearance	clear, sl. oil sheen										

COMMENTS:
Pumped dry with ISCO after one volume, (1.75 gal).
Slow recharge.

A-2347

URS	URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11/3/87

WELL NO.: GW-2D

① TOTAL CASING AND SCREEN LENGTH (FT.): 47.10'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 12.90'

④ VOLUME OF WATER IN CASING (GAL.) 5.81

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
pH	7.56	7.10									
Conductivity	1430	2350									
Turbidity	—	—									
Water Level After Vol. Rem	12.90'	13.12									

COMMENTS:
Pumped very slowly because pump battery was very low.
~~2nd~~ Turbimeter battery died.
5.8 gal removed

A-2347

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Grantwick = Riverside Park
PROJECT NO.: 35149
STAFF: RAF / KSK
DATE: 11-4-87

WELL NO.: GW-20

(1) TOTAL CASING AND SCREEN LENGTH (FT.): 47.10'
(2) CASING INTERNAL DIAMETER (in.): 2"
(3) WATER LEVEL BELOW TOP OF CASING (FT.) 12.75'
(4) VOLUME OF WATER IN CASING (GAL.) 5.84

$V = 0.0408\,(②)^2 \times (①-③) =$ ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6	7	8	9	10
pH	7.49	7.33	7.28	7.28	7.35	7.40	7.15	7.23	7.23	7.22	7.20
Conductivity	1620	2430	2460	2430	2440	2430	2410	2420	2390	2370	2380
Turbidity	23	off scale			198	54	off scale			150	30
Water Level Aft. Vol. Rem.	12.75	12.78	12.78	12.79	12.59	12.80	13.96	14.00	13.55	13.90	–

COMMENTS:

110 gal removed.
Volume #9 - 2 min 20 sec. - pumped 5 gal with Fuji-Robins pump.

A-2347

URS | URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11-4-87

WELL NO.: GW-2D cont.)

① TOTAL CASING AND SCREEN LENGTH (FT.): ______

② CASING INTERNAL DIAMETER (in.): ______

③ WATER LEVEL BELOW TOP OF CASING (FT.) ______

④ VOLUME OF WATER IN CASING (GAL.) ______

$V = 0.0408 (②)^2 \times (①-③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	11	12	13	14	16	18	19				
pH	7.24	7.23	7.23	7.22	7.21	7.20					
Conductivity	2340	2370	2390	2390	2370	2410					
Turbidity	46	26	23	17	28	20					
Water Level Aft. Vol. Rem.	13.64	—	—	—	—	—	12.87				

COMMENTS:

A-2347

URS Company, Inc.
CONSULTANTS ENGINEERS
NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12-10-87

WELL NO.: 3S

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

① TOTAL CASING AND SCREEN LENGTH (FT.): 13.70'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.16'

④ VOLUME OF WATER IN CASING (GAL.) ~0.75 gal

V = 0.0408 (②)^2 x (①-③) = ________ GAL.

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	0	1	2	3	4	5	6	7		
pH	Very black & thick.	10.11	9.78	9.13	10.44	10.71	10.57	10.82		
Conduc.		4150	4440	4600	4800	4880	4780	5030		
Turbid.		Black		Dark gray	Black	→				
Appear		off scale			→					

COMMENTS: (5.25 gal)
Removed 7 volumes with ISCO.
Fairly rapid recharge.

A-2347

URS | URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12-14-87

WELL NO.: 3S

① TOTAL CASING AND SCREEN LENGTH (FT.): 13.70'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.21'

④ VOLUME OF WATER IN CASING (GAL.) 0.76 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ _______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6	7	8	9	10
Turbidity	05	05	120	86	68	60	48	27	18	~~10~~ 19	25
Appear	black	dark gray	gray	light gray			clear with black solids				
H_2O Level	9.21'								10.35'		
~~[illegible]~~	11	12	13	14							
Turbidity	24	20	72	46							

18.

COMMENTS:

Removed 18 well volumes (13.5 gal) with ISCO.

A-2347

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12/9/87

WELL NO.: 4S

① TOTAL CASING AND SCREEN LENGTH (FT.): 15.50'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 12.15'

④ VOLUME OF WATER IN CASING (GAL.) 0.56 gal/ft

V = 0.0408 (②)^2 x (①-③) = 0.5 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	0	1	2	2	3	4	5	6		
pH	10.30	10.41	10.71	10.48	10.93	11.02	—	—		
Conductivity	2760	2750	2730	2760	2800	2830	—	—		
Turbidity	All off scale									
Appear.	Brown Hazy tan									

COMMENTS:
Went dry after 2 well volumes removed.
3 gal (6 well volumes) removed with
ISCO pump.

A-2347

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Bratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12-10-87

WELL NO.: 45

① TOTAL CASING AND SCREEN LENGTH (FT.): 15.50'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 12.27'

④ VOLUME OF WATER IN CASING (GAL.) 0.5 gal

V = 0.0408 (②)^2 x (① - ③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	2	3	4	5				
pH	9.41	10.16	10.91	10.45	10.58	10.65	10.41				
Conductivity	2720	2740	2750	2750	2730	2750	2800				
Turbidity	64	off	scale			142	-				
Appearance	whitish hazy	light tan	brown	tan	tan	clear	clear				

COMMENTS:
Pumped dry with ISCO every 2 volumes.
Removed 2.5 gal (5 volumes).
Slow recharge.

A-2347

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 12-14-87

WELL NO.: 4S

① TOTAL CASING AND SCREEN LENGTH (FT.): ~~12.42'~~ 15.50'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 12.42'
④ VOLUME OF WATER IN CASING (GAL.) 0.5 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3							
pH	10.57	10.61	9.52	-							
Conductiv.	2690	2730	2700	-							
Turbidity	05	05	14	86							
Appear.											

COMMENTS:
Pumped dry with ISCO every one (1) well volume.
Total volume removed - 1.5 gal

A-2347

URS | URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: Kevin Kearney

DATE: 11-30-87

WELL NO.: 5S

① TOTAL CASING AND SCREEN LENGTH (FT.): 14.60'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 5.16'

④ VOLUME OF WATER IN CASING (GAL.) 1.6 ≈ 1.5

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
PH	11.99	12.04									
Conductivity	3760	3690									
APPEAR. Turbidity	light green OS	black OS									

COMMENTS:
pumped from bottom of well, sample had a surfur odor. both samples were off scale (NTU'S)

A-2347

URS | URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: K.S.K

DATE: 12-7-87

WELL NO.: 5 S

① TOTAL CASING AND SCREEN LENGTH (FT.): 14.60'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 5.29'

④ VOLUME OF WATER IN CASING (GAL.) 1.58 gal

V = 0.0408 (②)^2 x (①-③) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	Initial 0	1								
PH	11.91	12.05								
Conductivity	5530	5630								
Appear turbidity	05 green	62 light green								

COMMENTS: Used Isco well pump. moved tubing up & down well casing, removed 1.75 gal to dryness. sample had a sulfur odor. slow recharge.

A-2347

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 12-10-87

WELL NO.: 55

① TOTAL CASING AND SCREEN LENGTH (FT.): 14.60'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 4.81'
④ VOLUME OF WATER IN CASING (GAL.) ~1.67 gal

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
pH	11.88	11.91									
Conductivity	5920	5820									
Turbidity	43	60									
Appearance	sl. hazy	clear									

COMMENTS:
Very slow recharge.
Pumped dry with ISCO after one well volume.
1.67 gal removed.

A-2347

URS — URS Company, Inc. CONSULTANTS ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12-14-87

WELL NO.: 5S

① TOTAL CASING AND SCREEN LENGTH (FT.): 14.60'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 5.41'

④ VOLUME OF WATER IN CASING (GAL.) 1.56gal ~ 1.5gal

$V = 0.0408\,(②)^2 \times (①-③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
	0	1	2							
pH	12.26	12.28	-							
Conductiv.	5770	5770	-							
Turbidity	18	6.4	68							
Appear.	green tint, clear									

COMMENTS:
Pumped dry with ISCO every one (1) well vol.
Total volume removed - 3gal

A-2347

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11-10-87

WELL NO.: GW-5D

① TOTAL CASING AND SCREEN LENGTH (FT.): 69.96'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 7.27'

④ VOLUME OF WATER IN CASING (GAL.) 10.66 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)											
	0	1	2	3	4	5	6	7	8	9	10	15
pH	9.29	7.27	7.41	7.38	7.27	7.31	7.17	7.35	7.32	7.50	7.48	7.5
Conductivity	3240	2830	2980	3070	3090	3090	3020	2930	3060	3080	3070	304
Turbidity	120	off Scale		192	36	164	Off Scale		→	No meter		—
Water Level After Vol. Rem.	7.27	7.34	7.32	7.31	7.31	7.32	7.44	7.48	7.48	7.38	7.40	7.5
Elapsed Time	[illegible]	19m. 37s.	18m. 29s.	17m. 43s.	17m. 41s.	18m. 0 s.	—	4m. 33s.	4m. 16s.	4m. 20s.	4m. 36s.	21 52

COMMENTS:

Volume 1-5 – ISCO
Volume 6-15 – Fuji
Strong S^{2-} odor.

165 gal removed.
Moved tubing up + down in well casing.

A-2347

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11/11/82

WELL NO.: GW-5D

① TOTAL CASING AND SCREEN LENGTH (FT.): 69.96'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 7.31'

④ VOLUME OF WATER IN CASING (GAL.) 10.65 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	5	10								
pH	7.08	7.23	7.26								
Conductivity	3200	3070	3110								
Coloration	light gray										
Depth After Volume Removed	7.31'	7.32'	7.35'								
Elapsed Time	-	26 min.	26 min. 23 s.								

COMMENTS:
No turbidity meter.
110 gal removed.
Moved tubing up & down in well casing.

A-2347

URS Company, Inc.
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NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149-00-001

STAFF: Kevin Kearney

DATE: 11-23-87

WELL NO.: 65

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.34'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 10.05

④ VOLUME OF WATER IN CASING (GAL.) ~~1.06~~ 1.0 gal

V = 0.0408 (②)^2 x (①-③) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
PH	10.31	10.64									
Conduct	1440	1730									
APPear Turbidity	black	black									

COMMENTS: pumped dry after 1 well volume. 2 1/8 gallons pumped. slow recharge. sample was black with sand particules.

A-2347

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149-00-001

STAFF: Kevin Kearney.

DATE: 11-24-87

WELL NO.: 65

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.34'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.60

④ VOLUME OF WATER IN CASING (GAL.) 1.14 = 1 gal

$V = 0.0408\,(②)^2 \times (①-③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
VOLUMES	0	1	2	3	4	Lunch	0	1	2	3	
PH	10.97	11.07	11.02	11.03	11.05		10.82	10.77	10.80	10.91	
Conduct	1650	1650	1620	1640	1650		1640	1600	1600	1600	
Appear turbidity	black 05	black 05	black 05	clear 28	clear 30		tan 88	tan 112	tan 74	clear 50	

COMMENTS:
pumped sample from bottom of well
sample was black for 2 well volumes
clear up last 2 well volumes.
was recharging faster than day before.

A-2347

URS Company, Inc.
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NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: K.S.K R.A.F

DATE: 12-8-87

WELL NO.: 6S

① TOTAL CASING AND SCREEN LENGTH (FT.): 16.34'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 10.05'

④ VOLUME OF WATER IN CASING (GAL.) 1.06 ≈ 1 gal

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
well volume	0	1	3	4	5	6	8				
PH	11.30	11.13	10.66	10.56	10.75	10.63	10.71				
Conductivity	2650	2220	2320	2340	2370	2370	2350				
Appear turbidity	blue tint 24	Gray 144	clear 16	clear 59	slight hazy 23	clear 4.2	clear 2.2				

COMMENTS: used Isco well pump. we shut pump off after 3 well volumes to let well recover. well recovered fully in 7 min pumped 5 more well volumes. total 8 volumes ≈ 8 gallons. slow recharge.

A-2347

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149-00-001

STAFF: Kevin Kearney

DATE: 11-24-87

WELL NO.: 6 I

① TOTAL CASING AND SCREEN LENGTH (FT.): 29.50'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 15.87'

④ VOLUME OF WATER IN CASING (GAL.) 2.3 = 2.5 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
PH	10.18	10.08									
Conduc	2130	2100									
turbidity	brown 05	brown 05									

COMMENTS:
pumped from bottom of well, sample was brown
pumped dry after 2 gallons.

A-2347

URS Company, Inc.
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NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF

DATE: 11-16-87

WELL NO.: GW-6D

① TOTAL CASING AND SCREEN LENGTH (FT.): 48.08'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 10.00'

④ VOLUME OF WATER IN CASING (GAL.) 6.47≈6.5gal

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6				
pH	7.74	7.21	7.24	7.36	7.36	7.34	7.32				
Conduc.	1420	2360	2410	2380	2420	2420	2400				
Appear/Turbidity	sl. haz. clear	hazy, tan	84	38	22	68	40				
H_2O lev. after volume rem.	10.00'	10.00'	10.00'	10.00'	10.00'	10.00'	10.00'				

COMMENTS:
Didn't have turbidity meter on site until 2nd well volume.
Kept moving tubing up in well casing. Evacuated 6 well volumes & then pumped directly into drum to make total volume 55 gal.
Constant recharge.

A-2347

URS — URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149-00-001

STAFF: Kevin Kearney

DATE: 11-23-87

WELL NO.: GW-6D

① TOTAL CASING AND SCREEN LENGTH (FT.): 48.08'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.70'

④ VOLUME OF WATER IN CASING (GAL.) 6.52 ≈ 6.5 gal

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5					
PH	7.36	7.03	6.93	6.84	6.85	6.76					
Conduc	1430	2710	2690	2690	2690	2680					
Appear/ Turbidity	clear	light tan	clear	clear	clear	clear					

COMMENTS:
Didnt have Turbidity meter
left tubing on bottom of well casing, Evacuted 5 well volumes. sample was clear.

A-2347

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park.

PROJECT NO.: 35149

STAFF: K.S.K

DATE: 12-1-87

WELL NO.: 7 S

① TOTAL CASING AND SCREEN LENGTH (FT.): 7.42

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 15.20

④ VOLUME OF WATER IN CASING (GAL.)

V = 0.0408 (②)^2 x (① - ③) = 1.25 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	Initial 0	1	2	3							
PH	4.72	4.76	4.76	4.74							
Conductivity	14,610	11,700	11,680	11,670							
turbidity	OS brown	OS tan	OS tan	OS tan							

COMMENTS:
pumped well dry after 3 well volumes
5 gallons removed, used Isco well pump.

A-2347

URS	URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY	WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12/9/87

WELL NO.: 7S

① TOTAL CASING AND SCREEN LENGTH (FT.): 15.20'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 7.30'

④ VOLUME OF WATER IN CASING (GAL.) 1.34 gal/v

$V = 0.0408 (②)^2 \times (① - ③) =$ 1.33 GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	7	8				
pH	4.61	4.72	4.83	4.87	5.11	3.73	4.71				
Conductivity	14450	9770	12360	13740	13610	7460	10750				
Turbidity	116	50	70	28	37	90	166				
Appear.	yellow		black & yellow	yellow tint	tan	tan					

COMMENTS:

Went dry after 4 well volumes removed. 10.6 gal (8 well volumes) removed with ISCO pump.

A-2347

URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: K.S.K

DATE: 12-1-87

WELL NO.: 8 S

① TOTAL CASING AND SCREEN LENGTH (FT.): 17.54

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 8.52'

④ VOLUME OF WATER IN CASING (GAL.) 1.5 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	Initial 0	1	2	3	4	5	6				
PH	11.17	11.15	11.14	11.14	11.14	11.12	11.11				
Conductivity	3630	3960	3930	3910	3910	3900	3920				
turbidity	black 05	tan 05	light tan 86	light tan 05	clear 20	light tan 81	light tan 60				

COMMENTS: removed 9 gallons 6 well volumes. moved tubing up & down well casing. Constant recharge.
d used Isco well pump.

A-2347

URS Company, Inc.
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NEW YORK NEW JERSEY

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: K.S.K

DATE: 12-7-87

WELL NO.: 8S

① TOTAL CASING AND SCREEN LENGTH (FT.): 17.54'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.04'

④ VOLUME OF WATER IN CASING (GAL.) 1.44 ≈ 1.5 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)									
well volumes	Initial 0	1	2	3	4	5		10		
PH	11.97	12.04	12.10	12.10	12.10	12.13		12.08		
Conductivity	3980	3990	3990	3940	4000	4020		4000		
Appear turbidity	tan 05	clear 3.1	clear 11	tan 05	clear 16	clear 2.4		clear 1.3		

COMMENTS: pumped with Isco well pump
pumped 10 well volumes out 15 gallons
Constant recharge.

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Grotwick-Riverside Park
PROJECT NO.: 35749
STAFF: RAF/KSK
DATE: 11-5-87

WELL NO.: GW-9S

① TOTAL CASING AND SCREEN LENGTH (FT.): 20.40'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.28'
④ VOLUME OF WATER IN CASING (GAL.) 1.89 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6	7	8	9	10
pH	11.11	10.84	10.74	10.85	10.97	11.02	11.07	11.06	11.05	11.04	11.07
Conductivity	1610	1790	1850	1880	1900	1910	1930	1920	1920	1910	1910
Turbidity	off Scale			152	off Scale			66	25	20	32
Water Level Aft. Vol. Removal	9.28'	9.28'	9.30'	9.30'	9.30'	9.30'	9.30'	9.30'	9.27'	9.30'	9.30'

COMMENTS:
115 gal removed.
Continuous recharge.
Removed 10 well volumes (18.9 gal) in 5 min. & 12 sec. & water level remained the same

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11-5-87

WELL NO.: GW-9S cont.)

① TOTAL CASING AND SCREEN LENGTH (FT.): ______

② CASING INTERNAL DIAMETER (in.): ______

③ WATER LEVEL BELOW TOP OF CASING (FT.) ______

④ VOLUME OF WATER IN CASING (GAL.) ______

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	11	12	22	32	32	42	52	62			
pH	11.07	11.05	11.06	11.09	11.34	11.23	11.20	11.28			
Conductivity	1870	1880	1870	1840	1930	1880	1830	1850			
Turbidity	25	off Scale	26	8	off scale	27	16	86			
Water Level After Vol. Rem.	9.30'	9.29'	9.34'	9.34'	9.28'	9.31'	9.33'	9.32'			

COMMENTS:

A couple hours later.

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Grantwick - Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 11-6-87

WELL NO.: GW-10S

① TOTAL CASING AND SCREEN LENGTH (FT.): 14.74'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.20'
④ VOLUME OF WATER IN CASING (GAL.) 0.94 gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6	7	8	9	10
pH	11.04	11.26	11.43	11.10	11.12	11.14	11.13	11.26	11.25	11.30	11.34
Conductivity	1670	1920	2100	2210	2240	2310	2350	2370	2340	2340	2360
Turbidity	Off Scale						116	152	100	80	34
Water Level Aft. Vol. Remov.	9.20	9.21	9.22	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.22

COMMENTS:
165 gal. removed. Constant recharge.
Constant recharge. - Water level was only lowered max. of 0.09' when pumping constantly with Fuji-Robins pump.
Moved tubing up and down in well casing throughout development.

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick Riverside Park

PROJECT NO.: 35749

STAFF: RAF/KSK

DATE: 11-6-87

WELL NO.: GW-105 cont.)

1. TOTAL CASING AND SCREEN LENGTH (FT.): ______
2. CASING INTERNAL DIAMETER (in.): ______
3. WATER LEVEL BELOW TOP OF CASING (FT.) ______
4. VOLUME OF WATER IN CASING (GAL.) ______

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	15	20	25	30	60	70	80	100	120	175	
pH	11.30	11.32	11.42	11.48	11.52	11.95	12.00	12.02	12.05	11.95	
Conductivity	2360	2390	2350	2420	2400	2400	2380	2360	2370	2400	
Turbidity	30	14	128	9	Off Scale		63	72	136	106	
Water Level Aft. Vol. Rem.	9.21	9.21	9.21	9.21	9.23	—	—	9.24	—	9.29	

COMMENTS:

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 11-5-87

WELL NO.: GW-11S

① TOTAL CASING AND SCREEN LENGTH (FT.): 11.43'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.89

④ VOLUME OF WATER IN CASING (GAL.) 0.26

V = 0.0408 (②)^2 x (①-③) = ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
pH	11.97	12.02									
Conductivity	2300	2180									
Turbidity	OS	OS									
Water Level Aft. Vol. Removed	9.89	Dry									

COMMENTS:
0.26 gal removed
Evacuated to dryness immediatly.
Slow recharge.

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OS = Off scale

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick Riverside Park
PROJECT NO.: 35149
STAFF: RAF/KSK
DATE: 11-6-87

WELL NO.: GW-11S

① TOTAL CASING AND SCREEN LENGTH (FT.): 11.43'
② CASING INTERNAL DIAMETER (in.): 2"
③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.70'
④ VOLUME OF WATER IN CASING (GAL.) 0.29gal

$V = 0.0408\,(②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
DATE	11-6 →		11-9								
	0	1									
pH	12.00	12.08									
Conductivity	2300	2330									
Turbidity	Off Scale										
Water Level Aft. 1 bl. Remov	9.70'	Dry									

COMMENTS:
Pumped dry immediatly, 0.29 gal removed.
Slow recharge.
OS = Off scale

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick - Riverside Park

PROJECT NO.: 35149

STAFF: KSK

DATE: 11-9-87

WELL NO.: GW-11S

① TOTAL CASING AND SCREEN LENGTH (FT.): 11.43'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.90

④ VOLUME OF WATER IN CASING (GAL.) 0.26 gal

$V = 0.0408 (②)^2 \times (① - ③) =$ ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	2									
PH	11.83	11.87									
Conductivity	2320	2250									
Turbidity	05	05									
water left Aft. Vol. Remov	9.90	Dry									

COMMENTS:
0.48 gal removed
Evacuated to dryness
Slow recharge

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35749

STAFF: RAF/KSK

DATE: 11-11-87

WELL NO.: GW-11S

① TOTAL CASING AND SCREEN LENGTH (FT.): 11.43'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 9.95'

④ VOLUME OF WATER IN CASING (GAL.) 0.25gal

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1									
pH	11.64	11.87									
Conductivity	2140	2070									
Coloration	tan	tan									
H_2O level after volume removal.	9.95	Dry									

COMMENTS:
Too dry no recharge.
0.25 gal removed.
No turbidity water.

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WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: Gratwick-Riverside Park

PROJECT NO.: 35149

STAFF: RAF/KSK

DATE: 12-10-87

WELL NO.: 11S

① TOTAL CASING AND SCREEN LENGTH (FT.): 11.43'

② CASING INTERNAL DIAMETER (in.): 2"

③ WATER LEVEL BELOW TOP OF CASING (FT.) 8.90

④ VOLUME OF WATER IN CASING (GAL.) ~0.5 gal

V = 0.0408 (②)^2 x (①-③) = ______ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										
	0	1	2	3	4	5	6	7	8	9	10
pH	11.95	11.97	11.95	11.93	11.93	11.91	11.90	11.84	11.84	11.84	11.81
Conductivity	2910	3010	2900	2650	2630	2550	2490	2620	2570	2550	2500
Turbidity	OS	128	OS	14	84	20	7.4	5.2	6.0	9.2	8.6
Appearance	gray tint	tan tint	tan	clear	sl. tan tint	clear					

COMMENTS:
Removed total of 5 gal (10 volumes) with ISCO.
Went dry after 2 volumes, then 4 more, then 4 more.
Rapid recharge.

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APPENDIX C.3
HYDRAULIC CONDUCTIVITY TESTING

C.3.1 INTRODUCTION

Hydraulic conductivity tests were performed on each monitoring well and piezometer to determine in-situ permeability of the subsurface formation screened at each location. Testing methods, and results are presented in the following sections. Additionally, triaxial permeability test were performed on selected Shelby tube samples recovered from the clay confining unit underlying the site and are detailed in Appendix B.3 (Geotechnical Testing Results).

C.3.2 SLUG TESTS

Hydraulic conductivity values of the geologic units were determined by analyzing the water level response in the monitor following an instantaneous change in water level. Water level response was monitored by either a HERMIT Environmental Data Logger Model SE10000B and Pressure Transducer Model PTX 160/D-0241 or manually with an electronic water level meter for those wells that were slow to recover. Hydraulic conductivity tests were performed by the slug test method. Where the data logger/transducer was used, the transducer was first inserted near the bottom of the well, and the water level allowed to stabilize. A 2- or 5-foot stainless steel slug was then inserted into the well until it was totally submerged to achieve a displacement (slug insertion). Water level readings were recorded by the data logger over either a minimum 10-minute period or until the water levels had recovered at least 70% of their maximum displacement. The slug was then removed and the change in water levels again recorded for either a minimum 10-minute period or until the levels had recovered to at least 70% of the maximum displacement (slug withdrawal). In general, slug tests for the monitoring wells took less than an hour. The transducer was thoroughly rinsed with deionized water between wells. Slugs were rinsed with acetone, hexane, acetone again, and deionized water between wells.

Two sets of results were generated from each well to calculate hydraulic conductivity values. For wells where the entire well screen is contained within the saturated zone, both slug insertion and slug withdrawal results were used. For wells where the screen crossed the saturated/unsaturated zone, only slug withdrawal results, which measure recovery in the saturated zone, were used.

Due to the relatively low permeability of the screened unit in the intermediate piezometers, slug test recoveries were measured, by initially pumping down the water level and observation of subsequent water level recover over a number of days.

It was not possible to slug test the four deep bedrock wells, since recoveries were nearly instantaneous. Hydraulic conductivity values were therefore approximated by lowering the water levels by pumping and then monitoring water level recovery using the data logger and transducer. Recoveries were then recorded for a minimum 10-minute period or until the water level reached steady state. Two tests were performed in each well.

Hydraulic conductivity values were calculated using the formulas developed by Hvorslev (1951) as referenced in Lambe & Whitman (1969). Both variable head and basic time lag equations were used as a check. Figures C3-1 (a) and (b) shows typical slug test data collected during a manual field test. Figure C3-2 illustrates the analysis of the data using the Hvorslev method including calculations used to establish a value of hydraulic conductivity (K) for the formation in which the monitoring well sand pack is located. Copies of all slug test analyses are contained in the project file.

The results of all slug test analyses are provided in Table C.3-1. The table lists calculated hydraulic conductivities (cm/sec) as established by long-term and short-term recovery analysis and by slug insertion and withdrawal test analysis. Averages of slug in and slug out results using the basic time lag equation are summarized in the text (Section 4.1.6).

Figure C.3-1 (a)

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SLUG TEST FIELD SHEET

PROJECT: NUMBER 35149 NAME Gratwick-Riverside Park

BOREHOLE: NO. 7 MONITOR NO. GW-7I

MONITOR: NOMINAL DIA. (in.) 2+ INSIDE DIA. (in.) 2.0 MATERIAL PVC

SCREEN: LENGTH (ft.) 2.0 INSIDE DIA. (in.) 2.0 MATERIAL PVC

FILTER PACK: LENGTH (ft.) 5.0 DIAMETER (in.) 7.5 MATERIAL Sand

TEST: START DATE 2/2/88 START TIME 8:20 a.m.

STATIC LEVEL, H (ft. BTOP) 7.69 INITIAL LEVEL, Ho (ft. BTOP) 8.92

COMPLETED BY: K.K. CHECKED BY: GHF

DATE	TIME t (h:m:s)	DEPTH h (ft. BTOP)	DATE	TIME t (h:m:s)	DEPTH h (ft. BTOP)
2/2/88	8:30 a.m.	8.92			
	8:30:30	8.92			
	8:31	8.91			
	8:32	8.90			
	8:34	8.90			
	8:39	8.90			
	9:35	8.88			
	5:18 p.m.	8.76			
2/3/88	9:36 a.m.	8.62			
	4:50 p.m.	8.56			
2/4/88	7:30 p.m.	8.37			
2/5/88	8:14 a.m.	8.32			
	5:47 p.m.	8.26			
2/8/88	8:12 a.m.	8.14*			
	5:24 p.m.	8.12			
2/9/88	7:53 a.m.	8.08			

COMMENTS: Slug withdrawal test

$h = 7.69 - 0.37\ (7.69-8.92) = 8.15$ ft. BTOP

* = 63% recovery

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NOTE: (1) Test may be stopped when $h = H - 0.37\ (H - H_o)$
(2) BTOP = "Below Top Of Pipe
(3) h:m:s = hours:minutes:seconds

Figure C.3-1 (b)

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SLUG TEST FIELD SHEET

PROJECT: NUMBER 35149 NAME Gratwick-Riverside Park

BOREHOLE: NO. 7 MONITOR NO. GW-7I

MONITOR: NOMINAL DIA. (in.) 2+ INSIDE DIA. (in.) 2.0 MATERIAL PVC

SCREEN: LENGTH (ft.) 2.0 INSIDE DIA. (in.) 2.0 MATERIAL PVC

FILTER PACK: LENGTH (ft.) 5.0 DIAMETER (in.) 7.5 MATERIAL Sand

TEST: START DATE 1/25/88 START TIME 9:40 a.m.

STATIC LEVEL, H (ft. BTOP) 7.83 INITIAL LEVEL, Ho (ft. BTOP) 6.02

COMPLETED BY: K.K. CHECKED BY: GHF

DATE	TIME t (h:m:s)	DEPTH h (ft. BTOP)	DATE	TIME t (h:m:s)	DEPTH h (ft. BTOP)
1/25/88	9:30 a.m.	7.83			
	9:40:10	6.62			
	9:41	6.63			
	9:42	6.63			
	9:45	6.64			
	9:50	6.64			
	10:50	6.675			
	11:57	6.70			
	4:45	6.77			
1/26/88	7:57 a.m.	6.97			
	4:20 p.m.	7.02			
1/27/88	8:23 a.m.	7.18			
	5:23 p.m.	7.20			
1/28/88	8:03 a.m.	7.30			
	5:23 p.m.	7.325			
1/29/88	7:58 a.m.	7.42*			
	5:24 p.m.	7.455			
2/01/88	8:23 a.m.	7.67			

COMMENTS: Slug Insertion

$h = 7.83 - 0.37\ (7.83 - 6.63) = 7.39$ ft. BTOP

* = 63% recovery

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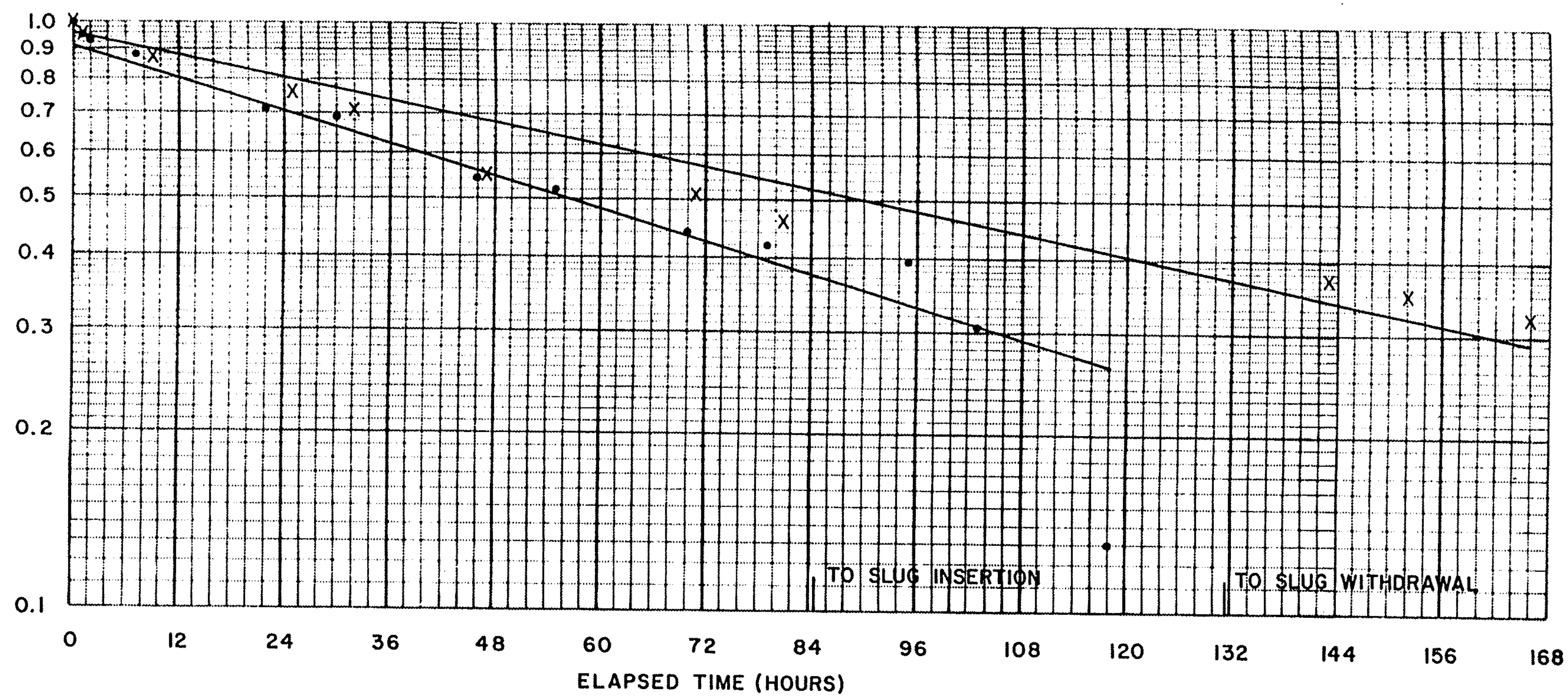
NOTE: (1) Test may be stopped when $h = H - 0.37\ (H - H_o)$
(2) BTOP = "Below Top Of Pipe
(3) h:m:s = hours:minutes:seconds



⊗ H = STATIC LEVEL
Ho = INITIAL LEVEL
h = MEASURED DEPTH

$$K = \frac{d^2 \text{Ln}\left[L/D + (1+(L/D)^2)^{1/2}\right]}{8\,L\,To}$$

LEGEND

• — SLUG INSERTION
X — SLUG WITHDRAWAL

SCREEN DIAMETER (d) = 50.8 mm
BOREHOLE DIAMETER (D) = 190.5 mm
SAND PACK LENGTH (L) = 1524 mm
ELAPSED TIME IN SECONDS TO 63% RECOVERY (To) = 3.04×10^5 S SLUG INSERTION
= 4.75×10^5 S SLUG WITHDRAWAL

HYDRAULIC CONDUCTIVITY (K) = 1.94×10^{-7} cm/s SLUG INSERTION
= 1.24×10^{-7} cm/s SLUG WITHDRAWAL

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EXAMPLE ANALYSIS OF SLUG TEST
(HVORSLEV'S METHOD)

FIG. C.3-2

C.3.3 SUMMARY OF HYDRAULIC CONDUCTIVITY VALUES

TABLE C.3-1
HYDRAULIC CONDUCTIVITY (BASIC TIME LAG)

Monitor #	Elevation of Test Interval (ft.)	Stratigraphic Unit Tested	Hydraulic Conductivity (cm/sec)			
			Long Term Recovery	Slug Insertion	Slug Withdrawal	Modified Pump Recovery
GW-1S	561.78-568.78	Lac.* Silt & Clay		*	$3.2x10^{-7}$	
GW-1D	532.39-539.79	Till/Bedrock				$5.9x10^{-3}$
GW-2S	560.61-567.61	Lac. Silt & Clay		*	$4.5x10^{-5}$	
GW-2D	529.37-540.87	Till/Bedrock				$9.2x10^{-3}$
GW-3S	561.93-568.93	Fill		*	$>1x10^{-2}$	
GW-3I	555.93-559.43	Till		$4.3x10^{-8}$		
GW-4S	562.87-569.87	Fill		*	$>1x10^{-2}$	
GW-4I	554.77-558.77	Lac. Silt & Clay/Till		$3.5x10^{-6}$	$2.2x10^{-6}$	
GW-5S	553.55-563.55	Fill		$8.2x10^{-6}$	$2.7x10^{-6}$	
GW-5I	537.69-546.19	Till	$3.2x10^{-7}$			
GW-5D	500.42-513.92	Till/Bedrock				$4.2x10^{-3}$
GW-6S	557.56-566.56	Fill		$3.9x10^{-3}$	$2.5x10^{-3}$	
GW-6I	543.98-546.98	Till	$1.8x10^{-7}$			
GW-6D	524.98-537.98	Till/Bedrock				$>1x10^{-2}$
GW-7S	557.36-565.36	Fill/Lac. Silt & Clay		$1.5x10^{-4}$	$1.3x10^{-4}$	
GW-7I	552.32-557.32	Lac. Silt & Clay		$1.9x10^{-7}$	$1.2x10^{-7}$	
GW-8S	558.09-565.59	Fill/Lac. Silt & Clay		$4.1x10^{-3}$	$1x10^{-2}$	
GW-8I	547.94-552.44	Lac. Silt & Clay/Till		$2.2x10^{-7}$	$5.2x10^{-8}$	
GW-9S	554.51-567.01	Fill/Till		$>1x10^{-2}$	$8.1x10^{-5}$	
GW-10S	559.05-567.05	Fill/Lac. Silt & Clay		$>1x10^{-2}$	$>1x10^{-2}$	
GW-11S	564.32-571.02	Fill/Lac. Silt & Clay		*	$5.9x10^{-3}$	

* water table within screened interval, slug insertion test not conducted

APPENDIX C.4 - GROUNDWATER LEVEL MONITORING

C.4.1 INTRODUCTION

Water levels in the monitoring wells and piezometers were monitored frequently during the RI component of the study in order to ensure full recovery of the wells following well development. Initially, water level readings were recorded on a near daily basis following the installation of each well starting in October, 1987. As the water level increased and eventually approached anticipated static conditions, monitoring frequency declined. Water levels were generally measured on a monthly basis over the period January to August 1988. The long-term water level measurement program served to: (a confirm static levels, and (b) record seasonal fluctuations. In addition, on two occasions (June 2, 1988 and May 18, 1989), for a twenty-four hour period, water levels in selected wells in the northern portion of the site were monitored, and the level of the Niagara River recorded in order to see the daily fluctuations and relationship between groundwater at the site and the River.

Table C.4-1 presents the water level measurements both during and after the drilling program. All values are in feet above mean sea level.

C.4.2 GROUNDWATER LEVEL DATA

BY ______ DATE ______ URS CORPORATION SHEET NO. ___ OF ___

CONSULTING ENGINEERS

CHKD. BY ELB DATE 12.14.87 JOB NO. 35149

CO-ORDINANTS ADDED: ERN 12.15.87

CKD: ELB 12.15.87

REVISED * 5/23/88 ERN

CHECKED ELB 5/23/88

SUBJECT: GRATWICK RIVERSIDE PARK

WELL LOCATIONS & ELEVEVATIONS

USGS VERTICAL DATUM ; ASSUMED CO-ORDINANTS

* ADDED 0.39' TO ALL ELEV.

WELL NO.	TOP OF CASING ELEV (ft)	TOP OF RISER ELEV (ft.)	NATURAL GROUND ELEV (ft)	LOCATION CO-ORDINANTS OR STATION & OFFSET
1-S	578.44	578.05	576.78	OFF SITE
1-D	579.26	578.61	576.79	OFF SITE
2-S	576.95	576.59	575.61	N 53439.2477 E 17273.7508
2-D	577.37	577.17	575.37	N 53431.6567 E 17285.0760
3-S	575.65	575.51	573.93	N 53248.9486 E 17011.1164
3-I	575.68	575.58	573.93	N 53237.3517 E 17018.2276
4-S	578.70	578.37	576.87	N 52685.6406 E 17467.1813
4-I	578.39	578.25	576.77	N 52692.1917 E 17459.5559
5-S	570.51	570.10	568.55	N 51671.7316 E 18073.6041
5-I	570.96	570.65	568.69	N 51675.2657 E 18068.5763
5-D	571.27	570.90	568.92	N 51699.3206 E 18069.5911
6-S	574.62	574.27	572.56	N 53051.0890 E 16886.7439
6-I	574.11	573.26	571.98	N 53037.5807 E 16886.8791
6-D	574.03	573.66	571.98	N 53050.6584 E 16871.7491
7-S	574.12	573.91	572.36	N 52247.9965 E 17878.1958
7-I	574.12	573.89	572.32	N 52255.4431 E 17875.2248
8-S	576.02	575.61	574.09	N 51797.6154 E 18307.1472
8-I	575.96	575.64	573.94	N 51804.7493 E 18300.8322
9-S	574.92	574.65	572.51	N 51091.3873 E 18970.7863
10-S	574.71	574.07	572.05	N 53679.7828 E 16260.9001
11-S	576.14	575.71	574.32	N 52005.9168 E 18583.0927
TB-1	—	—	580.85	N 50357.5284 E 19726.3499

PROJECT NO. 35149 GRATWICK RIVERSIDE PARK JULY 17, 1989

DATE		10/19/87		10/22/87		10/23/87		10/24/87		10/26/87		10/27/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05					12.15	565.90	12.08	565.97	11.50	566.55	11.12	566.93
GW-1D	578.61					13.93	564.68	13.98	564.63	13.47	565.14	13.75	564.86
GW-2S	576.59												
GW-2D	577.17												
GW-3S	575.51												
GW-3I	575.58												
GW-4S	578.37												
GW-4I	578.25												
GW-5S	570.10												
Gw-5I	570.65												
Gw-5D	570.90												
GW-6S	574.27												
GW-6I	573.26												
GW-6D	573.66												
GW-7S	573.91												
Gw-7I	573.89												
GW-8S	575.61												
Gw-8I	575.64												
GW-9S	574.65	8.61	566.04	8.91	565.74	8.91	565.74	8.91	565.74	8.82	565.83	8.84	565.81
Gw-10S	574.07	7.84	566.23	8.52	565.55	8.50	565.57	8.50	565.57	8.49	565.58	8.48	565.59
GW-11S	575.71	8.93	566.78	9.41	566.30	9.38	566.33	9.35	566.36	9.28	566.43	9.28	566.43
Niagara River			564.04		564.24		564.39		564.19		564.35		564.13

DATE		10/28/87		10/29/87		10/30/87		11/1/87		11/2/87		11/3/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1D	578.61	14.06	564.55	14.02	564.59	14.01	564.60	14.41	564.20	14.27	564.34	14.01	564.60
GW-2S	576.59					4.70	571.89	4.65	571.94	4.63	571.96	4.63	571.96
GW-2D	577.17					12.70	564.47	13.08	564.09	12.96	564.21	12.70	564.47
GW-3S	575.51												
GW-3I	575.58												
GW-4S	578.37												
GW-4I	578.25												
GW-5S	570.10												
GW-5I	570.65												
GW-5D	570.90												
GW-6S	574.27												
GW-6I	573.26												
GW-6D	573.66												
GW-7S	573.91												
GW-7I	573.89												
GW-8S	575.61												
GW-8I	575.64												
GW-9S	574.65	8.86	565.79	8.91	565.74	8.90	565.75	8.71	565.94	9.02	565.63	8.97	565.68
GW-10S	574.07	8.48	565.59	8.50	565.57	8.49	565.58	8.50	565.57	8.51	565.56	8.50	565.57
GW-11S	575.71	9.28	566.43	9.36	566.35	9.33	566.38	9.38	566.33	9.39	566.32	9.41	566.30
Niagara River			564.05		564.04		564.10		563.62		563.67		564.00

DATE		11/4/87		11/5/87		11/6/87		11/9/87		11/10/87		11/11/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1D	578.61	13.93	564.68	13.79	564.82	13.83	564.78	14.28	564.33	14.53	564.08	14.52	564.09
GW-2S	576.59	5.07	571.52	4.96	571.63	4.92	571.67	4.84	571.75	5.08	571.51	4.87	571.72
GW-2D	577.17	12.55	564.62	12.43	564.74	12.45	564.72	13.01	564.16	13.27	563.90	13.23	563.94
GW-3S	575.51												
GW-3I	575.58												
GW-4S	578.37												
GW-4I	578.25												
GW-5S	570.10												
Gw-5I	570.65												
Gw-5D	570.90									6.90	564.00	6.94	563.96
GW-6S	574.27												
GW-6I	573.26												
GW-6D	573.66												
GW-7S	573.91												
Gw-7I	573.89												
GW-8S	575.61												
Gw-8I	575.64												
GW-9S	574.65	8.96	565.69	9.01	565.64	8.95	565.70	9.04	565.61	9.09	565.56	9.14	565.51
Gw-10S	574.07	8.50	565.57	8.54	565.53	8.56	565.51	8.54	565.53	8.57	565.50	8.57	565.50
GW-11S	575.71	9.39	566.32	9.46	566.25	9.27	566.44	9.47	566.24	9.58	566.13	9.59	566.12
Niagara River			564.08		564.34		564.45		563.78		563.48		564.59

DATE		11/12/87		11/13/87		11/13/87		11/14/87		11/14/87		11/15/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1D	578.61	14.01	564.60	13.97	564.64	13.86	564.75	14.23	564.38	14.32	564.29	14.49	564.12
GW-2S	576.59	4.85	571.74	4.88	571.71	4.85	571.74	4.90	571.69	4.91	571.68	4.95	571.64
GW-2D	577.17	12.70	564.47	12.62	564.55	12.54	564.63	12.96	564.21	12.04	565.13	13.20	563.97
GW-3S	575.51												
GW-3I	575.58												
GW-4S	578.37												
GW-4I	578.25												
GW-5S	570.10												
GW-5I	570.65												
GW-5D	570.90	6.40	564.50	6.38	564.52	6.27	564.63	6.66	564.24	6.73	564.17	6.91	563.99
GW-6S	574.27												
GW-6I	573.26												
GW-6D	573.66												
GW-7S	573.91												
GW-7I	573.89												
GW-8S	575.61												
GW-8I	575.64												
GW-9S	574.65	9.11	565.54	9.09	565.56	9.04	565.61	9.13	565.52	9.15	565.50	9.19	565.46
GW-10S	574.07	8.57	565.50	8.57	565.50	8.57	565.50	8.58	565.49	8.59	565.48	8.60	565.47
GW-11S	575.71	9.57	566.14	9.59	566.12	9.56	566.15	9.61	566.10	9.65	566.06	9.66	566.05
Niagara River			564.14		564.09		564.24		563.74		563.70		563.55

DATE		11/15/87		11/16/87		11/17/87		11/19/87		11/21/87		11/23/87		11/24/87		11/25/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1D	578.61	14.46	564.15	14.38	564.23	13.64	564.97	13.75	564.86	13.75	564.86	14.23	564.38	13.99	564.62	14.62	563.99
GW-2S	576.59	4.9	571.69	4.94	571.65	4.92	571.67	4.64	571.95	4.74	571.85	4.72	571.87	5.24	571.35	4.76	571.83
GW-2D	577.17	13.17	564	13.13	564.04	12.99	564.18	12.46	564.71	12.41	564.76	12.88	564.29	12.64	564.53	13.4	563.77
GW-3S	575.51																
GW-3I	575.58																
GW-4S	578.37																
GW-4I	578.25																
GW-5S	570.10											5.35	564.75	5.27	564.83	5.41	564.69
GW-5I	570.65											5.89	564.76	5.88	564.77	5.92	564.73
GW-5D	570.90	6.89	564.01	6.82	564.08			6.19	564.71	6.18	564.72	6.63	564.27	6.35	564.55	7.05	563.85
GW-6S	574.27							9.09	565.18	9.31	564.96	9.73	564.54	9.25	565.02	10.25	564.02
GW-6I	573.26							12.21	561.05	12.18	561.08	15.91	557.35	15.59	557.67	27.92	545.34
GW-6D	573.66							8.93	564.73	9.04	564.62	9.37	564.29	9.09	564.57	9.95	563.71
GW-7S	573.91																
GW-7I	573.89																
GW-8S	575.61													9.57	566.04	9.61	566
GW-8I	575.64											20.8	554.84	19.33	556.31	18.24	557.4
GW-9S	574.65	9.2	565.45	9.13	556.32	9.26	547.06	9.07	565.58	9.12	565.53	9.09	565.56	9.09	565.56	9.15	565.5
GW-10S	574.07	8.6	565.47	8.63	556.84	8.63	548.21	8.58	565.49	8.63	565.44	8.52	565.55	8.58	565.49	8.58	565.49
GW-11S	575.71	9.68	566.03	9.62	556.41	9.58	546.83	9.59	566.12	9.58	566.13	9.57	566.14	9.59	566.12	9.57	566.14
Niagara River			563.55		563.59		563.69		564.4		563.82		563.9		564.02		562.91

DATE		11/25/87		11/27/87		11/28/87		11/29/87		11/30/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05			7.55	570.5	6.99	571.06	6.47	571.58	6.13	571.92
GW-1D	578.61			14.52	564.09	14.21	564.4	13.94	564.67	13.45	565.16
GW-2S	576.59			4.52	572.07	4.48	572.11	4.32	572.27	4.3	572.29
GW-2D	577.17			13.23	563.94	12.92	564.25	12.64	564.53	12.12	565.05
GW-3S	575.51										
GW-3I	575.58										
GW-4S	578.37										
GW-4I	578.25										
GW-5S	570.10	5.43	564.67	5.53	564.57	5.5	564.6	5.01	565.09	4.76	565.34
GW-5I	570.65	5.96	564.69	6.01	564.64	6.08	564.57	5.93	564.72	5.66	564.99
GW-5D	570.90	6.75	564.15	6.93	563.97	6.61	564.29	6.32	564.58	5.82	565.08
GW-6S	574.27	10.13	564.14	10.26	564.01	9.82	564.45	9.56	564.71	8.83	565.44
GW-6I	573.26	27.7	545.56	26.17	547.09	25.35	547.91	24.64	548.62	24	549.26
GW-6D	573.66	9.55	564.11	9.71	563.95	9.41	564.25	9.15	564.51	8.59	565.07
GW-7S	573.91									7.25	566.66
GW-7I	573.89									9.53	564.36
GW-8S	575.61			9.23	566.38	9.13	566.48	8.54	567.07	8.09	567.52
GW-8I	575.64			16.23	559.41	5.36	570.28	14.66	560.98	14.08	561.56
GW-9S	574.65	8.94	565.71							8.21	566.44
GW-10S	574.07			8.52	565.55	8.48	565.59			8.25	565.82
GW-11S	575.71			9.11	566.6	9.01	566.7			7.72	567.99
Niagara River			563.69		563.29		563.71		563.93		564.63

DATE		12/1/87		12/2/87		12/6/87		12/7/87		12/7/87		12/8/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05	5.85	572.2	5.63	572.42			4.91	573.14			4.73	573.32
GW-1D	578.61	13.85	564.76	13.74	564.87			14.22	564.39			13.98	564.63
GW-2S	576.59	4.26	572.33	4.29	572.3			4.36	572.23			4.38	572.21
GW-2D	577.17	12.6	564.57	12.39	564.78			12.9	564.27			12.65	564.52
GW-3S	575.51									8.98	566.53	9	566.51
GW-3I	575.58									13.7	561.88	13.58	562
GW-4S	578.37			11.54	566.83			11.83	566.54			11.84	566.53
GW-4I	578.25			12.51	565.74	12.23	566.02	12.22	566.03			12.17	566.08
GW-5S	570.10	4.91	565.19	4.69	565.41			4.89	565.21			4.93	565.17
GW-5I	570.65	5.29	565.36	5.25	565.4	5.33	565.32	5.37	565.28			5.43	565.22
GW-5D	570.90	6.26	564.64	6.11	564.79			6.61	564.29			6.41	564.49
GW-6S	574.27	9.48	564.79	9.18	565.09			9.73	564.54			9.64	564.63
GW-6I	573.26	23.37	549.89	22.65	550.61	20.34	552.92	19.99	553.27			19.39	553.87
GW-6D	573.66	9.15	564.51	8.86	564.8			9.4	564.26			9.16	564.5
GW-7S	573.91	7.21	566.7	7.83	566.08			7.33	566.58			7.22	566.69
GW-7I	573.89	9.27	564.62	9.01	564.88	8.4	565.49	8.32	565.57			8.17	565.72
GW-8S	575.61	8.11	567.5	8.21	567.4			8.62	566.99			8.65	566.96
GW-8I	575.64	13.57	562.07	12.99	562.65	11.31	564.33	11.11	564.53			10.77	564.87
GW-9S	574.65	8.07	566.58	8.02	566.63			8.18	566.47			8.21	566.44
GW-10S	574.07	8.14	565.93	8.1	565.97			8.17	565.9			8.17	565.9
GW-11S	575.71	7.75	567.96	7.92	567.79			8.39	567.32			8.46	567.25
Niagara River			564.02		564.44		563.94		563.76		563.89		564.05

DATE		12/9/87		12/10/87		12/11/87		12/12/87		12/14/87		12/15/87	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05	4.31	573.74	4.54	573.51			13.45	564.6	12.5	565.55	12.03	566.02
GW-1D	578.61	14.31	564.3	13.78	564.83			13.95	564.66	14.35	564.26	14.36	564.25
GW-2S	576.59	4.62	571.97	5.36	571.23	4.48	572.11	4.48	572.11	4.41	572.18		
GW-2D	577.17	12.11	565.06	12.5	564.67	12.81	564.36	12.58	564.59	13.13	564.04		
GW-3S	575.51	9	566.51	9.02	566.49			9.03	566.48	9.04	566.47	9.03	566.48
GW-3I	575.58	13.49	562.09	13.4	562.18			13.24	562.34	14.18	561.4	13.14	562.44
GW-4S	578.37	11.82	566.55	11.94	566.43			11.97	566.4	12.09	566.28		
GW-4I	578.25	12.16	566.09	12.11	566.14			12.08	566.17	12.07	566.18		
GW-5S	570.10	4.82	565.28	4.4	565.7			4.98	565.12	5	565.1		
GW-5I	570.65	5.94	564.71	18.4	552.25			8.44	562.21	6.82	563.83		
GW-5D	570.90	6.27	564.63	6.17	564.73			6.36	564.54	9.96	560.94		
GW-6S	574.27	9.56	564.71	9.2	565.07			9.74	564.53	24.05	550.22	10.33	563.94
GW-6I	573.26	19.02	554.24	18.55	554.71			25.55	547.71	9.66	563.6	23.46	549.8
GW-6D	573.66	9.12	564.54	9.02	564.64			9.13	564.53			9.79	563.87
GW-7S	573.91	7.09	566.82	7.27	566.64			7.31	566.6	7.22	566.69	6.9	567.01
GW-7I	573.89	8.1	565.79	8.03	565.86			7.92	565.97	7.9	565.99	7.85	566.04
GW-8S	575.61	8.63	566.98	8.63	566.98	8.66	566.95	8.68	566.93	8.81	566.8		
GW-8I	575.64	10.55	565.09	10.34	565.3	10.2	565.44	9.99	565.65	9.79	565.85		
GW-9S	574.65	8.23	566.42	8.24	566.41	8.25	566.4	8.31	566.34	8.4	566.25		
GW-10S	574.07	8.15	565.92	8.2	565.87	8.19	565.88	8.21	565.86	8.24	565.83		
GW-11S	575.71	8.46	567.25	8.47	567.24			8.49	567.22	8.62	567.09		
Niagara River			564.06		564.23		563.17		564.42		563.57		562.73

DATE		12/16/87		1/8/88		1/25/88		2/1/88		3/7/88		4/8/88	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05	14.76	563.29	5.7	572.35	4.42	573.63			4.16	573.89	3.94	574.11
GW-1D	578.61	12.88	565.73	14.06	564.55	14.09	564.52	14.18	564.43	14.01	564.6	13.8	564.81
GW-2S	576.59			5.1	571.49	4.83	571.76						
GW-2D	577.17			11.73	565.44	12.96	564.21	12.95	564.22	12.77	564.4	12.54	564.63
GW-3S	575.51	8.83	566.68	9.1	566.41	9.08	566.43	9.09	566.42	9.09	566.42	8.93	566.58
GW-3I	575.58	13.09	562.49	8.9	566.68	8.4	567.18			7.13	568.45		
GW-4S	578.37	11.78	566.59	11.96	566.41	12.42	565.95	12.58	565.79	12.32	566.05	11.8	566.57
GW-4I	578.25	11.94	566.31	11.82	566.43	12.12	566.13	12.21	566.04	12.21	566.04	12.25	566
GW-5S	570.10	3.17	566.93	4.76	565.34	5.17	564.93	5.21	564.89	5.44	564.66	4.8	565.3
Gw-5I	570.65	5.9	564.75	5.13	565.52	6.55	564.1	6.67	563.98	6.45	564.2	6.01	564.64
Gw-5D	570.90	5.56	565.34	6.23	564.67	6.5	564.4	6.62	564.28	6.44	564.46	6.22	564.68
GW-6S	574.27			8.28	565.99	9.72	564.55	9.79	564.48	9.64	564.63	9.41	564.86
GW-6I	573.26			12.62	560.64	11	562.26	10.56	562.7	9.6	563.66	9.44	563.82
GW-6D	573.66			8.18	565.48	9.35	564.31	9.35	564.31	9.26	564.4	9.03	564.63
GW-7S	573.91	6.83	567.08	7.13	566.78	7.6	566.31	7.6	566.31	7.56	566.35	7.26	566.65
Gw-7I	573.89	7.82	566.07	7.77	566.12	7.83	566.06			8.06	565.83	8.02	565.87
GW-8S	575.61	8.08	567.53	8.94	566.67	9.24	566.37	9.35	566.26	8.96	566.65	8.51	567.1
Gw-8I	575.64	9.54	566.1	8.88	566.76	9.18	566.46			9.07	566.57	8.95	566.69
GW-9S	574.65			8.36	566.29	8.9	565.75	9.04	565.61	8.51	566.14	8.15	566.5
Gw-10S	574.07			8.25	565.82	8.43	565.64	8.56	565.51	8.33	565.74	8.14	565.93
GW-11S	575.71	7.79	567.92	8.81	566.90	9.09	566.62	9.19	566.52	8.72	566.99	8.29	567.42
Niagara River			564.88		564.16		563.68		563.71		563.87		564.07

DATE		4/13/88		5/18/88		8/26/88	
WELL NO.	Top of Riser	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL	DEPTH (ft)	WATER LEVEL
GW-1S	578.05			4.57	573.48	8.4	569.65
GW-1D	578.61			13.78	564.83	13.92	564.69
GW-2S	576.59						
GW-2D	577.17			12.44	564.73	12.58	564.59
GW-3S	575.51	8.99	566.52	9.19	566.32	9.25	566.26
GW-3I	575.58	8.38	567.20	8.54	567.04	9	566.58
GW-4S	578.37			12.58	565.79	12.56	565.81
GW-4I	578.25			12.53	565.72	12.5	565.75
GW-5S	570.10			5.13	564.97	4.76	565.34
GW-5I	570.65			5.7	564.95	4.1	566.55
GW-5D	570.90			6.2	564.7	6.34	564.56
GW-6S	574.27			9.56	564.71	9.2	565.07
GW-6I	573.26			9.18	564.08	9.22	564.04
GW-6D	573.66			8.96	564.7	9.12	564.54
GW-7S	573.91			7.58	566.33	9.72	564.19
GW-7I	573.89			8.32	565.57	8.24	565.65
GW-8S	575.61			9.48	566.13	9.58	566.03
GW-8I	575.64			9.47	566.17		
GW-9S	574.65			8.91	565.74	9.02	565.63
GW-10S	574.07			8.42	565.65	8.56	565.51
GW-11S	575.71			9.37	566.34	9.55	566.16
Niagara River			564.21		563.95		564.17

PROJECT NO. 35149

WATER LEVEL DATA

TABLE 2 SHEET 1 of 8

GRATWICK PARK T. WATERMAN

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV. (DATE 6-2-88)	(198 8/6/2) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198 8/6/2) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198 8/6/2) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198 8/6/2) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198 8/6/2) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198 8/6/3) DEPTH FROM TOP OF MONITOR	WATER ELEV
----			T of Riser	8:16	AM	9:03	AM	9:37	AM	10:04	AM				
575.37	2	D	577.17	12.62	564.55	12.60	564.57	12.56	564.61	12.58	564.59				
----				8:17	AM	9:04	AM	9:39	AM	10:05	AM				
575.61	2	S	576.59	5.18	571.41	5.20	571.39	5.18	571.41	5.18	571.41				
----				8:15	AM	9:06	AM	9:40	AM	10:08	AM				
573.93	3	I	575.58	8.65	566.93	8.64	566.94	8.64	566.94	8.64	566.94				
----				8:15	AM	9:07	AM	9:40	AM	10:09	AM				
573.93	3	S	575.51	9.20	566.31	9.22	566.29	9.22	566.29	9.22	566.29				
----				7:56	AM	9:17	AM	9:45	AM	10:14	AM				
571.98	6	D	573.66	9.17	564.49	9.10	564.56	9.08	564.58	9.08	564.58				
----				8:05	AM	9:09	AM	9:47	AM	10:13	AM				
571.98	6	I	573.76	9.17	564.59	9.18	564.58	9.16	564.60	9.18	564.58				
----				8:03	AM	9:09	AM	9:46	AM	10:12	AM				
572.56	6	S	574.27	9.72	564.55	9.66	564.61	9.62	564.65	9.62	564.65				
----	STREAM	GAUGE	566.11	7:56 19.0"	AM 564.53	9:09 20.25"	AM 564.43	9:50 20.50"	AM 564.41	10:15 20.00"	Am 564.45				

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

WATER LEVEL DATA

PROJECT NO. ______ TABLE 2 SHEET 2 of 8

GRATWICK PARK T. WATERMAN

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV. (DATE 6-2-88)	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV
--- 575.31	2	D	577.17	10:36 12.60	AM 564.57	11:07 12.60	AM 564.51	11:33 12.58	AM 564.59	12:03 12.55	PM 564.62	12:34 12.55	PM 564.62	1.03 12.54	PM 564.63
--- 575.61	2	S	576.59	10:38 5.20	AM 571.39	11:08 5.20	AM 571.39	11:34 5.20	AM 571.39	12:04 5.21	PM 571.38	12:35 5.21	PM 571.38	1.04 5.21	PM 571.38
--- 573.93	3	II	575.58	10:41 8.64	AM 566.94	11:10 8.62	AM 566.96	11:37 8.63	AM 566.95	12:07 8.63	PM 566.95	12:37 8.64	PM 566.94	1.07 8.64	PM 566.94
--- 573.93	3	S	575.51	10:43 9.21	AM 566.30	11:11 9.22	AM 566.29	11:38 9.21	AM 566.30	12:08 9.22	PM 566.29	12:38 9.22	PM 566.29	1.08 9.22	PM 566.29
--- 571.98	6	D	573.66	10:48 9.10	AM 564.56	11:13 9.09	AM 564.57	11:44 9.04	AM 564.62	12:13 9.06	PM 564.60	12:44 9.04	PM 564.62	1.14 9.04	PM 564.62
--- 571.98	6	I	573.76	10:46 9.18	AM 564.58	11:14 9.17	AM 564.59	11:41 9.16	AM 564.60	12:12 9.16	PM 564.60	12:43 9.16	PM 564.60	1.11 9.16	PM 564.60
--- 572.56	6	S	574.27	10:47 9.61	AM 564.66	11:15 9.59	AM 564.68	11:42 9.57	AM 564.70	12:10 9.55	PM 564.72	12:41 9.53	PM 564.74	1.13 9.51	PM 564.76
---	STREAM GAUGE		566.11	10:49 19.75"	AM 564.51	11:17 20.5"	AM 564.41	11:45 21.0"	AM 564.31	12:14 21.5"	PM 564.33	12:45 21.5"	PM 564.33	1:15 21.5"	[illegible]

PM 564.33

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

PROJECT NO.______ GRATWICK PARK T. WATERMAN

WATER LEVEL DATA

TABLE 12 SHEET 3 of 8

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV.	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV
DATE 6.2.88															
--- 575.37	2	D	577.17	1:37 12.54	PM 564.63	2:02 12.54	PM 564.63	2:32 12.56	PM 564.61	3:00 12.58	PM 564.59	3:34 12.60	PM 564.51	4:04 12.63	PM 564.54
--- 575.61	2	S	576.59	1:38 5.21	PM 571.38	2:03 5.21	PM 571.38	2:33 5.21	PM 571.38	3:01 5.21	PM 571.38	3:35 5.21	PM 571.38	4:05 5.20	PM 571.39
--- 573.93	3	I	575.58	1:41 8.63	PM 566.95	2:05 8.63	PM 566.95	2:36 8.63	PM 566.95	3:04 8.64	PM 566.94	3:37 8.63	PM 566.95	4:08 8.64	PM 566.94
--- 573.93	3	S	575.51	1:42 9.21	PM 566.30	2:06 9.22	PM 566.29	2:37 9.21	PM 566.30	3:05 9.22	PM 566.29	3:38 9.22	PM 566.29	4:09 9.22	PM 566.29
--- 571.98	6	D	573.66	1:47 9.04	PM 564.62	2:11 9.06	PM 564.60	2:42 9.08	PM 564.58	3:09 9.09	PM 564.57	3:44 9.13	PM 564.53	4:11 9.16	PM 564.50
--- 571.98	6	I	573.76	1:46 9.16	PM 564.60	2:10 9.16	PM 564.60	2:41 9.16	PM 564.60	3:08 9.16	PM 564.60	3:42 9.16	PM 564.60	4:12 9.16	PM 564.60
--- 572.56	6	S	574.27	1:45 9.48	PM 564.79	2:08 9.48	PM 564.79	2:39 9.47	PM 564.80	3:07 9.48	PM 564.79	3:41 9.48	PM 564.79	4:14 9.50	PM 564.77
---	STREAM GAUGE		566.11	1:48 21.25"	PM 564.35	2:12 20.15"	PM 564.41	2:42 20.25"	PM 564.43	3:10 19.75"	PM 564.47	3:45 19.00"	PM 564.53	4:15 18.00"	PM 564.61

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

PROJECT NO.______ GRATWICK PARK

WATER LEVEL DATA

T. WATERMAN

TABLE 2 SHEET 4 of 8

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV	DATE 6-2-88 (19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV
---				4:43	PM	4:59	PM	5:34	PM	6:05	PM	6:36	PM	7:02	PM
575.31	2	D	577.17	12.68	564.49	12.68	564.49	12.71	564.46	12.74	564.43	12.77	564.40	12.74	564.38
---				4:44	PM	4:58	PM	5:35	PM	6:06	PM	6:35	PM	7:01	PM
575.61	2	S	576.59	5.20	571.39	5.20	571.39	5.20	571.39	5.21	571.38	5.21	571.38	5.21	571.38
---				4:40	PM	5:01	PM	5:38	PM	6:08	PM	6:38	PM	7:05	PM
573.93	3	I	575.58	8.66	566.92	8.64	566.94	8.64	566.94	8.64	566.94	8.64	566.94	8.65	566.95
---				4:41	PM	5:02	PM	5:40	PM	6:09	PM	6:40	PM	7:06	PM
573.93	3	S	575.51	9.20	566.31	9.20	566.31	9.22	566.29	9.22	566.29	9.21	566.30	9.22	566.29
---				4:38	PM	5:06	PM	5:42	PM	6:11	PM	6:44	PM	7:10	PM
571.98	6	D	573.66	9.17	564.49	9.19	564.47	9.24	564.42	9.29	564.37	9.31	564.35	9.34	564.32
---				4:37	PM	5:07	PM	5:43	PM	6:12	PM	6:43	PM	7:09	PM
571.98	6	I	573.76	9.16	564.60	9.17	564.59	9.16	564.60	9.17	564.59	9.17	564.59	9.19	564.57
---				4:35	PM	5:05	PM	5:44	PM	6:13	PM	6:42	PM	7:08	PM
572.56	6	S	574.27	9.46	564.81	9.52	564.75	9.55	564.72	9.58	564.69	9.61	564.66	9.63	564.64
---	STREAM GAUGE		566.11	4:38 17.50"	PM 564.66	5:06 16.75	PM 564.71	5:44 16.25	PM 564.76	6:14 15.75"	PM 564.81	6:45 15.50"	PM 645.82	7:10 15.00	PM 564.86

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

PROJECT NO. ______

GRATWICK PARK

WATER LEVEL DATA

TABLE 2 **SHEET** 5 **of** 8

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV.	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV	(19__/__/__) DEPTH FROM TOP OF MONITOR	WATER ELEV
--- 515.37	2	D	577.17	8:11 12.81	PM 564.36	9:32 12.86	564.31	10:06 12.88	564.29	10:26 12.92	564.25	11:15 12.88	564.29	11:36 12.84	564.33
--- 575.61	2	S	576.59	8:10 5.21	571.38	9:33 5.22	571.37	10:05 5.22	571.37	10:35 5.23	571.36	11:13 5.23	571.36	11:34 5.22	571.37
--- 573.93	3	I	575.58	9:02 8.64	566.94	9:37 8.62	566.96	10:09 8.66	566.92	10:40 8.66	566.92	11:19 8.68	566.90	11:40 8.64	566.94
--- 573.93	3	S	575.51	9:00 9.22	566.29	9:38 9.22	566.29	10:10 9.22	566.29	10:41 9.22	566.29	11:20 9.23	566.28	11:41 9.22	566.29
--- 571.98	6	D	573.66	9:07 9.37	564.29	9:40 9.42	564.24	10:15 9.44	564.22	10:48 9.46	564.20	11:25 9.42	564.24	11:48 9.38	564.28
--- 571.98	6	I	573.76	9:06 9.18	564.58	9:41 9.18	564.58	10:12 9.17	564.59	10:47 9.18	564.58	11:21 9.19	564.57	11:46 9.20	564.56
--- 572.56	6	S	574.27	9:05 9.74	564.53	9:42 9.76	564.51	10:13 9.78	564.49	10:45 9.79	564.48	11:22 9.82	564.45	11:45 9.82	564.48
---	STEAM GAUGE		566.11			9:43 14.25	564.93	10:16 13.75	564.97	10:49 14.00	564.93	11:26 15.00	564.86	11:49 15.50	564.87

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

PROJECT NO. ______
GRATWICK PARK 6/3/88

WATER LEVEL DATA

TABLE 2 SHEET 6 of 8

BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	MONITOR TYPE	TOP OF MONITOR ELEV	(1988 6/3/88) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198_/_/_) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198_/_/_) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198_/_/_) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198_/_/_) DEPTH FROM TOP OF MONITOR	WATER ELEV	(198_/_/_) DEPTH FROM TOP OF MONITOR	WATER ELEV
575.37	2	D	577.17	12:06 12.84	AM 564.33	12:37 12.82	564.35	1:06 12.79	1:? 564.38	1:32 12.76	~~2:04~~ 564.41 ~~12.73~~	2:04 12.73	564.44	2:36 12.74	564.43
575.61	2	S	576.59	12:05 5.23	571.36	12:36 5.23	571.36	1:04 5.23	571.36	1:33 5.22	571.37	2:03 5.23	571.36	2:34 5.23	571.36
573.93	3	I	575.58	12:11 8.65	566.93	12:43 8.68	566.90	1:10 8.67	566.91	1:37 8.64	566.44	2:09 8.64	566.94	2:41 8.67	566.91
573.93	3	S	575.51	12:12 9.25	566.26	12:45 9.23	566.28	1:11 9.23	566.28	1:38 9.23	566.28	2:10 9.23	566.28	2:43 9.22	[illegible]
571.98	6	D	573.66	12:17 9.35	564.31	12:48 9.33	564.33	1:15 9.31	564.35	1:45 9.28	564.38	2:16 9.26	564.40	2:47 9.25	564.41
571.98	6	I	573.76	12:16 9.18	564.58	12:51 9.19	564.57	1:18 9.20	564.56	1:43 9.18	564.58	2:14 9.20	564.56	2:45 9.20	564.56
572.56	6	S	574.27	12:15 9.85	564.42	12:49 9.82	564.45	1:16 9.82	564.45	1:44 9.78	564.49	2:15 9.80	564.47	2:51 9.78	564.49
---	STREAM	GAUGE	566.11	12:20 16.50	564.74	12:53 16.75	564.72	1:22 17.25	564.68	1:40 17.50	564.66	2:17 17.50	564.66	2:54 17.75	564.64

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

WATER LEVEL DATA

PROJECT NO.______ TABLE 2 SHEET 7 of 8

GRATWICK PARK 6/3/88

	DATE 6/3/88			(19__/__/__)		(19__/__/__)		(19__/__/__)		(19__/__/__)		(19__/__/__)		(19__/__/__)	
BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	TYPE	TOP OF MONITOR ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV
--- 575.37	2	D	577.17	3:06 12.73	Am 564.44	3:37 12.74	564.43	4:04 12.72	564.45	4:35 12.74	564.43	5:05 12.71	564.46	5:34 12.70	564.47
--- 575.61	2	S	576.59	3:04 5.23	571.36	3:36 5.22	571.37	4:03 5.22	571.37	4:34 5.23	571.36	5:03 5.24	571.35	5:35 5.23	571.36
--- 573.43	3	I	575.58	3:10 8.66	566.92	3:45 8.64	566.94	4:09 8.66	566.92	4:39 8.67	566.91	5:10 8.68	566.90	5:36 8.66	566.90
--- 573.93	3	S	575.51	3:12 9.22	566.29	3:40 9.24	566.27	4:10 9.24	566.27	4:40 9.22	566.29	5:12 9.23	566.28	5:37 9.22	566.29
--- 571.98	6	D	573.66	3:16 9.24	564.42	3:50 9.20	564.46	4:12 9.22	564.44	4:44 9.21	564.45	5:15 9.21	564.45	5:42 9.22	564.44
--- 571.98	6	I	573.76	3:19 9.20	564.56	3:49 9.20	564.56	4:15 9.18	564.58	4:46 9.20	564.56	5:17 9.20	564.56	5:40 9.15	564.61
--- 572.56	6	S	574.27	3:19 9.76	564.51	3:48 9.73	564.54	4:14 9.74	564.53	4:47 9.73	564.54	5:18 9.72	564.55	5:41 9.68	564.59
---	STREAM GAUGE		566.11	3:21 18.00	564.61	3:52 18.25	564.6	4:18 18.50	564.58	4:50 18.25	564.6	5:20 18.25	564.6	5:43 18.25	564.6

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

PROJECT NO. ______
GRATWICK PARK

WATER LEVEL DATA

TABLE 7 SHEET 8 of 8

	DATE 6/3/88			(__/__/__)		(__/__/__)		(__/__/__)		(__/__/__)		(__/__/__)		(__/__/__)	
BOREHOLE NO. / GROUND ELEV.	MONITOR NO.	TYPE	TOP OF MONITOR ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV	DEPTH FROM TOP OF MONITOR	WATER ELEV
--- 575.37	2	D	577.17	6:03 12.66	564.51	6:35 12.71	564.46	7:06 12.71	564.46	7:33 12.68	564.49				
--- 575.61	2	S	576.59	6:04 5.22	571.37	6:33 5.24	571.35	7:04 5.24	571.35	7:34 5.24	571.35				
--- 573.93	3	I	575.58	6:07 8.66	566.92	6:39 8.67	566.91	7:11 8.67	566.91	7:37 8.63	566.95				
--- 573.93	3	S	575.51	6:08 9.25	566.26	6:41 9.22	566.29	7:13 9.21	566.30	7:38 9.18	566.33				
--- 571.98	6	D	573.66	6:12 9.17	564.49	6:44 9.23	564.43	7:16 9.21	564.45	7:42 9.20	564.46				
--- 571.98	6	I	573.76	6:13 9.20	564.56	6:45 9.20	564.56	7:17 9.20	564.56	7:44 9.17	564.59				
--- 572.56	6	S	574.27	6:14 9.67	564.60	6:47 9.70	564.57	7:18 9.70	564.57	7:43 9.72	564.55				
---	STREAM GAUGE		566.11	6:14 18.25	564.6	6:49 17.75	564.63	7:20 17.50	564.66	7:45 17.75	564.64				

● - Piezometer ▲ - Standpipe ■ - Gas Monitor

FIGURE 15-5 WATER LEVEL DATA LOG

A-2544

PROJECT NO. 35149 -

DATE				5 / 18 / 89		" / " / "		" / " / "		" / " / "		5 / 18 / 89	
TIME					A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.
BOREHOLE Nº GROUND ELEV.	MONITOR Nº	TYPE	TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
572.56	6	S	574.27	8:50 9.46	AM 564.81	10:45 9.38	AM 564.92	11:35 9.34	AM 564.93	12:05 9.35	PM 564.92	1:07 9.36	PM 564.91
571.98	6	D	573.66	8:52 8.94	AM 564.72	10:47 8.34	AM 565.32	11:37 9.00	AM 564.66	12:07 9.01	PM 564.65	1:09 9.00	PM 564.66
571.98	6	I	573.26	8:53 9.35	AM 563.91	10:46 9.34	AM 563.92	11:36 9.32	AM 563.94	12:06 9.26	PM 564.00	1:08 9.32	PM 563.94
575.61	2	S	576.59	8:58 4.28	AM 572.31	10:55 4.34	AM 572.25	11:46 4.30	AM 572.29	12:13 4.37	PM 572.22	1:18 4.38	PM 572.21
573.93	3	S	575.58	9:30 8.8	A.M 566.78	10:53 8.82	AM 566.69	11:41 8.88	AM 566.63	12:11 8.83	PM 566.68	1:14 8.80	PM 566.71
573.93	3	I	575.58	9:31 9.6	A.M 565.98	10:52 9.58	AM 566.00	11:40 9.56	AM 566.02	12:10 9.58	PM 566.00	1:15 9.55	PM 566.03
575.37	2	D	577.17	8:59 12.41	AM 564.76	10:56 12.42	AM 564.75	11:47 12.42	AM 564.75	12:14 12.46	PM 564.71	1:19 12.49	PM 564.68
— — —	~~STREAM~~ GAUGE		566.00	8:40 19.5"	AM 564.4	11:15 1.45'	AM 564.55	11:15 1.45'	AM 564.55	12:00 1.55'	PM 564.45	1:04 1.50'	PM 564.5
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○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 1 of 6

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 35149.00.001

DATE				5/18/89		"/"/"		"/"/"		"/"/"		5/18/89	
TIME					A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.
BOREHOLE № / GROUND ELEV.	MONITOR №	TYPE	TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
572.56	6	S	574.27	1:07 9.36	PM 564.91	2:03 9.40	PM 564.87	3:01 9.45	PM 564.82	4:04 9.47	PM 564.80	5:03 9.55	PM 564.72
571.98	6	I	573.26	1:08 9.32	PM 563.94	2:04 9.33	PM 563.93	3:02 9.05	PM 564.21	4:05 9.10	PM 564.16	5:04 9.32	PM 563.94
571.98	6	D	573.66	1:09 9.00	PM 564.66	2:05 9.05	PM 564.61	3:03 9.33	PM 564.33	4:06 9.22	PM 564.44	5:05 9.14	PM 564.52
573.93	3	S	575.51	1:14 8.80	PM 565.13	2:07 8.81	PM 565.12	3:05 8.33	PM 565.6	4:08 8.81	PM 565.12	5:07 8.83	PM 565.1
573.93	3	I	575.58	1:15 9.55	PM 566.03	2:08 9.55	PM 566.03	3:06 9.59	PM 565.99	4:09 9.58	PM 566.00	5:08 9.58	PM 566.00
575.61	2	S	576.59	1:18 4.38	PM 572.21	2:10 4.38	PM 572.21	3:08 4.38	PM 572.21	4:13 4.38	PM 572.21	5:10 4.39	PM 572.20
575.31	2	D	577.17	1:19 12.49	PM 564.68	2:11 12.52	PM 564.65	3:09 12.54	PM 564.63	4:14 12.57	PM 564.60	5:11 12.58	PM 564.59
— — —	STREAM GAUGE		566.00	1:04 1.50	564.5	1:00 1.55	564.45	3:00 1.65	564.35	4:00 1.72	564.28	5:00 1.85	564.15
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○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 2 of 6

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 35149.00.001

DATE				5/18/89		"/"/"		"/"/"		"/"/"		5/18/89	
TIME					A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.
BOREHOLE Nº / GROUND ELEV.	MONITOR Nº	MONITOR TYPE	TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
572.56	6	S	574.27	6:02 9.55	PM 564.72	7:06 9.59	PM 564.68	9:32 9.70	PM 564.57	10:05 9.71	PM 564.56	11:05 9.75	PM 564.52
571.98	6	I	573.26	6:03 9.30	PM 563.96	7:07 9.34	PM 563.92	9:34 9.33	PM 563.93	10:07 9.34	PM 563.92	11:07 9.36	PM 563.90
571.98	6	D	573.66	6:04 9.16	PM 564.50	7:08 9.23	PM 564.43	9:37 9.32	PM 564.34	10:09 9.37	PM 564.29	11:09 9.38	PM 564.28
573.93	3	I	575.51	6:05 9.61	PM 565.90	7:12 9.62	PM 565.89	9:42 9.61	PM 565.90	10:12 9.60	PM 565.91	11:13 9.60	PM 565.91
573.93	3	S	575.58	6:06 8.81	PM 566.77	7:13 8.85	PM 566.73	9:45 8.84	PM 566.74	10:14 8.84	PM 566.74	11:15 8.84	PM 566.74
575.61	2	D	576.59	6:08 12.65	PM 563.94	7:15 12.66	PM 563.93	9:51 12.77	PM 563.82	10:17 12.82	PM 563.77	11:20 12.80	PM 563.79
575.37	2	S	577.17	6:09 4.39	PM 572.78	7:16 4.39	PM 572.27	9:51 4.40	PM 572.77	10:16 4.40	PM 572.77	11:18 4.40	F... 572.77
---	STREAM GAUGE		566.00	6:00 1.85	564.15	7:02 1.87	564.13	9:00 1.95	564.05	10:00 2.00	564.0	11:00 2.00	564.0

○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 3 of 6

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 3549.00.001

DATE				5/19/89		"/"/"		"/"/"		"/"/"		5/19/89	
TIME					A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.
BOREHOLE Nº / GROUND ELEV.	MONITOR Nº	MONITOR TYPE	MONITOR TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
572.56	6	S	574.27	12:04 9.76	AM 564.51	1:12 9.79	AM 564.48	2:21 9.76	AM 564.51	3:05 9.73	AM 564.54	4:17 9.70	AM 564.57
571.98	6	I	573.26	12:05 9.38	AM 563.88	1:10 9.33	AM 563.93	2:20 9.37	AM 563.89	3:04 9.35	AM 563.91.	4:16 9.38	AM 563.88
571.98	6	D	573.66	12:06 9.32	AM 564.34	1:13 9.29	AM 564.37	2:24 9.23	AM 564.43	3:06 9.20	AM 564.46	4:18 9.18	AM 564.48
573.93	3	I	575.51	12:15 9.60	AM 565.91	1:18 9.60	AM 565.91	2:29 9.60	AM 565.91	3:13 9.59	AM 565.92	4:24 9.60	AM 565.91
573.93	3	S	575.58	12:14 8.83	AM 566.75	1:20 8.84	AM 566.74	2:30 8.84	AM 566.74	3:14 8.84	AM 566.74	4:25 8.84	AM 566.74
575.61	2	S	576.59	12:20 4.40	AM 572.19	1:24 4.41	AM 572.18	2:34 4.40	AM 572.19	3:19 4.41	AM 572.18	4:30 4.41	AM 572.18
575.37	2	D	577.17	12:19 12.77	AM 564.40	1:25 12.73	AM 564.44	2:33 12.68	AM 564.49	3:20 12.65	AM 564.52	4:31 12.64	AM 564.53
---	STREAM GAUGE		566.00	11:55 1.96	PM 564.04	1:05 1.88	AM 564.12	2:07 1.80	AM 564.2	3:00 1.74	AM 564.26	4:12 1.65	AM 564.35

○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 4 of 6

URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 35149.00.001

BOREHOLE Nº / GROUND ELEV.	MONITOR Nº	MONITOR TYPE	TOP OF MONITOR ELEV.	5/19/89 DEPTH FROM TOP OF MONITOR	5/19/89 WATER ELEV.	" / " / " DEPTH FROM TOP OF MONITOR	" / " / " WATER ELEV.	5/19/89 DEPTH FROM TOP OF MONITOR	5/19/89 WATER ELEV.	— / — / — DEPTH FROM TOP OF MONITOR	— / — / — WATER ELEV.	— / — / — DEPTH FROM TOP OF MONITOR	— / — / — WATER ELEV.
TIME					A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.
572.56	6	S	574.27	5:08 9.69	AM 564.58	6:05 9.64	AM 564.63	7:11 9.60	AM 564.67				
571.98	6	I	573.26	506 9.36	Am 563.90	6:06 9.38	AM 563.88	7:10 9.34	AM 563.92				
571.98	6	D	573.66	5:10 9.14	Am 564.52	6:07 9.10	Am 564.56	7:12 9.07	AM 564.59				
573.93	3	I	575.51	5:12 9.60	Am 565.91	6:10 9.60	AM 565.91	7:16 9.60	AM 565.91				
573.93	3	S	575.58	5:14 8.86	Am 566.72	6:11 8.83	AM 566.75	7:15 8.86	AM 566.72				
575.61	2	S	576.59	5:19 4.42	Am 572.17	6:16 4.41	AM 572.18	7:20 4.42	AM 572.17				
575.37	2	D	577.17	5:18 12.62	AM 564.55	6:15 12.57	AM 564.60	7:21 12.54	AM 564.63				
— — —	STREAM GAUGE		566.00	5:00 1.63	564.37	6:03 1.63	564.37	7:07 1.58	564.42				
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○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 5 of 6

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 35149.00

DATE				5/18/89		5/18/89		5/19/89		—/—/—		—/—/—	
TIME				A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.	
BOREHOLE Nº / GROUND ELEV.	MONITOR Nº	MONITOR TYPE	MONITOR TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
572.51	9	S	574.65	10:06 7.88	AM 566.77	8:30 7.91	PM 566.74	7:50 7.93	AM 566.72				
574.32	11	S	575.71	10:08 8.17	AM 567.54	9:28 8.22	PM 567.49	8:09 8.27	AM 567.44				
574.09	8	S	576.02	10:15 8.38	AM 567.64	9:20 8.45	PM 567.57	8:00 8.49	AM 567.53				
573.94	8	I	575.64	10:23 8.90	AM 566.74	9:19 8.91	PM 566.73	7:59 8.90	AM 566.74				
568.55	5	S	570.10	10:26 4.50	AM 565.60	9:18 4.56	PM 565.54	7:55 4.60	AM 565.5				
568.6[illegible]	5	I	570.65	10:27 5.60	AM 565.05	9:16 5.64	PM 565.01	7:53 5.64	AM 565.01				
568.92	5	D	570.90	10:29 6.12	AM 564.78	9:14 6.43	PM 564.47	7:54 6.21	AM 564.69				
572.32	7	I	573.89	10:34 8.25	AM 565.64	9:11 8.30	PM 565.59	8:14 8.30	AM 565.59				
572.36	7	S	573.91	10:35 7.05	AM 566.86	9:10 6.97	PM 566.94	8:13 6.80	AM 567.11				
576.87	4	S	578.37	10:38 11.25	AM 565.12	7:57 11.26	PM 567.11	8:18 11.29	AM 567.08				
576.77	4	I	578.25	10:39 12.05	AM 566.2	7:58 12.03	PM 566.22	8:19 12.01	AM 566.24				
572.56	6	S	574.27	10:45 9.35	AM 564.92	8:01 9.62	PM 564.65	8:21 9.53	AM 564.74				
571.98	6	I	573.26	10:46 9.34	AM 563.92	8:02 9.34	PM 563.92	8:20 9.34	AM 563.92				
571.98	6	D	573.66	10:47 8.34	AM 565.32	8:03 9.25	PM 564.41	8:22 9.93	AM 563.73				
572.05	10	S	574.07	10:50 7.95	AM 566.12	8:05 7.94	PM 566.13	8:28 7.98	AM 566.09				

○ PIEZOMETER ● MONITORING WELL

TABLE ____ SHEET ____ of ____

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

A-2544

PROJECT NO. 3514900

DATE				5/18/89		5/18/89		5/19/89		/ /		/ /	
TIME				A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.		A.M. P.M.	
BOREHOLE Nº GROUND ELEV.	MONITOR Nº	TYPE	TOP OF MONITOR ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.	DEPTH FROM TOP OF MONITOR	WATER ELEV.
573.93	3	I	575.58	10:52 9.58	AM 566.00	8:07 9.61	PM 565.97	8:24 9.60	AM 565.98				
573.93	3	S	575.51	10:53 8.82	AM 566.69	8:08 8.83	PM 566.68	8:25 8.84	AM 566.67				
575.61	2	S	576.59	10:55 4.34	AM 572.25	8:11 4.39	PM 572.20	8:30 4.42	AM 572.17				
575.37	2	D	577.17	10:56 12.46	AM 564.71	8:10 12.70	PM 564.47	8:31 12.43	AM 564.74				
576.78	1	S	578.05	11:04 4.00	AM 574.04	8:16 3.98	PM 574.07	7:31 3.99	AM 574.06				
576.79	1	D	578.61	11:06 13.77	AM 564.84	8:15 13.92	PM 564.69	7:30 13.86	AM 564.75				
— — —	STREAM GAUGE		566.00	11:15 1.45	564.55	7:55 1.90	564.1	8:03 1.43	564.57				
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○ PIEZOMETER ● MONITORING WELL

TABLE 3 SHEET 6 of 6

URS Company, Inc.
CONSULTING ENGINEERS
NEW YORK NEW JERSEY

GRATWICK RIVERSIDE PARK
WATER LEVEL ELEVATIONS

APPENDIX D

NIAGARA RIVER WATER LEVELS

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

OCTOBER 1987

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	564.37	564.70	564.31	564.18	564.52	564.31	564.09	564.39
200	564.21	564.80	564.09	564.23	564.55	564.63	564.15	564.41
300	564.23	564.90	563.99	564.26	564.57	564.49	564.21	564.51
400	564.37	564.97	564.01	564.24	564.59	564.72	564.25	564.53
500	564.39	565.11	564.08	564.21	564.60	564.59	564.29	564.55
600	564.26	565.23	564.08	564.21	564.58	564.53	564.37	564.60
700	564.43	565.30	564.17	564.22	564.60	564.40	564.48	564.63
800	564.50	565.27	564.25	564.26	564.67	564.44	564.58	564.59
900	564.38	565.25	564.28	564.30	564.66	564.40	564.62	564.56
1000	564.41	565.20	564.28	564.31	564.65	564.25	564.64	564.49
1100	564.33	565.13	564.19	564.33	564.63	564.18	564.59	564.44
1200	564.30	565.12	564.21	564.32	564.60	564.22	564.57	564.37
1300	564.28	565.03	564.17	564.35	564.53	564.16	564.52	564.31
1400	564.24	564.89	564.11	564.34	564.43	564.19	564.47	564.27
1500	564.23	564.76	564.02	564.36	564.32	564.19	564.41	564.26
1600	564.28	564.72	563.97	564.38	564.20	564.21	564.45	564.19
1700	564.26	564.69	563.89	564.37	564.07	564.13	564.34	564.16
1800	564.23	564.65	563.82	564.36	563.97	564.20	564.39	564.13
1900	564.32	564.60	563.81	564.35	563.88	564.14	564.37	564.09
2000	564.36	564.63	563.82	564.34	563.84	564.10	564.36	564.04
2100	564.38	564.65	563.88	564.40	563.90	564.14	564.33	564.11
2200	564.41	564.67	563.95	564.45	563.98	564.23	564.38	564.19
2300	564.51	564.48	564.05	564.48	564.04	564.12	564.37	564.17
2400	564.59	564.44	564.13	564.49	564.12	564.09	564.40	564.17
MEAN	564.34	564.88	564.07	564.32	564.35	564.29	564.40	564.34

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	564.19	564.41	563.91	564.09	564.06	564.10	564.06	564.04
200	564.23	564.34	563.93	564.14	564.05	564.13	564.12	564.05
300	564.26	564.28	563.93	564.19	564.09	564.14	564.19	564.05
400	564.33	564.27	563.96	564.22	564.16	564.17	564.25	564.08
500	564.41	564.30	563.99	564.26	564.19	564.19	564.28	564.10
600	564.47	564.29	564.01	564.27	564.23	564.22	564.32	564.15
700	564.55	564.27	564.03	564.28	564.29	564.27	564.33	564.21
800	564.59	564.24	564.01	564.26	564.30	564.29	564.31	564.23
900	564.62	564.23	563.99	564.23	564.27	564.29	564.27	564.21
1000	564.69	564.08	563.95	564.17	564.21	564.27	564.21	564.18
1100	564.76	563.99	563.91	564.10	564.15	564.27	564.14	564.13
1200	564.82	563.94	563.88	564.05	564.08	564.27	564.08	564.06
1300	564.87	563.90	563.87	564.01	564.02	564.25	564.04	564.00
1400	564.89	563.88	563.85	563.97	563.96	564.22	564.02	563.96
1500	564.87	563.87	563.86	563.92	563.91	564.17	563.98	563.90
1600	564.80	563.91	563.89	563.90	563.88	564.11	563.96	563.84
1700	564.79	563.89	563.91	563.91	563.85	564.07	563.94	563.81
1800	564.63	563.87	563.91	563.95	563.85	563.99	563.94	563.79
1900	564.54	563.83	563.89	563.97	563.82	563.91	563.88	563.78
2000	564.48	563.76	563.84	563.98	563.81	563.86	563.86	563.78
2100	564.48	563.78	563.88	564.05	563.87	563.88	563.92	563.83
2200	564.43	563.83	563.96	564.07	563.96	563.91	563.96	563.90
2300	564.42	563.85	564.00	564.07	564.01	563.96	563.97	563.97
2400	564.48	563.86	564.06	564.07	564.05	564.03	564.02	564.03
MEAN	564.57	564.04	563.93	564.09	564.04	564.12	564.09	564.00

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

OCTOBER 1987

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	564.07	564.73	564.07	563.92	564.25	564.20	564.49	563.86
200	564.15	564.67	564.15	563.91	564.24	564.29	564.73	563.90
300	564.17	564.61	564.22	563.90	564.25	564.32	564.79	563.93
400	564.18	564.52	564.27	563.92	564.21	564.37	564.89	563.97
500	564.19	564.43	564.28	563.95	564.20	564.37	564.86	564.02
600	564.19	564.35	564.28	564.02	564.19	564.39	564.80	564.10
700	564.21	564.35	564.28	564.09	564.31	564.39	564.82	564.14
800	564.22	564.33	564.27	564.17	564.33	564.37	564.69	564.18
900	564.21	564.36	564.24	564.13	564.38	564.32	564.54	564.14
1000	564.21	564.31	564.19	564.09	564.46	564.27	564.44	564.12
1100	564.21	564.29	564.12	564.06	564.75	564.23	564.36	564.08
1200	564.20	564.30	564.06	564.02	564.92	564.21	564.32	564.09
1300	564.11	564.25	564.00	564.04	564.75	564.26	564.30	564.07
1400	564.24	564.24	563.94	564.02	564.63	564.27	564.37	564.03
1500	564.34	564.24	563.88	564.04	564.58	564.29	564.30	563.99
1600	564.29	564.26	563.85	564.05	564.38	564.30	564.30	563.97
1700	564.27	564.18	563.83	564.08	564.19	564.22	564.26	564.00
1800	564.27	564.09	563.80	564.04	564.07	564.14	564.24	564.20
1900	564.26	564.00	563.79	564.12	564.02	564.04	564.13	564.42
2000	564.36	563.88	563.82	564.08	563.91	563.97	564.02	564.71
2100	564.39	563.86	563.87	564.21	563.95	564.01	563.94	564.63
2200	564.66	563.90	563.92	564.23	564.01	564.09	563.92	564.56
2300	564.69	563.96	563.93	564.28	564.09	564.05	563.88	564.53
2400	564.79	564.02	563.93	564.26	564.14	564.31	563.88	564.80
MEAN	564.29	564.26	564.04	564.07	564.30	564.24	564.39	564.19

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	564.81	564.34	564.03	563.85	563.95	563.86	563.89
200	564.81	564.39	564.07	563.97	563.99	563.94	563.87
300	564.78	564.38	564.11	564.07	564.03	564.01	563.86
400	564.73	564.43	564.13	564.13	564.03	564.10	563.87
500	564.58	564.49	564.18	564.24	563.98	564.19	563.89
600	564.52	564.55	564.19	564.27	564.13	564.34	563.94
700	564.52	564.54	564.25	564.31	564.20	564.39	563.99
800	564.48	564.54	564.28	564.32	564.22	564.37	564.05
900	564.29	564.50	564.28	564.29	564.19	564.33	564.08
1000	564.18	564.49	564.22	564.19	564.25	564.24	564.06
1100	564.15	564.43	564.16	564.06	564.28	564.15	564.04
1200	564.16	564.42	564.17	563.96	564.26	564.10	564.01
1300	564.19	564.44	564.34	563.90	564.21	564.09	563.95
1400	564.20	564.44	564.41	563.91	564.21	564.03	563.91
1500	564.14	564.46	564.42	563.89	564.20	564.02	563.82
1600	564.06	564.51	564.42	563.88	564.09	564.09	563.73
1700	564.01	564.53	564.31	563.98	564.00	564.09	563.69
1800	563.97	564.45	564.21	564.04	563.93	564.11	563.64
1900	563.95	564.28	564.08	564.07	563.90	564.10	563.55
2000	563.94	564.07	563.94	564.03	563.80	564.08	563.54
2100	563.93	563.91	563.77	563.99	563.73	563.93	563.53
2200	564.01	563.87	563.75	563.95	563.78	563.89	563.50
2300	564.12	563.93	563.74	563.99	563.78	563.94	563.51
2400	564.24	563.99	563.75	563.96	563.84	563.93	563.56
MEAN	564.28	564.35	564.13	564.05	564.04	564.10	563.81

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.30 AT 700 ON 2
MINIMUM HOURLY ELEVATION: 563.50 AT 2200 ON 31
MONTHLY MEAN: 564.21
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

NOVEMBER 1987

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.57	563.59	563.91	563.96	564.07	564.41	565.05	563.76
200	563.57	563.57	563.94	563.97	564.11	564.43	565.27	563.84
300	563.58	563.53	563.98	564.02	564.07	564.45	565.22	564.13
400	563.61	563.54	563.97	564.07	564.08	564.36	565.11	563.99
500	563.63	563.53	563.97	564.10	564.08	564.44	565.08	563.98
600	563.63	563.54	563.97	564.11	564.09	564.46	565.01	563.96
700	563.63	563.58	563.93	564.12	564.05	564.47	564.81	564.01
800	563.64	563.62	563.90	564.11	564.06	564.40	564.64	563.99
900	563.62	563.63	564.02	564.11	564.21	564.43	564.50	563.97
1000	563.61	563.68	564.08	564.15	564.26	564.41	564.33	564.04
1100	563.61	563.67	564.11	564.19	564.20	564.40	564.16	564.02
1200	563.67	563.71	564.16	564.19	564.29	564.35	564.05	563.96
1300	563.65	563.74	564.22	564.19	564.38	564.39	563.99	563.92
1400	563.67	563.73	564.13	564.20	564.49	564.40	563.96	563.97
1500	563.65	563.74	564.02	564.19	564.56	564.43	563.99	563.98
1600	563.66	563.73	564.00	564.17	564.57	564.45	564.04	563.94
1700	563.62	563.74	564.05	564.13	564.64	564.44	564.11	563.91
1800	563.62	563.71	564.01	564.07	564.59	564.42	564.14	563.84
1900	563.62	563.70	563.94	564.05	564.70	564.38	564.18	563.83
2000	563.62	563.71	563.95	564.00	564.69	564.43	564.13	563.84
2100	563.65	563.71	563.95	563.96	564.63	564.45	564.03	563.87
2200	563.61	563.76	563.97	563.97	564.59	564.59	563.96	563.86
2300	563.62	563.80	563.95	564.00	564.48	564.65	563.88	563.82
2400	563.61	563.87	563.94	564.00	564.37	564.72	563.80	563.77
MEAN	563.62	563.67	564.00	564.08	564.34	564.45	564.39	563.93

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.79	563.56	563.48	564.02	564.08	563.80	563.69	563.51
200	563.84	563.48	563.41	564.11	564.06	563.82	563.64	563.53
300	563.87	563.43	563.43	564.15	564.01	563.83	563.59	563.54
400	563.92	563.42	563.46	564.24	563.99	563.82	563.56	563.57
500	563.92	563.43	563.47	564.28	564.01	563.81	563.53	563.56
600	563.83	563.42	563.47	564.26	564.06	563.78	563.53	563.55
700	563.80	563.42	563.46	564.23	564.12	563.78	563.53	563.55
800	563.78	563.46	563.41	564.20	564.19	563.74	563.55	563.57
900	563.71	563.47	563.42	564.16	564.27	563.73	563.55	563.57
1000	563.64	563.47	563.42	564.09	564.33	563.70	563.60	563.55
1100	563.64	563.43	563.41	564.04	564.36	563.68	563.64	563.58
1200	563.65	563.42	563.48	564.04	564.43	563.70	563.63	563.60
1300	563.65	563.46	563.55	564.01	564.40	563.68	563.61	563.60
1400	563.71	563.54	563.56	564.05	564.30	563.71	563.60	563.61
1500	563.76	563.56	563.58	564.11	564.24	563.70	563.59	563.64
1600	563.79	563.58	563.61	564.14	564.18	563.70	563.55	563.64
1700	563.76	563.61	563.69	564.16	564.11	563.70	563.52	563.63
1800	563.80	563.59	563.72	564.20	564.00	563.74	563.51	563.60
1900	563.85	563.51	563.74	564.20	563.95	563.76	563.47	563.60
2000	563.89	563.45	563.80	564.17	563.92	563.78	563.43	563.61
2100	563.88	563.43	563.83	564.18	563.85	563.79	563.42	563.62
2200	563.82	563.43	563.85	564.20	563.80	563.77	563.44	563.65
2300	563.75	563.48	563.88	564.14	563.77	563.73	563.46	563.68
2400	563.67	563.49	563.93	564.07	563.80	563.71	563.47	563.68
MEAN	563.78	563.48	563.59	564.14	564.09	563.75	563.55	563.59

**- MISSING DATA　　*- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

NOVEMBER 1987

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.63	564.01	564.04	564.75	563.79	563.67	563.82	563.97
200	563.61	564.05	564.05	564.72	563.77	563.69	563.84	564.04
300	563.63	563.99	564.15	564.62	563.78	563.71	563.86	564.16
400	563.66	564.02	564.28	564.48	563.83	563.74	563.88	564.27
500	563.68	564.07	564.34	564.42	563.82	563.76	563.87	564.37
600	563.66	564.38	564.40	564.32	563.86	563.79	563.82	564.43
700	563.65	564.78	564.38	564.08	563.80	563.76	563.79	564.51
800	563.62	565.17	564.39	563.86	563.78	563.75	563.79	564.52
900	563.60	565.50	564.49	563.82	563.75	563.74	563.79	564.41
1000	563.63	565.60	564.58	563.80	563.73	563.75	563.77	564.28
1100	563.66	565.48	564.51	563.79	563.72	563.76	563.79	564.11
1200	563.71	565.39	564.38	563.79	563.76	563.79	563.83	564.00
1300	563.74	565.53	564.42	563.88	563.82	563.76	563.85	563.90
1400	563.77	565.26	564.40	563.96	563.82	563.78	563.93	563.82
1500	563.73	565.11	564.38	563.88	563.89	563.78	564.05	563.83
1600	563.67	565.00	564.35	563.91	564.00	563.77	564.10	563.82
1700	563.70	565.00	564.36	563.87	564.04	563.71	564.08	563.82
1800	563.65	564.85	564.35	563.87	564.02	563.70	564.05	563.80
1900	563.68	564.78	564.37	563.81	563.93	563.69	564.00	563.77
2000	563.69	564.66	564.39	563.81	563.88	563.65	563.94	563.77
2100	563.73	564.46	564.52	563.80	563.81	563.68	563.94	563.75
2200	563.77	564.24	564.59	563.75	563.76	563.72	563.94	563.72
2300	563.81	564.08	564.70	563.73	563.73	563.77	563.93	563.69
2400	563.87	564.06	564.75	563.75	563.69	563.80	563.93	563.69
MEAN	563.69	564.73	564.40	564.02	563.82	563.74	563.90	564.02

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30
100	563.64	563.75	563.05	563.63	563.61	564.40
200	563.56	563.75	563.06	563.69	563.62	564.36
300	563.47	563.80	563.02	563.71	563.62	564.46
400	563.35	563.81	563.05	563.74	563.64	564.42
500	563.21	563.78	563.04	563.76	563.74	564.51
600	563.11	563.77	563.09	563.77	563.89	564.55
700	563.04	563.75	563.12	563.76	563.91	564.56
800	562.99	563.71	563.15	563.78	563.94	564.63
900	562.96	563.64	563.19	563.76	563.91	564.79
1000	562.91	563.57	563.20	563.72	563.95	564.83
1100	562.91	563.54	563.17	563.71	563.95	564.82
1200	563.00	563.43	563.19	563.69	563.98	564.78
1300	563.18	563.39	563.25	563.72	563.97	564.79
1400	563.33	563.36	563.28	563.71	563.96	564.70
1500	563.44	563.36	563.36	563.73	563.95	564.64
1600	563.59	563.32	563.41	563.72	563.99	564.60
1700	563.69	563.31	563.49	563.73	563.97	564.66
1800	563.76	563.32	563.52	563.75	564.01	564.70
1900	563.81	563.31	563.48	563.73	564.03	564.69
2000	563.90	563.30	563.51	563.72	564.06	564.69
2100	563.92	563.30	563.54	563.69	564.04	564.71
2200	563.83	563.25	563.56	563.67	564.11	564.67
2300	563.79	563.15	563.56	563.65	564.18	564.62
2400	563.75	563.10	563.60	563.59	564.27	564.58
MEAN	563.42	563.49	563.29	563.71	563.93	564.63

**- MISSING DATA   *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.60 AT 1000 ON 18
MINIMUM HOURLY ELEVATION: 562.91 AT 1000 ON 25
MONTHLY MEAN: 563.91
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

DECEMBER 1987

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	564.56	564.06	564.61	563.77	563.90	564.03	563.84	563.83
200	564.48	564.12	564.49	563.78	563.90	564.04	563.83	563.89
300	564.40	564.14	564.35	563.70	563.92	564.06	563.83	563.93
400	564.31	564.19	564.24	563.58	564.00	564.04	563.84	563.93
500	564.28	564.30	564.18	563.47	564.02	564.01	563.82	563.92
600	564.18	564.35	564.14	563.41	564.01	563.99	563.81	563.91
700	564.09	564.38	564.08	563.39	564.03	563.96	563.79	563.84
800	564.01	564.36	564.06	563.40	564.04	563.90	563.79	563.84
900	563.96	564.44	564.01	563.41	564.04	563.88	563.80	563.85
1000	563.93	564.41	563.96	563.49	564.04	563.87	563.76	563.82
1100	563.92	564.38	563.89	563.55	564.05	563.87	563.79	563.81
1200	563.91	564.41	563.84	563.63	564.03	563.91	563.81	563.81
1300	563.91	564.37	563.86	563.67	563.97	563.93	563.85	563.90
1400	563.90	564.39	563.81	563.75	563.97	563.94	563.87	563.98
1500	563.88	564.46	563.79	563.86	563.93	563.97	563.89	564.05
1600	563.81	564.44	563.77	563.97	563.91	563.98	563.89	564.08
1700	563.81	564.46	563.76	564.03	563.90	563.95	563.86	564.06
1800	563.80	564.63	563.72	564.04	563.92	563.93	563.81	564.04
1900	563.83	564.67	563.68	564.02	563.92	563.91	563.72	564.00
2000	563.84	564.73	563.69	564.01	563.94	563.88	563.71	563.98
2100	563.86	564.76	563.65	563.96	563.98	563.87	563.74	563.94
2200	563.88	564.74	563.68	563.95	564.02	563.85	563.71	563.88
2300	563.94	564.70	563.70	563.91	564.02	563.85	563.75	563.86
2400	563.99	564.65	563.76	563.91	564.05	563.84	563.76	563.85
MEAN	564.02	564.44	563.95	563.74	563.98	563.94	563.80	563.92

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.84	564.76	563.98	563.72	564.53	563.71	563.57	566.41
200	563.85	564.61	563.95	563.85	564.47	563.75	563.53	566.50
300	563.87	564.56	563.88	563.78	564.41	563.76	563.46	566.49
400	563.89	564.45	563.84	563.92	564.42	563.75	563.39	566.56
500	563.91	564.33	563.86	564.39	564.33	563.74	563.31	566.71
600	563.94	564.28	563.85	564.35	564.22	563.74	563.22	566.52
700	564.02	564.24	563.80	564.31	564.08	563.75	563.12	566.25
800	564.05	564.22	563.77	564.11	564.07	563.71	562.99	565.94
900	564.03	564.18	563.75	564.04	563.94	563.66	562.79	565.70
1000	564.04	564.23	563.71	563.81	564.07	563.68	562.73	565.42
1100	564.06	564.19	563.65	563.63	564.10	563.65	562.83	565.14
1200	564.06	564.20	563.63	563.66	564.12	563.61	563.07	564.99
1300	564.05	564.23	563.66	563.69	564.11	563.58	563.23	564.97
1400	564.05	564.23	563.72	563.78	564.09	563.61	563.53	564.88
1500	564.07	564.13	563.72	563.98	564.09	563.57	563.88	564.81
1600	564.16	564.07	563.70	564.42	564.01	563.57	564.14	564.90
1700	564.28	564.03	563.68	564.75	563.89	563.56	564.90	565.01
1800	564.43	563.96	563.63	564.83	563.86	563.53	566.23	565.02
1900	564.64	563.87	563.57	564.66	563.82	563.53	566.54	565.07
2000	564.96	563.86	563.48	564.60	563.79	563.57	566.25	565.08
2100	564.97	563.91	563.41	564.69	563.74	563.57	566.50	565.07
2200	564.91	563.92	563.43	564.49	563.80	563.60	566.45	565.07
2300	564.90	563.91	563.47	564.40	563.77	563.62	566.10	565.01
2400	564.93	563.95	563.65	564.48	563.73	563.61	566.13	564.86
MEAN	564.25	564.18	563.70	564.18	564.06	563.64	564.25	565.52

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

DECEMBER 1987

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	564.78	564.56	564.64	563.88	565.08	565.00	564.14	564.02
200	564.68	564.54	564.63	563.81	565.10	564.88	564.22	563.99
300	564.62	564.53	564.63	563.67	565.18	564.80	564.26	563.94
400	564.54	564.51	564.61	563.61	565.18	564.72	564.39	563.89
500	564.51	564.49	564.62	563.60	565.29	564.54	564.50	563.85
600	564.53	564.46	564.68	563.49	565.32	564.39	564.55	563.86
700	564.53	564.46	564.81	563.48	565.41	564.32	564.46	563.87
800	564.60	564.45	564.80	563.54	565.49	564.27	564.43	563.88
900	564.58	564.44	564.76	563.69	565.55	564.21	564.34	563.90
1000	564.68	564.45	564.69	563.87	565.55	564.16	564.23	563.99
1100	564.72	564.47	564.55	564.04	565.47	564.17	564.15	564.00
1200	564.73	564.48	564.42	564.18	565.28	564.21	564.11	564.00
1300	564.74	564.47	564.23	564.47	565.11	564.21	564.18	564.00
1400	564.75	564.50	564.09	564.89	565.00	564.17	564.23	563.99
1500	564.72	564.51	563.97	565.31	564.96	564.14	564.18	563.98
1600	564.68	564.51	563.91	565.61	564.88	564.10	564.23	564.03
1700	564.68	564.52	563.85	565.79	564.81	564.02	564.25	564.07
1800	564.64	564.54	563.84	565.80	564.90	563.98	564.26	564.07
1900	564.63	564.56	563.86	565.75	565.08	564.04	564.19	564.14
2000	564.59	564.56	563.87	565.61	565.14	564.16	564.17	564.12
2100	564.55	564.53	563.86	565.47	565.17	564.16	564.16	564.08
2200	564.54	564.56	563.87	565.29	565.17	564.10	564.11	564.06
2300	564.53	564.59	563.83	565.14	565.17	564.04	564.05	564.07
2400	564.56	564.65	563.87	565.05	565.12	564.07	564.03	564.00
MEAN	564.63	564.51	564.29	564.54	565.18	564.29	564.24	563.99

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	564.00	563.73	563.61	563.67	563.66	564.02	563.73
200	564.04	563.68	563.65	563.64	563.62	563.97	563.71
300	564.05	563.65	563.67	563.60	563.64	563.89	563.70
400	564.08	563.62	563.70	563.56	563.59	563.84	563.73
500	564.13	563.62	563.73	563.49	563.60	563.78	563.78
600	564.16	563.62	563.79	563.40	563.70	563.73	563.84
700	564.11	563.62	563.83	563.35	563.75	563.71	563.85
800	564.10	563.62	563.86	563.34	563.72	563.74	563.98
900	564.09	563.60	563.89	563.30	563.72	563.74	564.08
1000	564.09	563.59	563.92	563.34	563.78	563.77	564.25
1100	564.09	563.57	563.92	563.38	563.81	563.80	564.34
1200	564.10	563.56	563.89	563.44	563.85	563.80	564.39
1300	564.06	563.56	563.82	563.38	563.87	563.80	564.41
1400	564.05	563.61	563.77	563.33	563.88	563.82	564.34
1500	564.00	563.67	563.71	563.36	563.90	563.80	564.34
1600	563.91	563.69	563.69	563.32	564.03	563.77	564.30
1700	563.83	563.69	563.66	563.28	564.07	563.76	564.25
1800	563.79	563.70	563.67	563.34	564.09	563.73	564.21
1900	563.74	563.68	563.67	563.27	564.17	563.72	564.22
2000	563.73	563.69	563.70	563.25	564.19	563.73	564.24
2100	563.74	563.67	563.70	563.37	564.17	563.71	564.33
2200	563.75	563.65	563.70	563.48	564.14	563.69	564.42
2300	563.74	563.64	563.71	563.56	564.13	563.69	564.52
2400	563.74	563.64	563.69	563.62	564.07	563.72	564.55
MEAN	563.96	563.64	563.75	563.42	563.88	563.78	564.15

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 566.71 AT 500 ON 16
MINIMUM HOURLY ELEVATION: 562.73 AT 1000 ON 15
MONTHLY MEAN: 564.12
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JANUARY 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	564.61	565.01	564.46	563.74	565.35	565.61	564.28	563.69
200	564.72	564.95	564.43	563.82	565.30	565.54	564.22	563.77
300	564.73	564.92	564.41	563.87	565.17	565.44	564.19	563.85
400	564.77	564.88	564.33	563.91	565.01	565.36	564.14	563.92
500	564.75	564.75	564.24	563.95	565.07	565.24	564.06	564.00
600	564.82	564.66	564.13	564.07	565.11	565.14	564.00	564.04
700	564.86	564.53	564.05	564.10	565.22	565.08	563.91	564.05
800	564.80	564.48	563.95	564.21	565.36	565.06	563.82	564.08
900	564.84	564.44	563.90	564.21	565.54	565.06	563.75	564.11
1000	564.85	564.41	563.87	564.24	565.66	565.02	563.68	564.12
1100	564.92	564.44	563.83	564.33	565.67	564.99	563.62	564.13
1200	564.88	564.40	563.85	564.47	565.66	564.92	563.60	564.19
1300	564.93	564.38	563.85	564.64	565.63	564.80	563.58	564.27
1400	565.23	564.41	563.85	564.94	565.49	564.74	563.58	564.31
1500	565.43	564.45	563.84	565.24	565.29	564.67	563.64	564.31
1600	565.62	564.48	563.84	565.48	565.24	564.63	563.70	564.32
1700	565.75	564.46	563.80	565.53	565.28	564.59	563.73	564.32
1800	565.72	564.45	563.75	565.64	565.30	564.54	563.72	564.31
1900	565.61	564.37	563.74	565.92	565.39	564.46	563.66	564.33
2000	565.46	564.38	563.71	565.83	565.52	564.42	563.59	564.35
2100	565.33	564.38	563.68	565.73	565.61	564.39	563.56	564.35
2200	565.23	564.42	563.68	565.85	565.64	564.35	563.59	564.35
2300	565.13	564.43	563.67	565.76	565.68	564.34	563.59	564.38
2400	565.08	564.46	563.70	565.50	565.67	564.33	563.61	564.39
MEAN	565.09	564.54	563.94	564.79	565.41	564.86	563.78	564.16

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	564.42	564.78	564.76	564.33	564.02	564.13	563.90	564.56
200	564.50	564.78	564.83	564.31	563.97	564.06	564.01	564.57
300	564.59	564.76	564.92	564.30	563.91	563.93	564.11	564.61
400	564.70	564.74	565.02	564.33	563.91	563.79	564.17	564.65
500	564.80	564.75	565.08	564.35	563.96	563.70	564.25	564.71
600	564.84	564.76	565.13	564.38	564.22	563.60	564.30	564.73
700	564.88	564.77	565.21	564.36	564.81	563.51	564.32	564.76
800	564.88	564.77	565.25	564.37	565.32	563.51	564.33	564.78
900	564.92	564.76	565.27	564.39	565.51	563.52	564.33	564.79
1000	564.95	564.76	565.30	564.39	565.57	563.61	564.31	564.80
1100	564.99	564.78	565.35	564.38	565.52	563.71	564.29	564.77
1200	565.06	564.76	565.37	564.35	565.32	563.77	564.32	564.74
1300	565.09	564.77	565.34	564.27	564.87	563.81	564.35	564.63
1400	565.05	564.80	565.33	564.16	564.59	563.80	564.44	564.45
1500	564.97	564.80	565.29	564.06	564.25	563.79	564.50	564.32
1600	564.93	564.80	565.27	563.98	564.14	563.75	564.54	564.19
1700	564.90	564.79	565.19	563.96	564.05	563.76	564.60	564.08
1800	564.86	564.76	565.02	564.00	564.04	563.73	564.59	563.99
1900	564.83	564.74	564.88	564.02	564.05	563.66	564.58	563.95
2000	564.82	564.72	564.75	564.06	564.17	563.66	564.56	563.92
2100	564.81	564.69	564.61	564.08	564.25	563.66	564.56	563.92
2200	564.81	564.69	564.48	564.11	564.26	563.69	564.55	563.96
2300	564.81	564.69	564.40	564.10	564.25	563.74	564.53	563.98
2400	564.79	564.72	564.37	564.09	564.21	563.84	564.54	563.98
MEAN	564.84	564.76	565.02	564.21	564.47	563.74	564.37	564.41

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JANUARY 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.99	563.47	563.82	563.26	564.20	563.74	563.85	563.73
200	563.92	563.55	563.86	563.36	564.21	563.72	563.80	563.71
300	563.85	563.63	563.87	563.41	564.19	563.72	563.83	563.69
400	563.81	563.69	563.90	563.49	564.21	563.74	563.83	563.69
500	563.79	563.72	563.89	563.56	564.29	563.74	563.84	563.71
600	563.73	563.72	563.86	563.63	564.28	563.75	563.89	563.73
700	563.70	563.71	563.86	563.73	564.29	563.75	563.92	563.73
800	563.67	563.69	563.85	563.78	564.31	563.74	563.93	563.73
900	563.64	563.65	563.81	563.76	564.35	563.74	563.86	563.78
1000	563.65	563.64	563.76	563.76	564.31	563.76	563.84	563.90
1100	563.65	563.66	563.71	563.74	564.24	563.77	563.83	563.90
1200	563.56	563.75	563.67	563.74	564.24	563.80	563.82	563.85
1300	563.56	563.89	563.58	563.73	564.23	563.82	563.88	563.84
1400	563.55	564.16	563.54	563.71	564.15	563.85	563.98	563.85
1500	563.55	564.30	563.50	563.65	564.05	563.84	563.99	563.87
1600	563.53	564.39	563.46	563.66	564.01	563.87	564.00	563.90
1700	563.50	564.41	563.42	563.69	563.96	563.90	564.06	563.96
1800	563.50	564.34	563.37	563.70	563.90	563.91	564.01	564.08
1900	563.48	564.26	563.34	563.70	563.85	563.92	563.96	564.54
2000	563.48	564.10	563.24	563.78	563.81	563.90	563.89	564.83
2100	563.44	564.00	563.11	563.81	563.77	563.91	563.86	564.80
2200	563.44	563.89	563.08	563.90	563.74	563.87	563.84	564.70
2300	563.46	563.82	563.11	563.91	563.71	563.88	563.76	564.69
2400	563.47	563.81	563.23	564.04	563.73	563.89	563.76	564.49
MEAN	563.62	563.89	563.58	563.69	564.08	563.81	563.88	564.03

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	564.27	563.39	564.16	564.47	563.90	563.75	563.76
200	564.13	563.41	564.15	564.44	563.91	563.72	563.78
300	564.09	563.37	564.11	564.41	563.95	563.72	563.79
400	563.96	563.46	564.04	564.33	564.01	563.75	563.77
500	563.84	563.74	564.01	564.27	564.05	563.76	563.78
600	563.80	564.01	563.98	564.21	564.11	563.78	563.80
700	563.84	564.26	563.98	564.16	564.10	563.78	563.81
800	563.83	564.55	564.01	564.13	564.14	563.79	563.81
900	563.76	564.85	564.06	564.16	564.16	563.84	563.79
1000	563.72	565.00	564.11	564.21	564.23	563.88	563.80
1100	563.70	564.96	564.15	564.27	564.21	563.88	563.78
1200	563.68	564.88	564.19	564.28	564.20	563.87	563.78
1300	563.68	564.81	564.17	564.24	564.08	563.89	563.80
1400	563.64	564.65	564.11	564.21	563.98	563.88	563.80
1500	563.59	564.47	564.05	564.17	563.90	563.85	563.81
1600	563.55	564.33	564.03	564.17	563.85	563.82	563.80
1700	563.50	564.26	564.00	564.12	563.81	563.81	563.80
1800	563.43	564.20	563.95	564.06	563.75	563.78	563.80
1900	563.40	564.17	563.90	563.98	563.75	563.77	563.82
2000	563.40	564.19	563.92	563.91	563.73	563.75	563.81
2100	563.37	564.16	564.02	563.87	563.75	563.74	563.80
2200	563.36	564.18	564.15	563.85	563.75	563.75	563.80
2300	563.36	564.17	564.30	563.84	563.75	563.74	563.85
2400	563.37	564.15	564.39	563.85	563.75	563.76	563.89
MEAN	563.68	564.23	564.08	564.15	563.95	563.79	563.80

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.92 AT 1900 ON 4
MINIMUM HOURLY ELEVATION: 563.08 AT 2200 ON 19
MONTHLY MEAN: 564.22
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

FEBRUARY 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.87	563.83	563.67	563.51	563.99	**	564.93	565.16
200	563.85	563.85	563.71	563.51	564.00	**	564.98	565.15
300	563.83	563.80	563.70	563.51	564.03	**	565.04	565.18
400	563.80	563.78	563.74	563.52	564.01	565.38	565.05	565.18
500	563.76	563.75	563.79	563.55	563.96	565.50	564.98	565.15
600	563.73	563.70	563.82	563.61	563.92	565.56	564.90	565.07
700	563.74	563.67	563.85	563.60	**	565.68	564.79	564.93
800	563.74	563.65	563.89	563.60	**	565.79	564.64	564.78
900	563.71	563.65	563.93	563.61	**	565.86	564.51	564.64
1000	563.68	563.65	563.90	563.62	**	565.91	564.51	564.58
1100	563.67	563.59	563.92	563.61	**	565.92	564.46	564.49
1200	563.68	563.61	563.90	563.66	**	565.89	564.40	564.35
1300	563.66	563.63	563.91	563.71	**	565.90	564.34	564.25
1400	563.66	563.65	563.91	563.74	**	565.88	564.38	564.15
1500	563.65	563.65	563.91	563.76	**	565.80	564.41	564.12
1600	563.61	563.66	563.85	563.83	**	565.68	564.43	564.12
1700	563.65	563.65	563.83	563.84	**	565.54	564.49	564.09
1800	563.66	563.64	563.81	563.83	**	565.44	564.63	564.08
1900	563.66	563.63	563.77	563.81	**	565.35	564.67	564.04
2000	563.64	563.59	563.74	563.81	**	565.25	564.77	564.00
2100	563.65	563.59	563.68	563.84	**	565.12	564.95	563.94
2200	563.70	563.59	563.61	563.87	**	565.06	565.04	563.95
2300	563.70	563.62	563.56	563.94	**	564.99	565.06	563.92
2400	563.78	563.65	563.54	563.99	**	564.94	565.12	563.90
MEAN	563.71	563.67	563.79	563.70	563.99*	565.54*	564.73	564.47

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.93	564.24	563.55	563.63	564.81	564.69	563.81	563.73
200	563.94	564.28	563.52	563.68	564.91	564.70	563.74	563.74
300	563.99	564.33	563.48	563.74	564.99	564.74	563.66	563.78
400	564.04	564.38	563.43	563.66	565.12	564.75	563.66	563.78
500	564.08	564.40	563.39	563.64	565.19	564.73	563.65	563.79
600	564.11	564.42	563.42	563.69	565.26	564.72	563.62	563.83
700	564.13	564.44	563.39	563.73	565.27	564.69	563.67	563.86
800	564.18	564.45	563.40	563.79	565.28	564.66	563.71	563.89
900	564.19	564.47	563.35	564.03	565.27	564.61	563.79	563.94
1000	564.22	564.45	563.31	564.26	565.20	564.55	563.82	563.99
1100	564.23	564.44	563.30	564.36	565.12	564.50	563.85	563.99
1200	564.25	564.39	563.31	564.49	565.11	564.47	563.99	563.97
1300	564.27	564.30	563.33	564.59	565.05	564.36	564.26	563.95
1400	564.27	564.16	563.36	564.62	565.06	564.19	564.47	563.89
1500	564.28	564.06	563.41	564.57	564.97	564.02	564.54	563.88
1600	564.29	563.98	563.44	564.48	564.91	563.95	564.51	563.87
1700	564.27	563.96	563.44	564.46	564.86	563.89	564.48	563.85
1800	564.22	563.93	563.46	564.41	564.77	563.79	564.36	563.84
1900	564.23	563.88	563.48	564.39	564.73	563.75	564.20	563.81
2000	564.22	563.84	563.49	564.44	564.65	563.75	564.03	563.79
2100	564.21	563.76	563.46	564.53	564.59	563.78	563.91	563.76
2200	564.20	563.70	563.47	564.55	564.58	563.78	563.78	563.73
2300	564.19	563.63	563.59	564.57	564.60	563.77	563.74	563.68
2400	564.24	563.58	563.61	564.67	564.64	563.78	563.73	563.67
MEAN	564.17	564.14	563.43	564.21	564.96	564.28	563.96	563.83

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

FEBRUARY 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.67	563.68	563.63	563.78	564.79	564.76	564.19	564.44
200	563.65	563.68	563.64	563.84	564.69	564.80	564.19	564.42
300	563.68	563.68	563.65	563.98	564.72	564.80	564.17	564.41
400	563.69	563.67	563.64	564.21	564.77	564.80	564.13	564.34
500	563.70	563.65	563.64	564.37	564.77	564.82	564.08	564.30
600	563.73	563.63	563.62	564.44	564.85	564.82	564.09	564.30
700	563.77	563.59	563.60	564.43	564.92	564.88	564.07	564.34
800	563.76	563.59	563.57	564.37	564.93	564.90	564.04	564.36
900	563.75	563.60	563.55	564.27	564.93	564.87	564.07	564.40
1000	563.74	563.59	563.53	564.19	564.93	564.88	564.14	564.44
1100	563.73	563.59	563.52	564.08	564.91	564.93	564.14	564.49
1200	563.72	563.63	563.52	563.97	564.85	564.90	564.15	564.56
1300	563.69	563.66	563.53	563.97	564.79	564.81	564.15	564.59
1400	563.70	563.69	563.54	563.94	564.67	564.68	564.07	564.64
1500	563.72	563.71	563.59	563.95	564.57	564.64	564.02	564.63
1600	563.76	563.71	563.64	564.04	564.51	564.61	564.02	564.62
1700	563.75	563.72	563.66	564.32	564.49	564.57	564.02	564.58
1800	563.74	563.70	563.63	564.59	564.43	564.50	564.07	564.53
1900	563.75	563.68	563.64	564.98	564.43	564.40	564.17	564.48
2000	563.74	563.66	563.62	565.23	564.42	564.34	564.26	564.42
2100	563.72	563.66	563.64	565.27	564.45	564.23	564.30	564.35
2200	563.70	563.64	563.65	565.13	564.54	564.27	564.30	564.29
2300	563.69	563.63	563.65	565.02	564.62	564.23	564.30	564.25
2400	563.68	563.63	563.70	564.93	564.67	564.23	564.37	564.23
MEAN	563.72	563.65	563.61	564.39	564.69	564.65	564.15	564.43

TIME, EASTERN STANDARD	DAY 25	26	27	28	29
100	564.16	564.03	563.77	563.74	563.59
200	564.16	564.02	563.80	563.73	563.67
300	564.24	564.03	563.82	563.75	563.73
400	564.33	564.04	563.82	563.76	563.82
500	564.33	564.07	563.84	563.76	563.95
600	564.32	564.13	563.79	563.77	563.99
700	564.36	564.20	563.76	563.82	563.98
800	564.42	564.28	563.72	563.84	563.90
900	564.43	564.32	563.70	563.88	563.89
1000	564.46	564.32	563.66	563.89	563.82
1100	564.47	564.28	563.64	563.89	563.82
1200	564.45	564.23	563.63	563.88	563.79
1300	564.39	564.16	563.62	563.87	563.79
1400	564.33	564.07	563.63	563.87	563.79
1500	564.29	564.00	563.64	563.87	563.84
1600	564.29	563.92	563.64	563.86	563.87
1700	564.27	563.89	563.65	563.82	563.87
1800	564.25	563.83	563.69	563.77	563.87
1900	564.23	563.81	563.70	563.72	563.85
2000	564.22	563.75	563.72	563.67	563.80
2100	564.20	563.72	563.74	563.60	563.79
2200	564.18	563.71	563.74	563.57	563.79
2300	564.12	563.69	563.74	563.57	563.77
2400	564.08	563.72	563.74	563.55	563.73
MEAN	564.29	564.01	563.72	563.77	563.82

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.92 AT 1100 ON 6
MINIMUM HOURLY ELEVATION: 563.30 AT 1100 ON 11
MONTHLY MEAN: 564.12
DATA CAPTURE: 97.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

MARCH 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.67	563.49	563.79	563.67	563.85	563.74	563.86	563.73
200	563.67	563.54	563.78	563.70	563.83	563.76	563.93	563.72
300	563.57	563.60	563.79	563.72	563.83	563.77	563.99	563.67
400	563.53	563.66	563.78	563.72	563.84	563.79	564.03	563.65
500	563.50	563.73	563.78	563.69	563.87	563.80	564.06	563.62
600	563.53	563.80	563.78	563.67	563.88	563.82	564.07	563.62
700	563.58	563.84	563.77	563.67	563.89	563.81	564.04	563.64
800	563.62	563.84	563.77	563.66	563.89	563.82	564.02	563.69
900	563.67	563.84	563.77	563.65	563.92	563.80	563.95	563.73
1000	563.75	563.84	563.76	563.64	563.91	563.80	563.88	563.72
1100	563.74	563.84	563.76	563.64	563.88	563.80	563.82	563.75
1200	563.75	563.81	563.77	563.64	563.87	563.78	563.78	563.79
1300	563.75	563.83	563.74	563.64	563.88	563.78	563.78	563.78
1400	563.77	563.87	563.73	563.64	563.87	563.78	563.77	563.74
1500	563.74	563.85	563.71	563.65	563.87	563.81	563.75	563.72
1600	563.68	563.83	563.64	563.66	563.88	563.84	563.78	563.72
1700	563.63	563.86	563.59	563.71	563.89	563.87	563.80	563.68
1800	563.59	563.87	563.57	563.74	563.87	563.85	563.81	563.69
1900	563.57	563.88	563.56	563.77	563.81	563.82	563.82	563.72
2000	563.53	563.84	563.54	563.79	563.77	563.79	563.83	563.72
2100	563.49	563.84	563.56	563.84	563.74	563.77	563.83	563.76
2200	563.48	563.82	563.59	563.84	563.74	563.72	563.82	563.78
2300	563.48	563.82	563.62	563.87	563.73	563.73	563.78	563.74
2400	563.47	563.80	563.64	563.88	563.73	563.78	563.77	563.78
MEAN	563.62	563.79	563.70	563.71	563.84	563.79	563.87	563.72

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.80	563.87	563.86	563.59	563.84	564.27	564.12	564.05
200	563.79	563.84	563.82	563.58	563.93	564.10	564.05	564.09
300	563.80	563.80	563.79	563.54	564.04	564.02	563.99	564.10
400	563.83	563.79	563.77	563.54	564.13	564.03	563.98	564.08
500	563.85	563.83	563.78	563.53	564.24	564.05	563.97	564.04
600	563.88	563.84	563.79	563.49	564.29	564.14	563.98	564.00
700	563.89	563.85	563.81	563.48	564.24	564.22	563.98	563.95
800	563.92	563.86	563.84	563.44	564.15	564.22	564.03	563.91
900	563.93	563.84	563.88	563.39	564.08	564.24	564.09	563.92
1000	563.95	563.84	563.92	563.40	564.09	564.25	564.17	563.98
1100	563.91	563.85	563.94	563.47	564.06	564.27	564.19	564.01
1200	563.84	563.84	563.96	563.51	564.09	564.19	564.18	564.03
1300	563.88	563.83	563.97	563.59	564.20	564.15	564.14	564.06
1400	563.86	563.85	563.97	563.67	564.26	564.09	564.10	564.09
1500	563.87	563.87	563.95	563.75	564.29	564.04	564.08	564.11
1600	563.85	563.83	563.92	563.79	564.35	564.00	564.07	564.14
1700	563.93	563.86	563.89	563.82	564.42	563.97	564.04	564.18
1800	563.94	563.88	563.84	563.92	564.49	563.94	564.02	564.18
1900	563.93	563.91	563.81	563.82	564.56	563.91	563.98	564.14
2000	563.96	563.91	563.77	563.79	564.54	563.91	563.97	564.07
2100	563.98	563.91	563.72	563.83	564.52	563.92	563.97	564.03
2200	564.02	563.95	563.66	563.90	564.51	563.99	563.97	563.94
2300	563.96	563.96	563.63	563.83	564.52	564.05	563.99	563.89
2400	563.89	563.92	563.61	563.79	564.43	564.14	564.03	563.84
MEAN	563.89	563.86	563.83	563.64	564.26	564.09	564.05	564.03

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

MARCH 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.83	563.79	563.85	564.13	563.79	563.74	563.49	563.84
200	563.84	563.78	563.85	564.25	563.85	563.68	563.54	563.85
300	563.83	563.78	563.85	564.19	563.93	563.64	563.64	563.87
400	563.84	563.79	563.89	564.05	564.04	563.64	563.74	563.83
500	563.87	563.79	563.92	563.94	564.07	563.69	563.80	563.83
600	563.92	563.83	563.96	563.84	564.05	563.77	563.79	563.84
700	563.95	563.83	563.93	563.69	564.03	563.85	563.79	563.83
800	564.02	563.87	563.93	563.62	563.93	563.91	563.82	563.83
900	564.04	563.89	563.95	563.69	563.84	563.94	563.80	563.82
1000	564.01	563.89	563.95	563.79	563.74	563.95	563.83	563.79
1100	564.00	563.92	563.94	563.82	563.66	563.93	563.89	563.74
1200	563.98	563.95	563.91	564.02	563.62	563.86	563.94	563.70
1300	563.98	563.99	563.86	564.13	563.63	563.80	563.98	563.74
1400	564.00	564.03	563.83	564.17	563.67	563.72	563.99	563.79
1500	564.00	564.05	563.86	564.14	563.71	563.65	564.02	563.79
1600	564.02	564.06	563.86	564.11	563.78	563.59	564.02	563.83
1700	563.99	564.18	563.87	564.04	563.83	563.57	564.00	563.89
1800	563.98	564.17	563.92	564.04	563.86	563.57	563.99	563.89
1900	563.95	564.09	563.93	563.97	563.88	563.52	563.97	563.93
2000	563.94	564.01	563.94	563.88	563.88	563.52	563.98	563.89
2100	563.92	563.99	563.99	563.82	563.87	563.52	563.97	563.84
2200	563.87	563.92	564.04	563.78	563.82	563.48	563.92	563.77
2300	563.88	563.86	564.02	563.73	563.78	563.44	563.88	563.74
2400	563.83	563.84	564.02	563.73	563.77	563.41	563.87	563.69
MEAN	563.94	563.93	563.92	563.94	563.83	563.68	563.86	563.82

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	563.65	564.04	564.25	564.28	563.73	563.91	564.09
200	563.64	564.04	564.25	564.21	563.62	563.87	564.12
300	563.67	564.04	564.46	564.11	563.59	563.85	564.12
400	563.69	564.04	564.39	564.12	563.49	563.83	564.10
500	563.73	564.07	564.43	564.17	563.49	563.82	564.12
600	563.78	564.15	564.43	564.17	563.55	563.80	564.02
700	563.82	564.14	564.40	564.19	563.55	563.78	563.92
800	563.86	564.16	564.35	564.20	563.63	563.78	563.80
900	563.85	564.14	564.24	564.23	563.70	563.91	563.73
1000	563.81	564.10	564.33	564.16	563.80	564.18	563.64
1100	563.81	564.04	564.35	564.10	563.87	564.58	563.60
1200	563.82	564.03	564.41	564.03	563.88	565.23	563.57
1300	563.85	564.02	564.53	563.92	563.89	565.37	563.58
1400	563.96	564.00	564.63	563.86	563.88	565.25	563.58
1500	563.96	563.97	564.68	563.79	563.86	565.08	563.59
1600	563.96	564.04	564.64	563.73	563.83	564.81	563.64
1700	563.89	564.06	564.67	563.71	563.81	564.45	563.73
1800	563.87	564.04	564.68	563.68	563.83	564.08	563.78
1900	563.92	564.18	564.63	563.68	563.76	563.89	563.78
2000	564.02	564.18	564.59	563.76	563.76	563.82	563.80
2100	564.07	564.12	564.59	563.71	563.81	563.72	563.79
2200	563.99	564.19	564.50	563.78	563.85	563.72	563.79
2300	563.97	564.14	564.41	563.79	563.88	563.84	563.69
2400	564.09	564.23	564.34	563.78	563.89	563.99	563.69
MEAN	563.86	564.09	564.47	563.97	563.75	564.19	563.80

**- MISSING DATA   *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.37 AT 1300 ON 30
MINIMUM HOURLY ELEVATION: 563.39 AT 900 ON 12
MONTHLY MEAN: 563.89
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

APRIL 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.68	563.77	563.66	564.05	563.85	563.71	563.84	563.84
200	563.68	563.83	563.74	564.14	563.92	563.77	563.84	563.89
300	563.69	563.83	563.84	564.17	563.94	563.84	563.93	563.93
400	563.79	563.91	563.92	564.32	563.99	563.91	563.97	564.00
500	563.89	563.91	563.97	564.39	564.09	563.96	564.01	564.03
600	563.97	563.93	564.02	564.36	564.18	563.98	564.04	564.07
700	564.07	563.91	564.09	564.31	564.22	564.03	564.14	564.16
800	564.11	563.89	564.20	564.41	564.33	564.13	564.34	564.26
900	564.19	564.03	564.22	564.41	564.37	564.17	564.33	564.28
1000	564.23	564.07	564.19	564.36	564.32	564.23	564.27	564.25
1100	564.17	564.09	564.17	564.32	564.19	564.19	564.24	564.21
1200	564.13	564.08	564.16	564.28	564.09	564.17	564.23	564.18
1300	564.08	564.10	564.14	564.35	564.02	564.08	564.21	564.14
1400	563.98	564.13	564.17	564.44	563.94	564.08	564.17	564.15
1500	563.90	564.08	564.07	564.47	563.92	564.00	564.13	564.12
1600	563.81	564.06	564.05	564.44	563.90	563.93	564.08	564.14
1700	563.77	563.99	564.00	564.40	563.87	563.82	564.02	564.18
1800	563.73	563.93	563.89	564.35	563.83	563.76	563.97	564.14
1900	563.73	563.84	563.79	564.22	563.78	563.84	563.93	564.14
2000	563.73	563.77	563.72	564.08	563.74	564.05	563.88	564.07
2100	563.73	563.63	563.62	563.93	563.68	563.87	563.76	563.98
2200	563.68	563.54	563.60	563.87	563.63	563.73	563.62	563.84
2300	563.67	563.49	563.67	563.86	563.64	563.84	563.65	563.82
2400	563.70	563.57	563.78	563.84	563.68	563.93	563.77	563.83
MEAN	563.88	563.89	563.95	564.24	563.96	563.96	564.02	564.07

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.84	563.88	563.84	563.89	563.89	564.07	564.50	564.44
200	563.85	563.91	563.93	563.97	564.03	564.14	564.59	564.49
300	563.88	563.99	563.96	563.99	564.11	564.24	564.70	564.50
400	563.93	564.06	564.04	564.00	564.16	564.34	564.91	564.57
500	564.01	564.13	564.13	564.01	564.24	564.43	565.07	564.63
600	564.07	564.25	564.20	564.02	564.28	564.54	565.16	564.72
700	564.16	564.38	564.26	564.04	564.34	564.64	565.30	564.77
800	564.27	564.47	564.34	564.12	564.47	564.77	565.40	564.88
900	564.36	564.49	564.39	564.13	564.53	564.79	565.52	564.88
1000	564.39	564.54	564.40	564.15	564.51	564.68	565.54	564.87
1100	564.41	564.53	564.35	564.18	564.47	564.56	565.73	564.74
1200	564.39	564.53	564.33	564.15	564.39	564.63	565.69	564.74
1300	564.34	564.49	564.32	564.17	564.35	564.56	565.70	564.74
1400	564.26	564.47	564.29	564.18	564.34	564.57	565.70	564.77
1500	564.21	564.40	564.24	564.14	564.28	564.58	565.47	564.75
1600	564.18	564.35	564.20	564.14	564.22	564.58	565.30	564.76
1700	564.07	564.29	564.20	564.10	564.17	564.59	565.16	564.73
1800	564.00	564.19	564.18	564.06	564.11	564.72	565.08	564.59
1900	563.99	564.09	564.12	564.03	564.07	564.92	564.94	564.49
2000	563.94	563.98	564.05	563.98	564.07	564.73	564.78	564.38
2100	563.80	563.84	563.97	563.88	564.02	564.59	564.62	564.24
2200	563.73	563.74	563.84	563.81	563.96	564.54	564.48	564.13
2300	563.76	563.72	563.82	563.79	563.97	564.52	564.42	564.08
2400	563.82	563.78	563.84	563.83	563.98	564.45	564.42	564.09
MEAN	564.07	564.19	564.14	564.03	564.21	564.55	565.09	564.58

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

APRIL 1988

TIME, EASTERN STANDARD	DAY							
	17	18	19	20	21	22	23	24
100	564.14	564.56	564.77	564.38	564.81	564.29	563.82	564.59
200	564.20	564.62	564.90	564.49	564.82	564.35	563.82	564.82
300	564.31	564.71	564.98	564.59	564.74	564.42	563.81	565.09
400	564.44	564.76	565.10	564.73	564.65	564.46	563.82	565.27
500	564.59	564.89	565.16	564.89	564.68	564.44	563.80	565.46
600	564.72	564.93	565.18	565.05	564.74	564.45	563.83	565.56
700	564.83	565.00	565.23	565.12	564.84	564.44	563.89	565.55
800	564.98	564.91	565.26	565.14	564.84	564.53	564.05	565.46
900	564.99	564.93	565.24	565.12	564.92	564.57	564.07	565.39
1000	565.00	564.95	565.18	565.05	564.93	564.59	564.12	565.36
1100	564.94	565.01	565.22	565.03	564.95	564.61	564.09	565.34
1200	564.98	564.93	565.17	564.99	564.87	564.59	564.02	565.34
1300	564.98	564.84	565.11	564.99	564.82	564.54	564.09	565.27
1400	565.03	564.91	565.11	565.02	564.87	564.50	564.20	565.32
1500	565.06	564.84	565.04	565.03	564.91	564.44	564.15	565.30
1600	564.99	564.87	565.00	564.97	564.97	564.38	564.11	565.26
1700	564.83	564.89	564.89	564.93	564.96	564.32	564.13	565.19
1800	564.69	564.92	564.77	564.96	564.88	564.23	564.05	565.12
1900	564.50	564.85	564.62	564.94	564.79	564.17	563.89	564.93
2000	564.37	564.77	564.52	564.79	564.62	564.08	563.87	564.77
2100	564.28	564.68	564.39	564.70	564.43	563.98	563.92	564.62
2200	564.23	564.62	564.27	564.99	564.28	563.84	564.13	564.48
2300	564.35	564.71	564.30	564.94	564.29	563.82	564.50	564.43
2400	564.53	564.74	564.31	564.98	564.29	563.82	564.48	564.42
MEAN	564.67	564.83	564.91	564.91	564.75	564.33	564.03	565.10

TIME, EASTERN STANDARD	DAY					
	25	26	27	28	29	30
100	564.35	564.00	563.89	563.77	564.15	564.05
200	564.33	564.03	563.94	563.89	564.18	564.12
300	564.37	564.07	563.93	564.04	564.18	564.15
400	564.40	564.09	563.89	564.03	564.16	564.17
500	564.44	564.12	563.84	564.14	564.20	564.17
600	564.45	564.17	563.78	564.29	564.29	564.21
700	564.52	564.26	563.76	564.44	564.44	564.26
800	564.52	564.43	563.80	564.55	564.62	564.36
900	564.59	564.54	563.79	564.52	564.71	564.41
1000	564.56	564.57	563.81	564.42	564.69	564.42
1100	564.56	564.57	563.83	564.33	564.67	564.42
1200	564.49	564.53	563.94	564.23	564.56	564.43
1300	564.42	564.52	564.21	564.17	564.52	564.39
1400	564.34	564.43	564.84	564.21	564.42	564.33
1500	564.32	564.34	564.98	564.21	564.34	564.28
1600	564.32	564.24	564.84	564.19	564.27	564.27
1700	564.32	564.15	564.77	564.24	564.22	564.24
1800	564.29	564.03	564.73	564.28	564.15	564.19
1900	564.24	563.94	564.57	564.31	564.09	564.14
2000	564.22	563.87	564.26	564.26	564.04	564.08
2100	564.09	563.79	563.94	564.14	563.90	563.96
2200	563.98	563.74	563.83	564.11	563.82	563.88
2300	563.98	563.78	563.80	564.12	563.91	563.94
2400	564.01	563.82	563.77	564.10	564.00	564.03
MEAN	564.34	564.17	564.11	564.21	564.27	564.20

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.73 AT 1100 ON 15
MINIMUM HOURLY ELEVATION: 563.49 AT 2300 ON 2
MONTHLY MEAN: 564.32
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN
WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

MAY 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	564.09	564.04	563.92	563.89	563.79	563.93	564.01	563.92
200	564.12	564.08	563.97	563.95	563.84	563.99	564.04	563.98
300	564.17	564.12	564.02	564.02	563.92	564.04	564.09	564.04
400	564.22	564.18	564.05	564.07	563.99	564.08	564.14	564.08
500	564.27	564.22	564.09	564.08	564.07	564.12	564.19	564.08
600	564.29	564.23	564.12	564.12	564.12	564.15	564.22	564.12
700	564.35	564.26	564.17	564.17	564.20	564.22	564.29	564.21
800	564.44	564.40	564.27	564.25	564.29	564.30	564.38	564.33
900	564.44	564.39	564.29	564.23	564.32	564.33	564.37	564.36
1000	564.43	564.35	564.28	564.19	564.33	564.34	564.35	564.37
1100	564.41	564.32	564.24	564.17	564.34	564.34	564.33	564.38
1200	564.38	564.29	564.21	564.14	564.29	564.34	564.29	564.36
1300	564.37	564.26	564.18	564.11	564.25	564.34	564.22	564.29
1400	564.35	564.24	564.14	564.09	564.23	564.32	564.16	564.26
1500	564.32	564.23	564.09	564.10	564.22	564.30	564.14	564.22
1600	564.30	564.23	564.07	564.10	564.19	564.28	564.16	564.17
1700	564.28	564.20	564.04	564.09	564.18	564.24	564.14	564.11
1800	564.23	564.14	564.01	564.07	564.15	564.21	564.09	564.07
1900	564.14	564.06	563.98	564.02	564.11	564.18	564.09	564.03
2000	564.04	563.97	563.94	563.95	564.07	564.13	564.05	564.01
2100	563.90	563.84	563.83	563.81	563.94	564.00	563.93	563.89
2200	563.84	563.79	563.76	563.70	563.82	563.92	563.82	563.81
2300	563.88	563.82	563.80	563.69	563.82	563.92	563.84	563.87
2400	563.97	563.87	563.87	563.74	563.87	563.94	563.88	563.92
MEAN	564.22	564.15	564.06	564.03	564.10	564.17	564.13	564.12

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.98	564.09	564.10	563.97	564.01	564.04	564.03	564.27
200	564.02	564.13	564.14	563.99	564.08	564.10	564.01	564.18
300	564.05	564.09	564.15	564.04	564.15	564.12	563.99	564.24
400	564.10	564.19	564.14	564.07	564.24	564.13	564.04	564.33
500	564.11	564.25	564.18	564.10	564.32	564.12	564.07	564.21
600	564.14	564.29	564.19	564.15	564.37	564.19	564.10	564.11
700	564.22	564.34	564.28	564.22	564.48	564.23	564.20	564.24
800	564.34	564.38	564.34	564.32	564.64	564.29	564.32	564.39
900	564.39	564.54	564.32	564.34	564.70	564.28	564.36	564.24
1000	564.40	564.49	564.31	564.38	564.70	564.26	564.43	564.33
1100	564.41	564.46	564.33	564.39	564.68	564.19	564.42	564.46
1200	564.43	564.46	564.30	564.38	564.58	564.14	564.40	564.28
1300	564.36	564.49	564.31	564.34	564.48	564.12	564.34	564.32
1400	564.27	564.47	564.29	564.26	564.37	564.08	564.31	564.32
1500	564.18	564.48	564.30	564.19	564.30	564.09	564.24	564.42
1600	564.18	564.42	564.28	564.09	564.15	564.07	564.12	564.43
1700	564.12	564.38	564.29	564.04	564.08	564.04	564.09	564.46
1800	564.13	564.28	564.28	563.98	564.03	564.03	564.04	564.33
1900	564.13	564.19	564.27	563.94	563.97	563.99	563.99	564.19
2000	564.11	564.06	564.15	563.93	563.89	563.93	563.93	564.12
2100	564.20	563.99	564.03	563.91	563.84	563.84	563.88	563.86
2200	564.03	563.93	563.93	563.84	563.79	563.84	563.89	563.67
2300	564.04	563.98	563.93	563.86	563.89	563.98	563.96	563.66
2400	564.06	564.02	563.94	563.93	563.99	563.99	564.18	563.70
MEAN	564.18	564.27	564.20	564.11	564.24	564.09	564.14	564.20

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

MAY 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.81	563.89	563.84	563.91	563.95	563.97	563.97	563.95
200	563.91	563.89	563.87	564.01	564.00	564.00	564.03	563.99
300	564.05	563.92	563.88	564.09	564.06	564.04	564.10	564.03
400	564.22	563.95	563.89	564.19	564.11	564.08	564.15	564.06
500	564.33	563.99	563.91	564.24	564.18	564.13	564.19	564.11
600	564.31	564.02	563.94	564.29	564.25	564.18	564.23	564.15
700	564.34	564.10	563.97	564.33	564.31	564.25	564.28	564.21
800	564.47	564.23	564.07	564.43	564.42	564.38	564.34	564.20
900	564.43	564.27	564.17	564.43	564.46	564.44	564.38	564.23
1000	564.35	564.21	564.17	564.39	564.43	564.48	564.34	564.27
1100	564.28	564.13	564.14	564.34	564.39	564.45	564.30	564.27
1200	564.24	564.09	564.13	564.30	564.34	564.43	564.27	564.28
1300	564.15	564.03	564.10	564.29	564.29	564.34	564.23	564.25
1400	564.11	563.94	564.09	564.28	564.26	564.32	564.22	564.24
1500	564.10	563.92	564.04	564.27	564.23	564.29	564.21	564.20
1600	564.12	563.89	564.03	564.27	564.22	564.27	564.21	564.20
1700	564.08	563.86	564.01	564.23	564.17	564.24	564.13	564.17
1800	564.13	563.87	563.99	564.21	564.12	564.18	564.15	564.13
1900	564.14	563.85	563.97	564.16	564.08	564.12	564.07	564.05
2000	564.09	563.82	563.92	564.08	564.03	564.03	564.09	563.98
2100	563.99	563.74	563.82	563.97	563.93	563.94	563.92	563.92
2200	563.86	563.68	563.75	563.89	563.83	563.86	563.82	563.86
2300	563.83	563.69	563.79	563.90	563.87	563.89	563.88	563.87
2400	563.86	563.79	563.84	563.91	563.92	563.93	563.92	563.89
MEAN	564.13	563.95	563.97	564.18	564.16	564.18	564.14	564.10

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	563.98	564.01	564.08	563.91	563.88	563.88	563.98
200	563.99	564.03	564.14	563.98	563.96	563.95	564.02
300	563.99	564.04	564.20	564.04	563.99	564.01	564.07
400	564.09	564.05	564.19	564.08	564.03	564.05	564.13
500	564.18	564.08	564.19	564.13	564.08	564.08	564.17
600	564.22	564.14	564.19	564.18	564.13	564.11	564.21
700	564.24	564.20	564.22	564.25	564.19	564.19	564.26
800	564.24	564.29	564.21	564.38	564.27	564.26	564.32
900	564.30	564.34	564.22	564.41	564.29	564.28	564.33
1000	564.28	564.34	564.23	564.37	564.29	564.29	564.28
1100	564.23	564.37	564.24	564.31	564.32	564.29	564.27
1200	564.18	564.33	564.25	564.28	564.29	564.29	564.24
1300	564.16	564.29	564.24	564.25	564.27	564.29	564.21
1400	564.22	564.27	564.27	564.22	564.23	564.29	564.16
1500	564.23	564.25	564.24	564.22	564.17	564.29	564.14
1600	564.22	564.19	564.18	564.21	564.11	564.27	564.13
1700	564.28	564.13	564.08	564.16	564.05	564.19	564.12
1800	564.28	564.12	564.02	564.13	564.01	564.11	564.09
1900	564.22	564.04	563.89	564.09	563.94	564.04	564.05
2000	564.15	563.99	563.79	564.02	563.88	563.97	563.99
2100	564.07	563.94	563.74	563.90	563.80	563.85	563.91
2200	563.98	563.89	563.72	563.81	563.73	563.76	563.79
2300	563.97	563.93	563.74	563.82	563.76	563.80	563.82
2400	563.99	564.01	563.82	563.84	563.80	563.90	563.89
MEAN	564.15	564.14	564.09	564.12	564.06	564.10	564.11

**- MISSING DATA   *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 564.70 AT 900 ON 13
MINIMUM HOURLY ELEVATION: 563.66 AT 2300 ON 16
MONTHLY MEAN: 564.13
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JUNE 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.98	563.74	563.92	563.73	564.06	564.01	563.98	563.63
200	564.04	563.72	563.93	563.78	564.08	564.08	564.03	563.72
300	564.11	563.73	563.92	563.86	564.09	564.11	564.12	563.77
400	564.18	563.77	563.92	564.00	564.12	564.13	564.13	563.86
500	564.22	563.80	563.90	564.09	564.17	564.16	564.16	563.92
600	564.23	563.86	563.82	564.19	564.23	564.18	564.16	564.02
700	564.29	563.96	563.82	564.26	564.36	564.21	564.19	564.12
800	564.43	564.05	563.93	564.31	564.52	564.26	564.25	564.19
900	564.47	564.08	563.93	564.37	564.61	564.27	564.25	564.21
1000	564.45	564.09	563.96	564.34	564.63	564.28	564.24	564.16
1100	564.47	564.22	564.01	564.28	564.68	564.30	564.23	564.09
1200	564.43	564.21	564.07	564.26	564.68	564.28	564.22	564.05
1300	564.39	564.17	564.16	564.22	564.63	564.31	564.22	563.97
1400	564.39	564.08	564.22	564.21	564.65	564.27	564.20	563.93
1500	564.36	563.95	564.23	564.20	564.68	564.23	564.18	563.91
1600	564.31	563.84	564.23	564.21	564.67	564.17	564.13	563.87
1700	564.23	563.76	564.23	564.21	564.60	564.11	564.07	563.86
1800	564.19	563.69	564.15	564.19	564.52	564.08	563.98	563.88
1900	564.08	563.68	564.04	564.15	564.41	564.03	563.91	563.92
2000	563.95	563.71	563.92	564.10	564.26	563.98	563.80	563.93
2100	563.83	563.68	563.80	564.03	564.08	563.91	563.70	563.81
2200	563.73	563.68	563.65	563.99	563.96	563.82	563.58	563.68
2300	563.74	563.82	563.62	564.01	563.95	563.86	563.57	563.68
2400	563.74	563.88	563.68	564.02	563.97	563.92	563.58	563.74
MEAN	564.18	563.88	563.96	564.13	564.36	564.12	564.04	563.91

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.73	563.73	564.03	563.96	563.87	563.88	563.86	563.83
200	563.74	563.76	564.07	564.03	563.96	563.96	563.93	563.89
300	563.77	563.78	564.08	564.08	563.99	564.03	563.98	563.97
400	563.78	563.82	564.07	564.12	564.03	564.08	564.05	564.03
500	563.83	563.89	564.06	564.18	564.08	564.11	564.08	564.05
600	563.89	564.00	564.07	564.21	564.12	564.15	564.13	564.11
700	563.98	564.11	564.13	564.26	564.18	564.21	564.19	564.14
800	564.03	564.24	564.21	564.38	564.28	564.32	564.28	564.27
900	563.98	564.28	564.23	564.42	564.40	564.44	564.36	564.23
1000	563.94	564.33	564.25	564.40	564.48	564.46	564.35	564.24
1100	563.83	564.36	564.26	564.39	564.54	564.43	564.31	564.20
1200	563.77	564.37	564.32	564.36	564.53	564.41	564.28	564.14
1300	563.73	564.34	564.38	564.34	564.47	564.37	564.26	564.13
1400	563.76	564.28	564.38	564.33	564.41	564.32	564.23	564.17
1500	563.76	564.22	564.37	564.31	564.36	564.28	564.23	564.23
1600	563.81	564.16	564.36	564.26	564.28	564.26	564.20	564.25
1700	563.86	564.08	564.29	564.23	564.21	564.21	564.14	564.23
1800	563.87	564.06	564.24	564.21	564.11	564.14	564.07	564.21
1900	563.92	564.05	564.16	564.14	564.03	564.06	564.01	564.17
2000	563.92	564.01	564.04	564.06	563.92	563.97	563.93	564.10
2100	563.86	563.92	563.88	563.93	563.80	563.82	563.77	563.91
2200	563.74	563.86	563.76	563.82	563.74	563.72	563.67	563.74
2300	563.73	563.89	563.78	563.81	563.77	563.73	563.72	563.69
2400	563.74	563.96	563.86	563.83	563.82	563.79	563.78	563.67
MEAN	563.83	564.06	564.14	564.17	564.14	564.13	564.08	564.07

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JUNE 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.67	563.86	563.79	563.83	563.82	563.77	563.99	563.63
200	563.73	563.87	563.88	563.88	563.88	563.84	564.02	563.64
300	563.79	563.90	563.96	563.97	563.91	563.95	564.03	563.73
400	563.88	563.95	564.05	564.06	563.92	564.03	563.97	563.81
500	563.94	563.98	564.12	564.13	563.98	564.08	563.98	563.87
600	564.03	564.02	564.17	564.21	564.03	564.12	564.07	563.94
700	564.13	564.09	564.22	564.26	564.07	564.20	564.12	564.06
800	564.27	564.21	564.31	564.38	564.21	564.27	564.16	564.22
900	564.30	564.27	564.38	564.38	564.26	564.38	564.17	564.23
1000	564.29	564.27	564.38	564.36	564.27	564.36	564.13	564.23
1100	564.27	564.25	564.34	564.33	564.26	564.31	564.12	564.22
1200	564.26	564.24	564.29	564.29	564.23	564.35	564.07	564.18
1300	564.22	564.24	564.27	564.26	564.20	564.37	564.06	564.11
1400	564.21	564.22	564.25	564.27	564.16	564.36	564.02	564.06
1500	564.16	564.17	564.21	564.22	564.12	564.28	564.04	563.99
1600	564.12	564.11	564.17	564.19	564.07	564.24	564.04	563.96
1700	564.08	564.06	564.13	564.17	564.03	564.14	563.99	563.92
1800	564.03	564.02	564.08	564.11	563.97	564.08	563.96	563.87
1900	563.99	563.95	564.03	564.06	563.88	564.03	563.91	563.80
2000	563.92	563.87	563.98	564.00	563.82	563.93	563.83	563.70
2100	563.82	563.73	563.90	563.93	563.73	563.87	563.71	563.61
2200	563.72	563.61	563.80	563.83	563.63	563.88	563.61	563.52
2300	563.75	563.61	563.77	563.81	563.67	563.98	563.62	563.56
2400	563.81	563.68	563.78	563.78	563.70	563.98	563.61	563.62
MEAN	564.02	564.01	564.09	564.11	563.99	564.12	563.97	563.90

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30
100	563.72	563.74	563.88	563.77	563.72	563.75
200	563.83	563.83	563.93	563.81	563.73	563.83
300	563.93	563.87	563.93	563.89	563.78	563.90
400	564.03	563.94	563.96	563.97	563.82	563.94
500	564.09	564.03	563.98	564.02	563.81	563.99
600	564.18	564.13	564.02	564.06	563.80	563.99
700	564.25	564.24	564.01	564.12	563.86	564.06
800	564.37	564.44	564.07	564.22	563.94	564.16
900	564.41	564.49	564.06	564.24	563.93	564.14
1000	564.41	564.47	564.07	564.30	563.97	564.09
1100	564.42	564.44	564.07	564.29	563.98	564.04
1200	564.42	564.38	564.07	564.26	564.03	563.96
1300	564.44	564.26	564.07	564.18	564.06	563.88
1400	564.43	564.11	564.07	564.18	564.08	563.83
1500	564.41	563.98	564.05	564.16	564.12	563.81
1600	564.39	563.85	564.02	564.17	564.13	563.76
1700	564.39	563.76	564.01	564.13	564.13	563.72
1800	564.33	563.73	563.95	564.07	564.10	563.74
1900	564.27	563.70	563.89	563.97	564.02	563.74
2000	564.21	563.68	563.83	563.86	563.92	563.73
2100	564.02	563.67	563.78	563.76	563.80	563.67
2200	563.90	563.66	563.81	563.66	563.70	563.62
2300	563.82	563.71	563.82	563.65	563.68	563.66
2400	563.76	563.78	563.81	563.65	563.69	563.73
MEAN	564.18	564.00	563.97	564.02	563.91	563.86

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 564.68 AT 1100 ON 5
MINIMUM HOURLY ELEVATION: 563.52 AT 2200 ON 24
MONTHLY MEAN: 564.04
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JULY 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.77	563.63	563.59	563.66	563.64	563.58	563.67	563.68
200	563.77	563.76	563.63	563.70	563.70	563.63	563.74	563.75
300	563.79	563.79	563.73	563.76	563.74	563.69	563.77	563.78
400	563.83	563.82	563.84	563.82	563.79	563.75	563.81	563.83
500	563.92	563.87	563.93	563.88	563.83	563.82	563.85	563.86
600	564.01	563.96	564.02	563.93	563.91	563.93	563.89	563.90
700	564.10	564.04	564.13	564.01	563.97	564.03	563.98	563.97
800	564.18	564.08	564.22	564.13	564.04	564.12	564.08	564.11
900	564.21	564.07	564.20	564.12	564.04	564.12	564.09	564.13
1000	564.18	564.07	564.21	564.11	564.01	564.08	564.11	564.13
1100	564.13	564.06	564.19	564.07	563.98	564.04	564.10	564.09
1200	564.09	564.05	564.16	564.03	563.95	564.02	564.06	564.06
1300	564.06	564.05	564.10	563.99	563.90	563.96	564.02	564.01
1400	563.99	564.07	564.07	563.97	563.88	563.92	563.99	563.97
1500	563.97	564.10	564.03	563.95	563.85	563.87	563.95	563.89
1600	563.92	564.13	564.00	563.92	563.82	563.83	563.92	563.85
1700	563.85	564.09	563.97	563.86	563.77	563.79	563.88	563.82
1800	563.80	564.07	563.92	563.80	563.75	563.76	563.84	563.81
1900	563.74	564.04	563.87	563.76	563.72	563.73	563.80	563.75
2000	563.61	563.92	563.81	563.72	563.68	563.72	563.77	563.72
2100	563.51	563.73	563.71	563.63	563.60	563.64	563.68	563.64
2200	563.46	563.58	563.64	563.55	563.50	563.57	563.60	563.56
2300	563.51	563.57	563.65	563.58	563.51	563.57	563.62	563.58
2400	563.58	563.58	563.65	563.62	563.53	563.63	563.65	563.62
MEAN	563.87	563.92	563.93	563.86	563.80	563.83	563.87	563.85

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.67	563.69	563.56	563.68	563.76	563.71	563.55	563.73
200	563.74	563.73	563.91	563.67	563.76	563.89	563.61	563.79
300	563.81	563.78	564.25	563.79	563.76	564.02	563.72	563.77
400	563.84	563.83	564.18	563.88	563.78	564.08	563.78	563.79
500	563.89	563.88	564.05	563.97	563.81	564.16	563.86	563.82
600	563.96	563.94	564.08	564.01	563.84	564.21	563.94	563.88
700	564.03	564.07	564.17	564.15	563.95	564.26	564.05	563.91
800	564.15	564.17	564.20	564.24	564.08	564.32	564.14	563.99
900	564.17	564.18	564.16	564.17	564.16	564.35	564.11	564.06
1000	564.18	564.18	564.23	564.10	564.18	564.36	564.08	564.09
1100	564.16	564.14	564.22	564.03	564.19	564.35	564.01	564.11
1200	564.14	564.10	564.22	564.02	564.18	564.32	563.96	564.10
1300	564.13	564.08	564.18	563.99	564.16	564.32	563.91	564.11
1400	564.14	564.16	564.13	563.97	564.09	564.33	563.87	564.13
1500	564.13	564.22	564.14	563.97	564.01	564.23	563.83	564.09
1600	564.13	564.24	564.08	563.97	563.89	564.22	563.80	564.03
1700	564.08	564.16	563.98	563.95	563.78	564.12	563.78	564.02
1800	564.06	564.09	563.94	563.92	563.73	564.09	563.74	563.96
1900	563.99	564.02	563.92	563.90	563.67	564.01	563.73	563.77
2000	563.91	563.77	563.92	563.87	563.61	563.88	563.72	563.68
2100	563.77	563.50	563.79	563.80	563.50	563.67	563.62	563.52
2200	563.65	563.39	563.69	563.72	563.42	563.52	563.56	563.51
2300	563.61	563.43	563.66	563.71	563.47	563.51	563.58	563.43
2400	563.63	563.48	563.67	563.75	563.56	563.53	563.67	563.47
MEAN	563.96	563.93	564.01	563.93	563.85	564.06	563.82	563.87

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS   DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

JULY 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.63	563.72	563.76	563.79	563.59	563.72	563.77	563.86
200	563.71	563.69	563.81	563.82	563.66	563.71	563.79	563.89
300	563.81	563.75	563.85	563.83	563.72	563.74	563.83	563.96
400	563.89	563.83	563.95	563.87	563.81	563.82	563.88	564.03
500	563.83	563.93	564.03	563.93	563.88	563.90	563.89	564.08
600	563.97	564.02	564.09	564.01	563.93	563.95	563.87	564.10
700	563.96	564.07	564.18	564.06	563.96	564.07	563.91	564.18
800	563.95	564.21	564.26	564.18	563.99	564.22	564.08	564.27
900	564.05	564.20	564.27	564.21	563.97	564.23	564.10	564.26
1000	564.21	564.17	564.27	564.17	563.95	564.22	564.11	564.26
1100	564.26	564.17	564.23	564.13	563.90	564.19	564.08	564.24
1200	564.22	564.14	564.19	564.08	563.86	564.13	564.11	564.22
1300	564.27	564.07	564.16	564.04	563.82	564.02	564.13	564.17
1400	564.29	564.01	564.07	563.99	563.83	563.98	564.05	564.16
1500	564.21	564.01	564.08	563.96	563.84	563.92	564.02	564.16
1600	564.29	563.94	564.04	563.92	563.87	563.87	563.99	564.14
1700	564.21	563.87	564.08	563.88	563.85	563.86	563.98	564.13
1800	564.17	563.82	564.07	563.86	563.86	563.88	563.96	564.14
1900	564.08	563.75	564.02	563.82	563.84	563.84	563.86	564.17
2000	564.07	563.67	563.96	563.76	563.76	563.78	563.75	564.06
2100	563.94	563.60	563.88	563.66	563.68	563.71	563.72	563.93
2200	563.75	563.54	563.78	563.55	563.60	563.62	563.60	563.77
2300	563.75	563.56	563.76	563.52	563.64	563.66	563.67	563.72
2400	563.74	563.68	563.78	563.54	563.68	563.71	563.77	563.73
MEAN	564.01	563.89	564.02	563.90	563.81	563.91	563.91	564.07

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	563.76	563.96	563.83	563.86	563.83	563.78	563.80
200	563.78	564.08	563.92	563.87	563.92	563.83	563.79
300	563.83	564.10	563.97	563.93	563.99	563.92	563.96
400	563.91	564.02	564.02	563.93	564.08	564.00	564.02
500	563.97	564.02	564.05	563.91	564.14	564.07	564.01
600	564.05	564.09	564.11	563.91	564.17	564.16	564.01
700	564.15	564.15	564.16	564.06	564.20	564.25	564.16
800	564.32	564.23	564.31	564.17	564.24	564.41	564.34
900	564.41	564.23	564.30	564.18	564.23	564.40	564.23
1000	564.40	564.23	564.30	564.17	564.23	564.37	564.21
1100	564.38	564.20	564.31	564.18	564.21	564.35	564.19
1200	564.33	564.18	564.30	564.19	564.18	564.34	564.23
1300	564.29	564.18	564.27	564.17	564.18	564.30	564.20
1400	564.25	564.21	564.23	564.13	564.17	564.22	564.21
1500	564.16	564.18	564.18	564.11	564.17	564.16	564.12
1600	564.06	564.16	564.09	564.05	564.16	564.08	564.09
1700	563.92	564.18	564.03	563.97	564.12	564.04	564.07
1800	563.84	564.14	564.02	563.89	564.06	563.99	564.03
1900	563.82	564.08	563.96	563.84	563.98	564.06	563.98
2000	563.84	563.98	563.88	563.77	563.90	564.46	563.91
2100	563.81	563.83	563.76	563.70	563.77	564.00	563.82
2200	563.75	563.68	563.67	563.68	563.65	563.93	563.69
2300	563.81	563.69	563.71	563.73	563.67	563.92	563.66
2400	563.88	563.77	563.77	563.78	563.72	563.98	563.74
MEAN	564.03	564.07	564.05	563.97	564.04	564.13	564.02

**- MISSING DATA   *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 564.46 AT 2000 ON 30
MINIMUM HOURLY ELEVATION: 563.39 AT 2200 ON 10
MONTHLY MEAN: 563.94
DATA CAPTURE: 100.0 %

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

AUGUST 1988

TIME, EASTERN STANDARD	DAY 1	2	3	4	5	6	7	8
100	563.82	563.79	563.88	563.85	563.87	564.16	564.00	563.98
200	563.92	563.85	563.89	563.90	563.94	564.09	564.03	563.99
300	563.92	563.90	563.94	563.93	564.03	564.14	563.98	563.99
400	563.99	563.97	564.00	564.03	564.08	564.18	563.98	563.99
500	564.04	564.05	564.09	564.09	564.12	564.19	564.07	564.04
600	564.07	564.12	564.10	564.15	564.17	564.14	564.09	564.08
700	564.17	564.19	564.20	564.26	564.23	564.29	564.20	564.16
800	564.27	564.34	564.27	564.40	564.37	564.55	564.30	564.26
900	564.27	564.35	564.28	564.43	564.39	564.50	564.40	564.28
1000	564.29	564.34	564.24	564.41	564.38	564.48	564.43	564.28
1100	564.35	564.29	564.24	564.36	564.34	564.47	564.44	564.28
1200	564.34	564.19	564.24	564.29	564.28	564.43	564.47	564.28
1300	564.25	564.12	564.22	564.24	564.23	564.47	564.48	564.28
1400	564.29	564.06	564.17	564.22	564.17	564.41	564.44	564.24
1500	564.25	563.98	564.11	564.17	564.12	564.43	564.34	564.22
1600	564.20	564.00	564.09	564.13	564.07	564.41	564.21	564.14
1700	564.12	563.99	564.04	564.10	564.05	564.47	564.14	564.10
1800	564.07	564.02	563.97	564.06	564.03	564.42	564.08	564.04
1900	563.97	564.00	563.92	564.00	564.04	564.44	564.01	564.00
2000	563.79	563.98	563.89	563.92	564.17	564.35	563.97	563.90
2100	563.60	563.87	563.80	563.77	563.92	564.17	563.89	563.77
2200	563.62	563.74	563.71	563.67	563.79	563.99	563.82	563.64
2300	563.64	563.76	563.72	563.71	563.82	563.93	563.88	563.67
2400	563.74	563.84	563.77	563.78	563.98	563.97	563.93	563.72
MEAN	564.04	564.03	564.03	564.08	564.11	564.30	564.15	564.06

TIME, EASTERN STANDARD	DAY 9	10	11	12	13	14	15	16
100	563.79	563.84	563.92	563.86	563.76	563.79	564.19	563.97
200	563.87	563.90	563.96	563.86	563.82	563.84	564.36	563.94
300	563.94	563.98	563.94	563.97	563.91	563.94	564.42	563.96
400	564.03	564.04	563.94	564.01	563.98	564.04	564.32	563.99
500	564.12	564.13	563.93	564.05	564.05	564.14	564.42	563.94
600	564.19	564.19	563.94	564.05	564.06	564.18	564.72	563.89
700	564.26	564.23	563.97	564.13	564.12	564.28	564.82	564.04
800	564.40	564.32	564.11	564.23	564.28	564.44	564.92	564.15
900	564.42	564.38	564.16	564.20	564.29	564.47	565.09	564.17
1000	564.40	564.33	564.20	564.23	564.28	564.48	564.99	564.20
1100	564.36	564.26	564.22	564.27	564.28	564.45	564.74	564.23
1200	564.32	564.22	564.22	564.21	564.28	564.43	564.63	564.24
1300	564.27	564.17	564.19	564.19	564.28	564.44	564.54	564.24
1400	564.21	564.08	564.18	564.14	564.23	564.47	564.43	564.25
1500	564.14	564.04	564.14	564.14	564.22	564.42	564.39	564.23
1600	564.14	564.01	564.14	564.09	564.15	564.31	564.34	564.19
1700	564.12	563.97	564.12	564.07	564.08	564.23	564.22	564.09
1800	564.09	563.96	564.07	564.01	563.99	564.10	564.17	563.99
1900	564.07	563.95	564.02	563.97	563.92	564.02	564.13	563.99
2000	563.98	563.92	563.88	563.87	563.84	563.94	564.03	563.85
2100	563.83	563.83	563.75	563.76	563.77	563.93	563.98	563.71
2200	563.73	563.78	563.64	563.63	563.67	564.11	563.91	563.68
2300	563.74	563.79	563.75	563.65	563.68	564.12	563.92	563.75
2400	563.79	563.85	563.84	563.70	563.73	564.13	563.93	563.83
MEAN	564.09	564.05	564.01	564.01	564.03	564.20	564.40	564.02

**- MISSING DATA *- MEAN BASED ON PARTIAL RECORD

U. S. ARMY ENGINEER DISTRICT, DETROIT
CORPS OF ENGINEERS — DETROIT, MICHIGAN

WATER LEVELS IN FEET, IGLD (1955)

NIAGARA RIVER- TONAWANDA ISL

AUGUST 1988

TIME, EASTERN STANDARD	DAY 17	18	19	20	21	22	23	24
100	563.86	563.64	563.59	563.68	563.75	563.69	563.44	564.25
200	563.97	563.72	563.56	563.70	563.78	563.74	563.48	564.38
300	563.98	563.81	563.59	563.77	563.78	563.73	563.58	564.37
400	564.02	563.92	563.64	563.81	563.84	563.73	563.65	564.26
500	564.04	563.99	563.76	563.86	563.88	563.72	563.77	564.14
600	563.98	564.00	563.78	563.87	563.93	563.73	563.84	564.03
700	564.02	564.07	563.87	563.90	563.97	563.81	563.94	563.95
800	564.25	564.17	563.94	563.98	564.03	563.92	564.07	564.03
900	564.26	564.07	564.01	563.99	564.02	564.01	564.10	564.04
1000	564.29	563.99	563.99	563.99	564.04	564.08	564.12	564.02
1100	564.34	563.98	564.02	563.98	564.03	564.10	564.09	563.99
1200	564.40	563.93	564.03	563.97	563.94	564.10	564.12	564.04
1300	564.39	563.80	563.98	563.99	563.88	564.05	564.08	564.09
1400	564.39	563.80	563.94	564.01	563.82	564.02	563.98	564.16
1500	564.39	563.77	563.86	564.04	563.80	563.97	563.88	564.23
1600	564.33	563.75	563.82	564.04	563.79	563.92	563.73	564.31
1700	564.25	563.78	563.77	564.03	563.79	563.84	563.56	564.47
1800	564.14	563.75	563.67	563.99	563.79	563.79	563.43	564.48
1900	563.97	563.78	563.59	563.92	563.75	563.69	563.49	564.36
2000	563.82	563.75	563.54	563.82	563.71	563.56	563.59	564.14
2100	563.63	563.64	563.50	563.72	563.64	563.44	563.71	563.88
2200	563.46	563.62	563.48	563.64	563.57	563.33	563.78	563.83
2300	563.42	563.64	563.52	563.69	563.60	563.33	563.92	563.64
2400	563.52	563.64	563.62	563.73	563.64	563.37	564.08	563.73
MEAN	564.05	563.83	563.75	563.88	563.82	563.78	563.81	564.12

TIME, EASTERN STANDARD	DAY 25	26	27	28	29	30	31
100	563.81	563.89	**	**	**	**	563.56
200	563.88	563.87	**	**	**	**	563.60
300	563.98	563.88	**	**	**	**	563.68
400	564.05	563.95	**	**	**	**	563.79
500	564.14	564.10	**	**	**	**	563.84
600	564.20	564.16	**	**	**	**	563.87
700	564.28	564.22	**	**	**	**	563.94
800	564.43	564.49	**	**	**	**	564.02
900	564.46	564.55	**	**	**	564.03	563.98
1000	564.52	564.54	**	**	**	564.03	563.97
1100	564.52	**	**	**	**	564.02	563.95
1200	564.56	**	**	**	**	563.99	563.92
1300	564.57	**	**	**	**	563.98	563.89
1400	564.64	**	**	**	**	563.95	563.86
1500	564.64	**	**	**	**	563.91	563.84
1600	564.53	**	**	**	**	563.85	563.79
1700	564.47	**	**	**	**	563.82	563.78
1800	564.44	**	**	**	**	563.79	563.73
1900	564.37	**	**	**	**	563.77	563.68
2000	564.24	**	**	**	**	563.68	563.63
2100	564.06	**	**	**	**	563.58	563.54
2200	563.93	**	**	**	**	563.49	563.47
2300	563.91	**	**	**	**	563.49	563.50
2400	563.91	**	**	**	**	563.53	563.55
MEAN	564.27	564.17*	**	**	**	563.81*	563.77

**- MISSING DATA   *- MEAN BASED ON PARTIAL RECORD

MAXIMUM HOURLY ELEVATION: 565.09 AT 900 ON 15
MINIMUM HOURLY ELEVATION: 563.33 AT 2200 ON 22
MONTHLY MEAN: 564.02
DATA CAPTURE: 87.4 %

APPENDIX E

ENVIRONMENTAL QUALITY

APPENDIX E
ENVIRONMENTAL QUALITY

TABLE OF CONTENTS

APPENDIX E.1
AIR AND SOIL VAPOR SCREENING

E.1.1 INTRODUCTION

Air and soil organic vapor screening was performed on site during September 1987. Screening was performed by URS Company, Inc. personnel for the purpose of targeting areas of elevated volatile organic contamination for more detailed evaluation by soil sampling and drilling. Appendix E.1 presents screening equipment, methodologies and results.

E.1.2 METHODOLOGIES

Prior to air and soil screening, field surveying was performed at the site to establish a grid system for locational control along a baseline ("P" Line) (Figure E-1). This grid system was used to identify sampling locations at 40-foot intervals throughout the site. Air and soil gas screening was performed at each of the grid points using a PHOTOVAC TIP photoionization organic vapor detector. The instrument was calibrated daily using a benzene (surrogate) standard of 52.6 ppm.

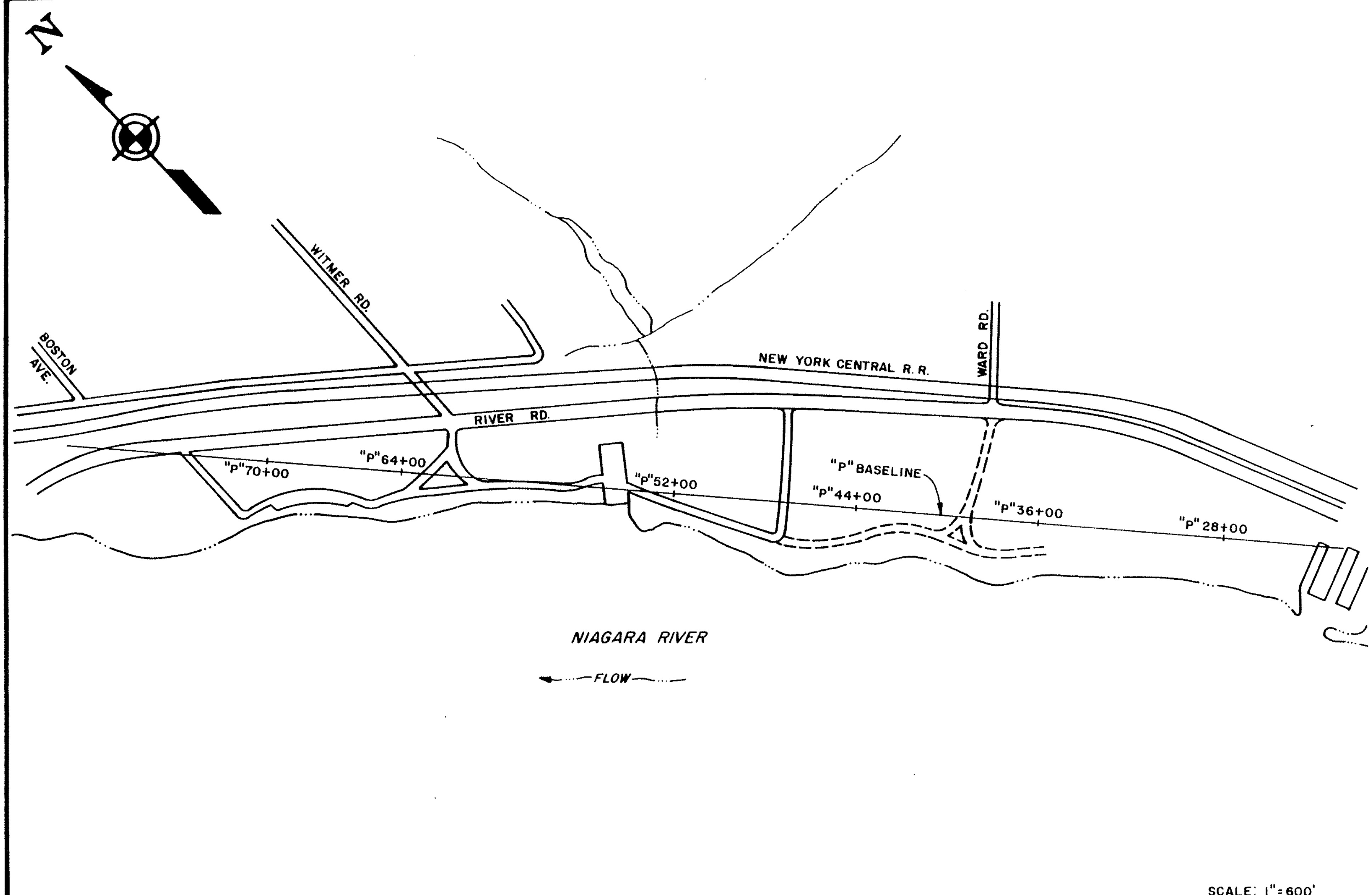
The procedure presented in Appendix A of the Work/QA Plan was followed during air and soil gas screening:

E.1.3 DISCUSSION

Air/soil gas screening began at the Gratwick-Riverside Park site on September 14, 1987 and was completed on September 26, 1987. Screening was postponed at times due to precipitation and/or wet grounds in an effort to provide some uniformity in weather conditions during screening. Table E.1-1 presents the weather conditions during the monitoring period and outlines the daily monitoring schedule.

A total of 1,383 test holes were advanced and monitored for organic vapor concentrations. At grid locations where roadways were encountered, the test hole was advanced to the required depth where ever penetration was possible, as long as the location of the test hole was within approximately 10 feet of the actual grid point. If it was not possible to advance a test hole within ten (10) feet of the grid point, soil gas readings were not taken and the word "impenetrable" was recorded for that grid point. At various locations throughout the site, it was not possible to advance the test hole to the required 18 inches. In such cases, further attempts were made at various locations within a foot of the point. As long as it was possible to

A-3023



URS URS Company, Inc. CONSULTING ENGINEERS NEW YORK NEW JERSEY

AIR AND SOIL SCREENING BASELINE

FIGURE E-1

TABLE E.1-1

SUMMARY OF WEATHER CONDITIONS DURING AIR AND SOIL GAS SCREENING PROGRAM

Date	High Temp.,(F)	Precipitation (inches)	Weather	Monitoring Schedule
9/13/87	--	Trace	--	Did not monitor
9/14/87	69	0.0	Sunny, clear, winds W - 5 mph	Monitoring commenced
9/15/87	68	0.01	Sunny, clear, winds NW - 10 mph	Monitored all day
9/16/87	74	Trace	Sunny, clear in AM, overcast in PM, PM winds W - 10 mph	Monitored all day
9/17/87	--	0.15	--	Did not monitor
9/18/87	61	0.82	Overcast, rain in AM, winds SW - 5-15 mph	Monitored in afternoon
9/19/87	66	0.20	Early AM - light drizzle, rest of day - overcast, no winds	Started monitoring in middle of morning
9/20/87	--	0.15	--	Did not monitor
9/21/87	70	0.03	Partly sunny, high winds late in PM - gusting to 20 mph	Monitored all day
9/22/97	69	0.13	Partly sunny, winds late in PM - NW - 10 mph	Monitored all day
9/23/87	68	0.01	Mostly sunny, winds - SW - 10-20 mph	Monitored all day

TABLE E.1-1 - Cont.

Date	High Temp.,(F)	Precipitation (inches)	Weather	Monitoring Schedule
9/24/87	66	0.05	Sunny, clear, winds - N - 10-15 mph	Monitored all afternoon
9/25/87	62	0.0	Sunny, clear, winds - SW - 10-15 mph	Monitored all day
9/26/87	68	0.0	Mostly sunny, winds - S - 5-10 mph	Monitored all day

Data supplied by the National Weather Service, Buffalo International Airport Weather Station.

advance the test hole to a depth greater than 14 inches, no special notations were made.

It was not possible to advance test holes to a depth greater than six (6) inches over one portion of the study area (centered on 40+00N, 300+R to 44+00N, 300+R) due to the presence of an impenetrable barrier located just below the surface of the soil. Soil gas readings were recorded from these holes, however their reduced depth should be noted.

E.1.4 RESULTS

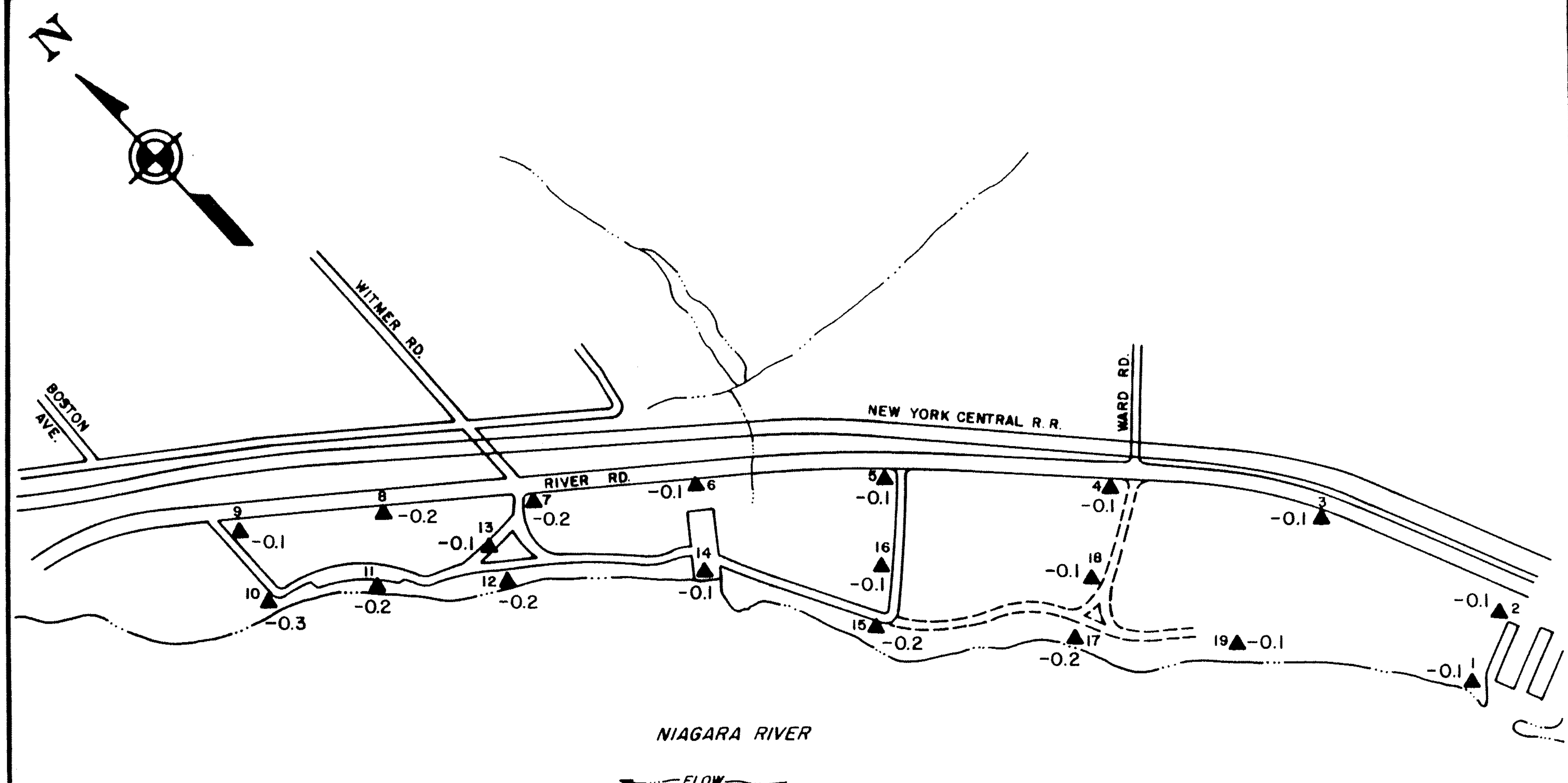
The air/soil gas screening data (organic vapor concentrations expressed in ppm) are summarized in Table E.1-2.

E.1.5 PERIMETER ORGANIC VAPOR SCREENING

At nineteen points around the perimeter of the site (Figure E-2), air screening was conducted using a calibrated PHOTOVAC TIP. Readings were taken on numerous occasions during the drilling operations. No readings above 1 ppm were recorded.

Results of the perimeter organic vapor screening are contained in the project files.

A-3015



NOTE:

PARK USE MIDDAY (11/16/87)
- 11 PARKED CARS
- 1 FISHERMAN
- 2 WALKERS
- 1 CAR DRIVING
- TEMP. 65° F.
- SUNNY
- WINDS WESTERLY 5-10 M.P.H.

LEGEND:

-0.2 ▲ AIR MONITORING POINT AND MEASURED VALUE ON NOV. 16, 1987 AS RECORDED WITH PHOTOVAC TIP

SCALE: 1" = 600'

URS — URS Company, Inc. CONSULTING ENGINEERS — NEW YORK — NEW JERSEY

PERIMETER ORGANIC VAPOR SCREENING

FIGURE E-2

TABLE 2
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
9/26/87	23+60	80 R	0.0	2.4
9/26/87	24+00	80 L	0.0	2.1
		40	0.0	2.4
		0	0.0	1.1
		40 R	0.0	1.2
		80	0.0	1.1
		120	0.0	11.0
9/26/87	24+40	120 R	0.0	0.2
		80	0.0	1.1
		40	0.0	1.3
		0	0.0	1.2
		60 L	0.0	1.2
		80	0.0	500.0
		120	0.0	30.6
		160	0.0	9.7
9/26/87	24+80	240 L	0.0	
		200	0.0	8.2
		160	0.0	15.9
		120	0.0	3.6
		80	0.0	3.3
		40	0.0	4.0
		0	0.0	1.2
		40 R	0.0	1.9
		80	0.0	5.9
		120	0.0	0.4
		160	0.0	0.3
9/26/87	25+20	160 R	0.0	6.3
		120	0.0	0.5
		80	0.0	2.8
		40	0.0	2.0
		0	0.0	0.9
		40 L	0.0	5.4
		80	0.0	9.1
		120	0.0	3.4
		160	0.0	11.7
		200	0.0	5.2
		240	0.0	
9/26/87	25+60	240 L	0.0	
		200	0.0	4.2
		160	0.0	4.1
		120	0.0	7.9
		80	0.0	2.7
		40	0.0	2.4
		0	0.0	1.0
		40 R	0.0	0.4
		80	0.0	0.9
		120	0.0	2.9
		160	0.0	0.4
9/26/87	26+00	200 R	0.0	1.4

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		160	0.0	2.9
		120	0.0	4.2
		80	0.0	10.7
		40	0.0	3.5
		0	0.0	1.1
		40 L	0.0	5.3
		80	0.0	0.5
		120	0.0	1.3
		160	0.0	2.0
		200	0.0	3.3
9/26/87	26+40	200 L	0.0	14.0
		160	0.0	3.1
		120	0.0	2.0
		80	0.0	1.9
		40	0.0	5.7
		0	0.0	3.1
		40 R	0.0	1.8
		80	0.0	2.7
		120	0.0	2.2
		160	0.0	2.5
		200	0.0	1.9
9/26/87	26+80	200 R	0.0	9.2
		160	0.0	5.9
		120	0.0	4.4
		80	0.0	8.0
		40	0.0	2.1
		0	0.0	4.7
		40 L	0.0	1.3
		80	0.0	5.1
		120	0.0	7.9
		160	0.0	2.4
		200	0.0	38.2
9/26/87	27+20	160 L	0.0	9.7
		120	0.0	2.8
		80	0.0	2.0
		40	0.0	7.5
		0	0.0	1.4
		40 R	0.0	0.3
		80	0.0	1.3
		120	0.0	14.7
		160	0.0	6.5
		200	0.0	3.9
		240	0.0	0.9
9/26/87	27+60	240 R	0.0	12.1
		200	0.0	4.0
		160	0.0	20.0
		120	0.0	16.0
		80	0.0	3.2
		40	0.0	10.5

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Location Left/Right		Readings in PPM Air	Soil
		0		0.0	1.7
		40	L	0.0	44.5
		80		0.0	1.4
		120		0.0	9.5
		160		0.0	6.3
9/26/87	28+00	200	L	0.0	3.6
		160		0.0	7.8
		120		0.0	15.8
		80		0.0	9.3
		40		0.0	4.5
		0		0.0	1.5
		40	R	0.0	2.5
		80		0.0	11.7
		120		0.0	4.5
		160		0.0	0.7
		200		0.0	7.5
		240		0.0	3.0
9/25/87	28+40	280	R	0.0	0.8
		240		0.0	1.7
		200		0.0	0.4
		160		0.0	5.3
		120		0.0	2.9
		80		0.0	10.7
		40		0.0	6.0
		0		0.0	13.7
9/26/87		40	L	0.0	1.3
		80		0.0	1.1
		120		0.0	8.5
		160		0.0	2.4
9/25/87	28+80	160	L	0.0	0.4
		120		0.0	0.2
		80		0.0	5.1
		40		0.0	7.9
		0		0.0	9.9
		40	R	0.0	0.3
		80		0.0	5.5
		120		0.0	11.5
		160		0.0	2.5
		200		0.0	7.8
		240		0.0	0.7
		280		0.0	1.3
9/25/87	29+20	280	R	0.0	2.8
		240		0.0	0.5
		200		0.0	0.2
		160		0.0	1.4
		120		0.0	0.0
		80		0.0	4.7
		40		0.0	31.7
		0		0.0	25.7

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location: "P"-Line	Location: Left/Right	Readings in PPM: Air	Readings in PPM: Soil
		40 L	0.0	2.6
		80	0.0	1.6
		120	0.0	0.8
		160	0.0	4.5
9/25/87	29+60	160 L	0.0	4.8
		120	0.0	1.4
		80	0.0	3.9
		40	0.0	18.0
		0	0.0	4.0
		40 R	0.0	0.8
		80	0.0	0.5
		120	0.0	0.1
		160	0.0	2.6
		200	0.0	3.2
		240	0.0	3.0
		280	0.0	7.2
		320	0.0	1.2
9/25/87	30+00	320 R	0.0	8.6
		280	0.0	3.6
		240	0.0	13.8
		200	0.0	1.1
		160	0.0	4.4
		120	0.0	17.2
		80	0.0	6.0
		40	0.0	5.6
		0	0.0	2.6
		40 L	0.0	3.4
		80	0.0	4.6
		120	0.0	3.0
		160	0.0	3.7
9/25/87	30+40	160 L	0.0	4.4
		120	0.0	10.5
		80	0.0	3.0
		40	0.0	0.6
		0	0.0	0.4
		40 R	0.0	0.6
		80	0.0	0.6
		120	0.0	13.3
		160	0.0	4.7
		200	0.0	1.3
		240	0.0	0.6
		280	0.0	3.7
		320	0.0	1.2
9/25/87	30+80	320 R	0.0	1.1
		280	0.0	1.6
		240	0.0	7.8
		200	0.0	4.1
		160	0.0	1.4
		120	0.0	3.6

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		80	0.0	6.6
		40	0.0	0.5
		0	0.0	3.1
		40 L	0.0	0.2
		80	0.0	3.1
		120	0.0	44.1
		160	0.0	3.5
9/25/87	31+20	160 L	0.0	14.4
		120	0.0	6.7
		80	0.0	7.5
		40	0.0	0.3
		0	0.0	0.3
		40 R	0.0	0.1
		80	0.0	0.1
		120	0.0	0.5
		160	0.0	0.5
		200	0.0	1.0
		240	0.0	26.1
		280	0.0	7.4
		320	0.0	1.9
9/25/87	31+60	320 R	0.0	3.1
		280	0.0	2.7
		240	0.0	0.9
		200	0.0	0.3
		160	0.0	1.2
		120	0.0	7.5
		80	0.0	0.3
		40	0.0	0.7
		0	0.0	0.4
		40 L	0.0	1,280.0
		80	0.0	0.3
		120	0.0	6.4
		160	0.0	1,200.0
9/24/87	32+00	160 L	0.0	34.0
		120	0.0	1.7
		80	0.0	0.1
		40	0.0	0.3
		0	0.0	1.5
9/25/87		40 R	0.0	0.2
		80	0.0	0.1
		120	0.0	4.6
		160	0.0	5.1
		200	0.0	6.4
		240	0.0	2.0
		280	0.0	1.2
		320	0.0	3.3
		360	0.0	8.7
9/24/87	32+40	360 R	0.0	79.3
		320	0.0	2.7

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		280	0.0	3.4
		240	0.0	3.7
		200	0.0	12.2
		160	0.0	20.0
		120	0.0	16.2
		80	0.0	2.0
		40	0.0	0.2
		0	0.0	4.5
		40 L	0.0	0.2
		80	0.0	1.6
		120	0.0	10.3
		160	0.0	29.2
9/24/87	32+80	160 L	0.0	7.2
		120	0.0	0.8
		80	0.0	0.9
		40	0.0	8.3
		0	0.0	0.3
		40 R	0.0	18.7
		80	0.0	1.6
		120	0.0	3.3
		160	0.0	107.8
		200	0.0	2.2
		240	0.0	1.8
		280	0.0	31.4
		320	0.0	21.2
		360	0.0	25.3
9/24/87	33+20	360 R	0.0	3.7
		320	0.0	2.0
		280	0.0	1.0
		240	0.0	6.0
		200	0.0	7.0
		160	0.0	3.5
		120	0.0	1.2
		80	0.0	2.1
		40	0.0	0.2
		0	0.0	0.2
		40 L	0.0	0.6
		80	0.0	1.0
		120	0.0	1.0
		160	0.0	6.4
9/23/87	33+60	160 L	0.0	2.7
		120	0.0	0.8
		80	0.0	0.3
		40	0.0	0.8
		0	0.0	0.4
		40 R	0.0	1.4
		80	0.0	2.2
		120	0.0	1.7
		160	0.0	12.6

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location: "P"-Line	Location: Left/Right	Readings in PPM: Air	Readings in PPM: Soil
		200	0.0	2.8
		240	0.0	4.2
		280	0.0	1.8
		320	0.0	2.4
		360	0.0	5.5
9/23/87	34+00	360 R	0.0	11.6
		320	0.0	4.9
		280	0.0	12.8
		240	0.0	12.8
		200	0.0	10.5
		160	0.0	21.5
		120	0.0	1.6
		80	0.0	0.5
		40	0.0	0.2
		0	0.0	5.6
		40 L	0.0	12.8
		80	0.0	0.4
		120	0.0	0.9
		160	0.0	2.2
9/23/87	34+40	200 R	0.0	7.0
		160	0.0	7.9
		120	0.0	5.5
		80	0.0	2.6
		40	0.0	5.9
		0	0.0	2.9
		40 L	0.0	14.4
		80	0.0	1.1
		120	0.0	0.4
		160	0.0	0.9
		200	0.0	27.5
		240	0.0	21.0
		280	0.0	3.8
		320	0.0	0.7
		360	0.0	5.6
9/23/87	34+80	390 R	0.0	
		360	0.0	9.9
		320	0.0	38.7
		280	0.0	22.2
		240	0.0	31.1
		200	0.0	34.7
		160	0.0	2.2
		120	0.0	4.5
		80	0.0	1.1
		40	0.0	1.9
		0	0.0	36.4
		40 L	0.0	12.7
		80	0.0	15.0
		120	0.0	1.5
		160	0.0	2.0

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		200	0.0	
9/23/87	35+20	200 L	0.0	
		160	0.0	4.8
		120	0.0	1.3
		80	0.0	18.4
		40	0.0	1.2
		0	0.0	3.9
		40 R	0.0	1.2
		80	0.0	0.8
		120	0.0	1.5
		160	0.0	0.6
		200	0.0	13.2
		240	0.0	69.5
		280	0.0	9.9
		320	0.0	14.2
		360	0.0	2.1
		390	0.0	0.4
9/23/87	35+60	390 R	0.0	0.8
		360	0.0	0.3
		320	0.0	0.8
		280	0.0	2.2
		240	0.0	2.4
		200	0.0	4.7
		160	0.0	5.4
		120	0.0	1.5
		80	0.0	9.1
		40	0.0	54.0
		0	0.0	1.6
		40 L	0.0	2.0
		80	0.0	97.5
		120	0.0	7.9
		160	0.0	3.5
		200	0.0	1.7
9/23/87	36+00	235 L	0.0	0.3
		200	0.0	54.6
		160	0.0	1.8
		120	0.0	14.3
		80	0.0	0.4
		40	0.0	14.4
		0	0.0	1.4
		40 R	0.0	2.2
		80	0.0	7.9
		120	0.0	1.3
		160	0.0	11.2
		200	0.0	4.2
		240	0.0	8.3
		280	0.0	40.8
		320	0.0	316.0
		360	0.0	1.0

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		390	0.0	2.2
9/23/87	36+40	390 R	0.0	0.7
		360	0.0	1.1
		320	0.0	4.2
		280	0.0	1.8
		240	0.0	1.4
		200	0.0	13.7
		160	0.0	5.4
		120	0.0	1.3
		80	0.0	90.2
		40	0.0	1.3
		0	0.0	1.1
		40 L	0.0	4.2
		80	0.0	8.0
		120	0.0	1.1
		160	0.0	26.8
		200	0.0	3.7
		240	0.0	1.9
9/23/87	36+80	200 L	0.0	8.3
		160	0.0	33.7
		120	0.0	20.3
		80	0.0	2.1
		40	0.0	3.5
		0	0.0	4.0
		40 R	0.0	1.8
		80	0.0	5.4
		120	0.0	1.7
		160	0.0	45.8
		200	0.0	70.7
		240	0.0	3.8
		280	0.0	13.0
		320	0.0	0.7
		360	0.0	0.5
		390	0.0	0.7
9/23/87	37+20	280 R	0.0	8.4
		240	0.0	1.9
		200	0.0	19.4
		160	0.0	0.2
		120	0.0	0.1
		80	0.0	0.2
		40	0.0	0.7
		0	0.0	0.2
		40 L	0.0	0.2
		80	0.0	0.1
		120	0.0	30.4
		160	0.0	463.0
		200	0.0	3.2
9/14/87	37+60	200 L	0.0	0.9
		160	0.0	1.0

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		120	0.0	2.8
		80	0.0	2.5
		40	0.0	12.2
		0	0.0	46.5
		40 R	0.0	210.0
		80	0.0	0.9
		120	0.0	8.2
		160	0.0	28.9
		200	0.0	0.7
		240	0.0	3.4
		280	0.0	5.6
		320	0.0	2.6
		360	0.0	
9/14/87	38+00	360 R	0.0	
		320	0.0	7.1
		280	0.0	25.5
		240	0.0	0.8
		200	0.0	3.2
		160	0.0	4.4
		120	0.0	2.9
		80	0.0	7.1
		40	0.0	0.5
		0	0.0	0.5
		40 L	0.0	2.9
		80	0.0	4.3
		120	0.0	1.6
		160	0.0	3.3
		200	0.0	0.6
9/14/87	38+40	200 L	0.0	0.4
		160	0.0	0.4
		120	0.0	1.2
		80	0.0	1.2
		40	0.0	1.5
		0	0.0	0.6
		40 R	0.0	0.3
		80	0.0	1.9
		120	0.0	1.2
		160	0.0	2.1
		200	0.0	6.0
		240	0.0	1.6
		280	0.0	
		320	0.0	0.6
		360	0.0	0.3
9/14/87	38+80	360 R	0.0	0.2
		320	0.0	0.5
		280	0.0	1.9
		240	0.0	0.9
		200	0.0	0.5
		160	0.0	0.9

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Location Left/Right	Readings in PPM Air	Soil
		120	0.0	2.6
		80	0.0	5.1
		40	0.0	7.3
		0	0.0	1.8
		40 L	0.0	1.2
		80	0.0	2.7
		120	0.0	2.5
		160	0.0	0.3
		200	0.0	0.1
9/14/87	39+20	200 L	0.0	1.2
		160	0.0	2.9
		120	0.0	24.9
		80	0.0	1.9
		40	0.0	49.3
		0	0.0	0.6
		40 R	0.0	2.8
		80	0.0	2.2
		120	0.0	2.3
		160	0.0	3.1
		200	0.0	0.3
		240	0.0	1.2
		280	0.0	0.2
		320	0.0	0.4
		360	0.0	1.2
9/15/87	39+60	360 R	0.0	2.0
		320	0.0	0.1
		280	0.0	0.5
		240	0.0	1.0
		200	0.0	17.5
		160	0.0	4.6
		120	0.0	1.4
		80	0.0	6.7
		40	0.0	32.3
		0	0.0	1.2
		40 L	0.0	2.0
		80	0.0	2.7
		120	0.0	3.0
		160	0.0	1.4
		200	0.0	10.0
9/15/87	40+00	200 L	0.0	1.0
		160	0.0	4.1
		120	0.0	2.8
		80	0.0	0.7
		40	0.0	0.4
		0	0.0	32.2
		40 R	0.0	1.0
		80	0.0	0.6
		120	0.0	0.2
		160	0.0	4.7

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right		Air	Soil
		200		0.0	4.4
		240		0.0	2.2
		280		0.0	0.3
		320		0.0	6.2
		360		0.0	3.6
9/15/87	40+40	360	R	0.0	2.6
		320		0.0	0.3
		280		0.0	0.3
		240		0.0	0.5
		200		0.0	0.4
		160		0.0	0.5
		120		0.0	2.1
		80		0.0	1.4
		40		0.0	1.1
		0		0.0	3.2
		40	L	0.0	0.5
		80		0.0	1.7
		120		0.0	8.0
		160		0.0	1.5
		200		0.0	0.5
9/15/87	40+80	200	L	0.0	0.5
		160		0.0	74.0
		120		0.0	1.7
		80		0.0	2.5
		40		0.0	3.9
		0		0.0	4.5
		40	R	0.0	6.9
		80		0.0	12.6
		120		0.0	8.7
		160		0.0	1.2
		200		0.0	0.2
		240		0.0	17.2
		280		0.0	0.8
		320		0.0	0.3
		360		0.0	0.5
9/15/87	41+20	360	R	0.0	0.5
		320		0.0	0.2
		280		0.0	0.1
		240		0.0	1.3
		200		0.0	8.7
		160		0.0	0.7
		120		0.0	0.2
		80		0.0	2.2
		40		0.0	4.6
		0		0.0	1.0
		40	L	0.0	12.4
		80		0.0	2.3
		120		0.0	5.6
		160		0.0	6.1

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		Location	Readings in PPM	
		200	0.0	2.2
9/15/87	41+60	200 L	0.0	0.6
		160	0.0	0.2
		120	0.0	2.4
		80	0.0	1.4
		40	0.0	0.1
		0	0.0	3.3
		40 R	0.0	0.6
		80	0.0	0.6
		120	0.0	0.5
		160	0.0	0.2
		200	0.0	0.8
		240	0.0	2.5
		280	0.0	
		320	0.0	0.2
		360	0.0	0.0
9/15/87	42+00	360 R	0.0	2.0
		320	0.0	1.6
		280	0.0	
		240	0.0	1.6
		200	0.0	1.3
		160	0.0	1.1
		120	0.0	1.6
		80	0.0	0.8
		40	0.0	0.7
		0	0.0	1.4
		40 L	0.0	0.7
		80	0.0	2.1
		120	0.0	1.3
		160	0.0	2.6
		200	0.0	0.9
		240	0.0	1.4
9/15/87	42+40	240 L	0.0	0.7
		200	0.0	0.7
		160	0.0	1.3
		120	0.0	0.3
		80	0.0	0.3
		40	0.0	1.4
		0	0.0	0.8
		40 R	0.0	0.8
		80	0.0	1.0
		120	0.0	4.8
		160	0.0	0.6
		200	0.0	1.5
		240	0.0	1.3
		280	0.0	
		320	0.0	1.0
		360	0.0	0.7
9/16/87	42+80	360 R	0.0	1.2

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right		Air	Soil
		Location		Readings in PPM	
		320		0.0	1.4
		280		0.0	
		240		0.0	9.1
		200		0.0	31.5
		160		0.0	1.3
		120		0.0	0.4
		80		0.0	3.5
		40		0.0	1.3
		0		0.0	0.4
		40	L	0.0	0.9
		80		0.0	12.5
		120		0.0	1.7
		160		0.0	10.9
		200		0.0	20.3
		240		0.0	71.4
9/16/87	43+20	200	L	0.0	6.3
		160		0.0	10.9
		120		0.0	31.1
		80		0.0	6.1
		40		0.0	4.6
		0		0.0	0.9
		40	R	0.0	2.2
		80		0.0	2.7
		120		0.0	2.3
		160		0.0	2.1
		200		0.0	5.3
		240		0.0	5.2
		280		0.0	
		320		0.0	0.0
		360		0.0	0.0
9/16/87	43+60	360	R	0.0	0.0
		320		0.0	
		280		0.0	
		240		0.0	0.1
		200		0.0	3.4
		160		0.0	9.8
		120		0.0	1.1
		80		0.0	11.7
		40		0.0	2.0
		0		0.0	3.2
		40	L	0.0	7.9
		80		0.0	0.7
		120		0.0	3.3
		160		0.0	23.2
		200		0.0	17.7
9/16/87	44+00	230	L	0.0	10.8
		200		0.0	43.9
		160		0.0	3.0
		120		0.0	4.1

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line (Location)	Left/Right (Location)	Air (Readings in PPM)	Soil (Readings in PPM)
		80	0.0	1.4
		40	0.0	0.4
		0	0.0	3.1
		40 R	0.0	3.4
		80	0.0	1.8
		120	0.0	12.7
		160	0.0	10.7
		200	0.0	2.2
		240	0.0	0.5
		280	0.0	1.2
		320	0.0	
		360	0.0	4.1
9/16/87	44+40	360 R	0.0	1.8
		320	0.0	
		280	0.0	1.5
		240	0.0	7.7
		200	0.0	3.8
		160	0.0	0.9
		120	0.0	3.3
		80	0.0	0.5
		40	0.0	1.5
		0	0.0	1.0
		40 L	0.0	3.8
		80	0.0	2.5
		120	0.0	0.3
		160	0.0	6.6
		200	0.0	1.6
9/16/87	44+80	200 L	0.0	5.9
		160	0.0	44.1
		120	0.0	5.4
		80	0.0	8.2
		40	0.0	1.1
		0	0.0	3.2
		40 R	0.0	1.9
		80	0.0	4.8
		120	0.0	3.2
		160	0.0	1.2
		200	0.0	8.0
		240	0.0	2.2
		280	0.0	
		320	0.0	
		360	0.0	2.1
9/16/87	45+00*	360 R	0.0	0.9
		320	0.0	
	* - Substituted	280	0.0	
	for 45+20	240	0.0	
		200	0.0	0.9
		160	0.0	0.8
		120	0.0	0.4

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		80	0.0	0.6
		40	0.0	2.2
		0	0.0	34.0
		40 L	0.0	0.8
		80	0.0	0.5
		120	0.0	3.6
		160	0.0	3.6
		200	0.0	6.4
		240	0.0	5.5
9/16/87	45+60	240 L	0.0	2.1
		200	0.0	5.4
		160	0.0	4.5
		120	0.0	3.3
		80	0.0	3.3
		40	0.0	2.6
		0	0.0	5.7
		40 R	0.0	2.4
		80	0.0	1.1
		120	0.0	2.9
		160	0.0	1.7
		200	0.0	0.5
		240	0.0	2.5
		280	0.0	0.5
		320	0.0	4.9
		360	0.0	8.2
9/16/87	46+00	360 R	0.0	1.7
		320	0.0	9.9
		280	0.0	124.6
		240	0.0	3.5
		200	0.0	2.0
		160	0.0	4.0
		120	0.0	86.9
		80	0.0	7.5
		40	0.0	6.6
		0	0.0	39.9
		40 L	0.0	2.7
		80	0.0	5.5
		120	0.0	4.4
		160	0.0	11.0
		200	0.0	
		240	0.0	1.8
		280	0.0	6.6
9/16/87	46+40	280 L	0.0	0.6
		240	0.0	8.6
		200	0.0	4.6
		160	0.0	9.9
		120	0.0	5.3
		80	0.0	14.0
		40	0.0	1.8

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		0	0.0	4.0
		40 R	0.0	1.3
		80	0.0	1.3
		120	0.0	2.1
		160	0.0	1.9
		200	0.0	1.3
		240	0.0	6.3
		280	0.0	33.0
		320	0.0	4.2
		360	0.0	0.9
9/16/87	46+80	360 R	0.0	2.3
		320	0.0	3.4
		280	0.0	4.5
		240	0.0	15.4
		200	0.0	1.2
		160	0.0	0.9
		120	0.0	0.8
		80	0.0	0.6
		40	0.0	0.4
		0	0.0	1.1
		40 L	0.0	1.3
		80	0.0	0.9
		120	0.0	1.5
		160	0.0	4.4
		200	0.0	
		240	0.0	5.1
9/18/87	47+20	240 L	0.0	0.4
		200	0.0	1.7
		160	0.0	0.4
		120	0.0	
		80	0.0	0.6
		40	0.0	0.7
		0	0.0	0.1
		40 R	0.0	1.7
		80	0.0	0.6
		120	0.0	0.2
		160	0.0	0.6
		200	0.0	1.1
		240	0.0	1.7
		280	0.0	55.0
		320	0.0	4.6
		360	0.0	0.5
9/18/87	47+60	360 R	0.0	5.9
		320	0.0	0.6
		280	0.0	0.7
		240	0.0	0.6
		200	0.0	0.4
		160	0.0	0.8
		120	0.0	1.8

The table head groups "P"-Line and Left/Right under "Location", and Air and Soil under "Readings in PPM".

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right		Air	Soil
		Location		Readings in PPM	
		80		0.0	1.1
		40		0.0	2.1
		0		0.0	0.9
		40	L	0.0	0.4
		80		0.0	1.1
		120		0.0	
		160		0.0	1.4
		200		0.0	0.2
		240		0.0	0.3
9/18/87	48+00	240	L	0.0	4.0
		200		0.0	
		160		0.0	22.6
		120		0.0	1.1
		80		0.0	1.9
		40		0.0	6.7
		0		0.0	9.0
		40	R	0.0	2.8
		80		0.0	2.6
		120		0.0	2.5
		160		0.0	2.4
		200		0.0	1.2
		240		0.0	6.7
		280		0.0	1.6
		320		0.0	3.6
		360		0.0	16.5
9/18/87	48+40	360	R	0.0	2.1
		320		0.0	1.6
		280		0.0	8.6
		240		0.0	76.1
		200		0.0	11.1
		160		0.0	1.9
		120		0.0	1.2
		80		0.0	1.1
		40		0.0	7.1
		0		0.0	3.6
		40	L	0.0	1.2
		80		0.0	1.2
		120		0.0	1.4
		160		0.0	
		200		0.0	
		240		0.0	0.4
9/18/87	48+80	160	L	0.0	2.1
		120		0.0	
		80		0.0	1.7
		40		0.0	7.2
		0		0.0	135.6
		40	R	0.0	1.4
		80		0.0	6.1
		120		0.0	55.6

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		160	0.0	4.7
		200	0.0	5.3
		240	0.0	1.3
		280	0.0	5.0
		320	0.0	6.4
		360	0.0	4.8
9/18/87	49+20	360 R	0.0	0.3
		320	0.0	1.1
		280	0.0	0.1
		240	0.0	0.1
		200	0.0	0.6
		160	0.0	3.0
		120	0.0	666.0
		80	0.0	0.6
		40	0.0	3.1
		0	0.0	0.6
		40 L	0.0	1.1
		80	0.0	0.1
		120	0.0	
		160	0.0	0.1
9/19/87	49+60	120 L	0.0	
		80	0.0	0.2
		40	0.0	3.2
		0	0.0	0.4
		40 R	0.0	0.5
		80	0.0	1.4
		120	0.0	0.8
		160	0.0	0.9
		200	0.0	0.2
		240	0.0	1.8
		280	0.0	1.0
		320	0.0	1.0
		360	0.0	0.5
9/19/87	50+00	360 R	0.0	3.2
		320	0.0	2.8
		280	0.0	0.3
		240	0.0	1.1
		200	0.0	2.9
		160	0.0	1.7
		120	0.0	5.1
		80	0.0	2.5
		40	0.0	1.5
		0	0.0	9.2
		40 L	0.0	2.3
		80	0.0	4.0
		120	0.0	45.8
9/19/87	50+40	120 L	0.0	4.4
		90	0.0	1.8
		40	0.0	36.2

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		0	0.0	1.9
		40 R	0.0	16.5
		80	0.0	0.9
		120	0.0	13.0
		160	0.0	17.4
		200	0.0	1.0
		240	0.0	0.7
		280	0.0	1.1
		320	0.0	3.0
		360	0.0	8.3
9/19/87	50+80	360 R	0.0	1.4
		320	0.0	3.9
		280	0.0	2.7
		240	0.0	2.4
		200	0.0	4.2
		160	0.0	8.7
		120	0.0	8.4
		80	0.0	5.1
		40	0.0	4.3
		0	0.0	3.3
		40 L	0.0	6.5
		80	0.0	1.3
9/19/87	51+20	90 L	0.0	1.6
		40	0.0	5.0
		0	0.0	5.0
		40 R	0.0	2.7
		80	0.0	8.2
		120	0.0	2.2
		160	0.0	20.2
		200	0.0	1.9
		240	0.0	2.0
		280	0.0	0.5
		320	0.0	0.2
9/19/87	51+60	320 R	0.0	1.2
		280	0.0	2.8
		240	0.0	2.4
		200	0.0	0.5
		160	0.0	0.4
		120	0.0	3.1
		80	0.0	2.1
		40	0.0	0.6
		0	0.0	5.5
		40 L	0.0	2.2
		80	0.0	0.7
9/19/87	52+00	80 L	0.0	4.7
		40	0.0	6.9
		0	0.0	1.1
		40 R	0.0	0.7
		80	0.0	1.9

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

	Location		Readings in PPM	
Date	"P"-Line	Left/Right	Air	Soil
		120	0.0	1.0
		160	0.0	0.8
		200	0.0	0.3
		240	0.0	1.2
		280	0.0	7.8
		320	0.0	2.1
9/19/87	52+40	320 R	0.0	1.2
		280	0.0	1.2
		240	0.0	12.9
		200	0.0	1.9
		160	0.0	1.4
		120	0.0	10.8
		80	0.0	0.9
		40	0.0	1.2
		0	0.0	5.2
		40 L	0.0	
		80	0.0	1.7
9/19/87	52+80	80 L	0.0	0.6
		40	0.0	2.0
		0	0.0	1.0
		40 R	0.0	1.3
		80 R	0.0	4.0
		120	0.0	2.4
		160	0.0	49.6
		200	0.0	6.9
		240	0.0	3.8
		280	0.0	1.2
		315	0.0	0.8
9/19/87	53+20	320 R	0.0	1.6
		280	0.0	1.5
		240	0.0	2.4
		200	0.0	0.4
		160	0.0	20.7
		120	0.0	4.3
		80	0.0	2.2
		40	0.0	0.3
9/19/87	53+60	305 R	0.0	0.2
		280	0.0	1.1
		240	0.0	1.3
		210	0.0	1.0
9/19/87	54+00	210 R	0.0	0.3
		240	0.0	2.6
		280	0.0	0.6
		295	0.0	1.0
9/19/87	54+40	290 R	0.0	0.4
		280	0.0	1.9
		240	0.0	1.0
		200	0.0	3.3
		185	0.0	0.5

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

	Location		Readings in PPM	
Date	"P"-Line	Left/Right	Air	Soil
		10 L	0.0	0.7
		40	0.0	6.0
		70	0.0	4.0
9/19/87	54+80	280 R	0.0	7.3
		240	0.0	4.9
		200	0.0	2.6
		160	0.0	0.8
		120	0.0	1.8
		80	0.0	1.9
		40	0.0	6.2
		0	0.0	
		40 L	0.0	0.6
		65	0.0	0.3
9/19/87	55+20	60 L	0.0	0.2
		40	0.0	0.2
		0	0.0	
		40 R	0.0	6.2
		80	0.0	9.0
		120	0.0	8.8
		160	0.0	0.6
		200	0.0	1.5
		240	0.0	0.4
		280	0.0	0.4
9/19/87	55+60	270 R	0.0	0.2
		240	0.0	5.0
		200	0.0	0.1
		160	0.0	0.2
		120	0.0	0.7
		80	0.0	0.7
		40	0.0	2.6
		0	0.0	
		40 L	0.0	0.3
9/19/87	56+00	40 L	0.0	0.6
		0	0.0	2.4
		40 R	0.0	8.8
		80	0.0	28.6
		120	0.0	0.8
		160	0.0	1.3
		200	0.0	0.1
		240	0.0	0.2
		260	0.0	0.7
9/19/87	56+40	240 R	0.0	2.8
		200	0.0	0.3
		160	0.0	3.5
		120	0.0	0.5
		80	0.0	0.0
		40	0.0	3.1
		0	0.0	3.3
		40 L	0.0	

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		60	0.0	0.7
9/19/87	56+80	60 L	0.0	0.0
		40	0.0	
		0	0.0	0.4
		40 R	0.0	0.2
		80	0.0	0.3
		120	0.0	1.8
		160	0.0	0.8
		200	0.0	0.1
		240	0.0	1.8
		250	0.0	0.9
9/19/87	57+20	240 R	0.0	1.2
		200	0.0	0.7
		160	0.0	2.2
		120	0.0	1.4
		80	0.0	2.4
		40	0.0	11.4
		0	0.0	24.9
		40 L	0.0	
		60	0.0	0.5
9/19/87	57+60	70 L	0.0	0.0
		40	0.0	
		0	0.0	3.1
		40 R	0.0	0.4
		80	0.0	1.1
		120	0.0	0.4
		160	0.0	0.2
		200	0.0	0.2
		240	0.0	0.3
9/19/87	58+00	230 R	0.0	1.8
		200	0.0	2.6
		160	0.0	1.8
		120	0.0	0.4
		80	0.0	1.2
		40	0.0	0.8
		0	0.0	2.1
		40 L	0.0	
		65	0.0	30.5
9/19/87	58+40	65 L	0.0	0.6
		40	0.0	
		20	0.0	2.1
		0	0.0	3.3
		30 R	0.0	0.8
		80	0.0	0.0
		120	0.0	0.0
		160	0.0	1.3
		200	0.0	4.8
		220	0.0	1.0
9/19/87	58+80	220 R	0.0	0.5

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right		Readings in PPM Air	Readings in PPM Soil
		200		0.0	1.4
		160		0.0	0.2
		120		0.0	2.9
		80		0.0	1.4
		65		0.0	0.9
		30		0.0	12.5
		0		0.0	1.3
		20	L	0.0	3.5
		40		0.0	
		70		0.0	0.7
9/19/87	59+20	80	L	0.0	1.5
		40		0.0	
		20		0.0	0.9
		0		0.0	0.9
		40	R	0.0	0.9
		80		0.0	1.1
		120		0.0	11.5
		160		0.0	1.1
		200		0.0	1.3
		210		0.0	1.2
9/19/87	59+60	200	R	0.0	6.3
		160		0.0	2.5
		120		0.0	1.3
		80		0.0	1.8
		40		0.0	6.0
		0		0.0	2.4
		40	L	0.0	
		80		0.0	7.0
9/19/87	60+00	80	L	0.0	1.6
		40		0.0	
		0		0.0	
		20	R	0.0	1.2
		40		0.0	1.4
		80		0.0	2.3
		120		0.0	2.1
		160		0.0	8.3
		200		0.0	2.8
9/21/87	60+40	200	R	0.0	1.4
		160		0.0	0.8
		120		0.0	2.1
		80		0.0	1.2
		40		0.0	1.0
		5	L	0.0	4.4
		40		0.0	10.9
		75		0.0	1.2
9/21/87	60+80	95	L	0.0	1.4
		80		0.0	3.6
		40		0.0	0.4
		0		0.0	0.3

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		40 R	0.0	1.4
		80	0.0	
		120	0.0	
9/21/87	61+20	160 R	0.0	0.9
		120	0.0	1.3
		80	0.0	1.8
		40	0.0	0.7
		0	0.0	0.9
		40 L	0.0	0.7
		80	0.0	
		90	0.0	1.8
		105	0.0	2.5
9/21/87	61+60	130 L	0.0	1.6
		120	0.0	1.7
		80	0.0	1.6
		40	0.0	1.5
		0	0.0	0.4
		40 R	0.0	1.2
		80	0.0	2.0
		120	0.0	0.7
		160	0.0	0.6
		170	0.0	0.3
9/21/87	62+00	170 R	0.0	0.8
		160	0.0	0.4
		120	0.0	0.3
		80	0.0	1.4
		40	0.0	1.1
		0	0.0	0.5
		40 L	0.0	2.3
		80	0.0	1.0
		115	0.0	1.7
		155	0.0	1.4
9/21/87	62+40	170	0.0	1.1
		160	0.0	1.1
		120	0.0	2.2
		80	0.0	
		65	0.0	0.7
		40	0.0	3.4
		0	0.0	2.3
		40 R	0.0	0.4
		80	0.0	0.9
		120	0.0	0.4
		155	0.0	0.6
9/21/87	62+80	155 R	0.0	0.3
		120	0.0	0.8
		80	0.0	0.8
		40	0.0	5.0
		0	0.0	0.6
		40 L	0.0	1.0

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	"P"-Line	Left/Right	Air	Soil
		80	0.0	4.5
		120	0.0	
		160	0.0	0.8
9/21/87	63+20	200 L	0.0	1.7
		160	0.0	2.3
		120	0.0	1.0
		80	0.0	1.3
		40	0.0	4.1
		0	0.0	1.0
		40 R	0.0	0.5
		80	0.0	0.5
		120	0.0	0.6
		145	0.0	0.5
9/21/87	63+60	135 R	0.0	0.6
		120	0.0	0.4
		80	0.0	0.4
		40	0.0	0.7
		0	0.0	1.2
		40 L	0.0	0.8
		80	0.0	0.3
		120	0.0	0.7
		140	0.0	
		160	0.0	0.7
		210	0.0	3.0
9/21/87	64+00	200 L	0.0	0.9
		160	0.0	
		120	0.0	0.8
		80	0.0	0.6
		40	0.0	1.1
		0	0.0	1.0
		40 R	0.0	0.9
		80	0.0	1.6
		120	0.0	0.5
		130	0.0	0.4
9/21/87	64+40	120 R	0.0	1.2
		80	0.0	4.4
		40	0.0	0.8
		0	0.0	1.1
		40 L	0.0	0.7
		80	0.0	0.8
		120	0.0	2.6
		160	0.0	
		180	0.0	5.4
9/21/87	64+80	180 L	0.0	8.2
		160	0.0	
		120	0.0	1.3
		80	0.0	2.7
		40	0.0	1.6
		0	0.0	0.9

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

	Location		Readings in PPM	
Date	"P"-Line	Left/Right	Air	Soil
		40 R	0.0	2.0
		80	0.0	0.6
		115	0.0	0.6
9/21/87	65+20	115 R	0.0	2.5
		80	0.0	0.6
		40	0.0	1.5
		0	0.0	0.7
		40 L	0.0	0.5
		80	0.0	0.2
		120	0.0	25.7
		160	0.0	
		200	0.0	0.5
9/21/87	65+60	200 L	0.0	0.4
		160	0.0	0.6
		120	0.0	1.6
		80	0.0	1.0
		40	0.0	1.7
		0	0.0	0.6
		40 R	0.0	0.7
		80	0.0	0.0
		100	0.0	62.5
9/21/87	66+00	100 R	0.0	2.5
		80	0.0	0.4
		40	0.0	0.5
		0	0.0	0.7
		40 L	0.0	1.6
		80	0.0	1.0
		120	0.0	0.2
		160	0.0	1.3
		200	0.0	18.6
9/21/87	66+40	190 L	0.0	1.4
		160	0.0	2.6
		120	0.0	2.4
		80	0.0	2.5
		40	0.0	4.3
		0	0.0	0.9
		40 R	0.0	1.3
		80	0.0	1.0
		90	0.0	1.6
9/21/87	66+80	80 R	0.0	0.9
		40	0.0	2.0
		0	0.0	2.6
		40 L	0.0	2.5
		80	0.0	6.0
		120	0.0	5.0
		160	0.0	1.0
		200	0.0	0.4
9/21/87	67+20	200 L	0.0	0.6
		160	0.0	

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		120	0.0	3.4
		80	0.0	3.9
		40	0.0	1.1
		0	0.0	0.5
		40 R	0.0	1.3
		80	0.0	2.3
9/21/87	67+60	75 R	0.0	4.5
		40	0.0	0.9
		0	0.0	1.1
		40 L	0.0	5.2
		80	0.0	1.5
		120	0.0	2.3
		160	0.0	
		200	0.0	0.8
9/21/87	68+00	200 L	0.0	4.8
		160	0.0	
		120	0.0	0.7
		80	0.0	0.2
		40	0.0	5.4
		0	0.0	0.4
		40 R	0.0	1.0
		65	0.0	4.3
9/21/87	68+40	55 R	0.0	0.1
		40	0.0	0.5
		0	0.0	0.4
		40 L	0.0	23.4
		80	0.0	1.2
		120	0.0	1.6
		160	0.0	
		200	0.0	0.9
9/21/87	68+80	220 L	0.0	0.5
		200	0.0	
		160	0.0	0.3
		120	0.0	0.7
		80	0.0	0.9
		40	0.0	0.3
		0	0.0	1.0
		40 R	0.0	0.2
		50	0.0	0.4
9/22/87	69+20	40 R	0.0	7.2
		0	0.0	0.4
		40 L	0.0	1.0
		80	0.0	0.8
		120	0.0	0.2
		160	0.0	0.2
		200	0.0	
		225	0.0	0.4
9/22/87	69+60	245 L	0.0	0.6
		200	0.0	1.3

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		160	0.0	1.8
		120	0.0	1.4
		80	0.0	1.5
		40	0.0	0.9
		0	0.0	1.6
		40 R	0.0	0.3
9/22/87	70+00	30 R	0.0	0.8
		0	0.0	11.4
		40 L	0.0	0.7
		80	0.0	9.8
		120	0.0	0.7
		160	0.0	16.4
		200	0.0	1.4
		240	0.0	2.7
		250	0.0	0.9
9/22/87	70+40	280 L	0.0	1.3
		240	0.0	12.8
		200	0.0	0.8
		160	0.0	0.8
		120	0.0	1.6
		80	0.0	1.8
		40	0.0	7.6
		0	0.0	1.2
		25 R	0.0	4.3
9/22/87	70+80	15 R	0.0	1.6
		0	0.0	0.2
		40 L	0.0	0.6
		80	0.0	2.9
		120	0.0	1.1
		160	0.0	1.8
		200	0.0	5.2
		240	0.0	2.0
		280	0.0	1.8
		310	0.0	1.3
9/22/87	71+20	320 L	0.0	2.9
		280	0.0	1.2
		240	0.0	2.0
		200	0.0	1.4
		160	0.0	3.9
		120	0.0	5.9
		80	0.0	2.0
		40	0.0	2.8
		0	0.0	8.9
		10 R	0.0	1.4
9/22/87	71+60	0	0.0	1.1
		40 L	0.0	1.6
		80	0.0	0.8
		120	0.0	
		160	0.0	1.4

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

Date	Location "P"-Line	Location Left/Right	Readings in PPM Air	Readings in PPM Soil
		200	0.0	0.5
		240	0.0	17.1
		280	0.0	3.7
		320	0.0	1.2
		360	0.0	0.8
9/22/87	72+00	320 L	0.0	6.8
		280	0.0	1.9
		240	0.0	0.9
		200	0.0	1.6
		160	0.0	1.4
		120	0.0	1.4
		80	0.0	
		40	0.0	1.5
		0	0.0	1.1
9/22/87	72+40	0	0.0	
		40 L	0.0	
		80	0.0	0.2
		120	0.0	0.9
		160	0.0	0.6
		180	0.0	1.1
		205	0.0	2.5
9/22/87	72+80	160 L	0.0	1.2
		120	0.0	0.8
		80	0.0	0.8
		40	0.0	0.1
		0	0.0	
9/22/87	73+20	0	0.0	
		25 L	0.0	0.6
		40	0.0	4.1
		80	0.0	29.6
9/22/87	73+60	40 L	0.0	2.9

STATISTICS:

	Air	Soil
# OF READINGS	1,452.0	1,383.0
AVERAGE	0.0	8.4
MAXIMUM	0.0	1,280.0
MINIMUM	0.0	0.0

TABLE 2 (Con't)
AIR/SOIL GAS SCREENING DATA

	Location		Readings in PPM	
Date	"P"-Line	Left/Right	Air	Soil
FREQUENCY			0	11
			5	1058
			10	159
			20	76
			30	24
			50	30
			100	14
			500	7
			1000	1
			1500	2
				0

APPENDIX E.2
ENVIRONMENTAL SAMPLING METHODOLOGIES

E.2.1 INTRODUCTION

Samples for chemical analysis were recovered for a number of matrices at Gratwick-Riverside Park during the remedial investigation. Sample matrices included: surface, subsurface and shoreline soil and waste; groundwater; surface water; and municipal water used during drilling. Appendix E.2.2 presents sampling procedures.

E.2.2 ENVIRONMENTAL SAMPLING

Groundwater, surface water, shoreline soil/waste, and onsite soil were sampled at Gratwick-Riverside Park from October 27, 1987 to December 21, 1987 and again between August 8, 1988 and August 19, 1988. The sample locations are shown in Figures 5-1 and 5-2, Section 5.0 of Volume 1. These samples were analyzed for a list of parameters including the full Hazardous Substance List (HSL) compounds as presented in the USEPA Contract Laboratory Program (CLP) Invitation for Bid (IFB), as well as a significant list of indicator parameters. Each time groundwater or surface water samples were delivered to the laboratory for analysis, a trip blank of deionized water supplied by the lab accompanied the samples. Trip blanks were analyzed for volatile organic compounds only. Rinse blanks were collected for the split-spoon sampler and bailer, used for soil and groundwater sampling, and submitted for analysis. A sample of drilling water (city water) was collected for CLP analysis and samples of the bentonite and sand pack materials used in well construction were delivered to the lab for leachable organic carbon analysis.

E.2.2.1 MONITORING WELL EVACUATION

Each monitoring well was evacuated prior to sampling to remove stagnant groundwater. Well evacuation details are summarized in Tables E.2-1(a) and E.2-1(b). The following summarizes the evacuation procedure.

The monitoring wells were evacuated with either a battery powered ISCO Portable Peristaltic Pump or a gasoline powered Fuji Robins Centrifugal Pump. In each case, dedicated, new, clean, polyethylene tubing was used for each well to avoid cross-contamination of wells. The ISCO pump removed water at a rate of approximately one gallon per minute and the Fuji Robins pump removed water at a rate of approximately two and one half gallons per minute. At least three well volumes were evacuated from each well prior to groundwater sampling. Wells GW-1S, GW-4S, and GW-5S were

TABLE E.2-1 (a)

GRATWICK-RIVERSIDE PARK

WELL EVACUATION INFORMATION (1st Round of Sampling)

Well	Date	Size/Type Casing	Water Level (Feet Below Top of Casing)	Well Depth (Feet Below Top of Casing)	Volume of Standing Water (Gals.)	Volume of Water Purged (Gals.)	Method of Purging	Recharge Rate*
GW-1S	12/11/87	2" SS	12.03	16.08	0.6	2.3	Pump	3
GW-1D	12/03/87	2" SS	14.56	48.58	5.8	24	Pump	1
GW-2S	12/11/87	2" SS	4.84	16.00	1.9	6.5	Pump	2
GW-2D	12/03/87	2" SS	12.85	47.10	5.8	20	Pump	1
GW-3S	12/11/87	2" SS	9.03	13.70	0.8	6.0	Pump	2
GW-4S	12/17/87	2" SS	11.50	15.50	0.6	1.1	Pump	2
GW-5S	12/17/87	2" SS	4.54	14.60	1.8	1.8	Pump	2
GW-5D	12/03/87	2" SS	6.74	69.96	10.7	53	Pump	1
GW-6S	12/11/87	2" SS	10.33	16.34	1.0	8.0	Pump	2
GW-6D	12/03/87	2" SS	9.58	48.08	6.5	51	Pump	1
GW-7S	12/11/87	2" SS	6.90	15.20	1.4	5.3	Pump	2
GW-8S	12/11/87	2" SS	9.04	17.54	1.4	17	Pump	1
GW-9S	12/11/87	2" SS	8.52	20.40	2.0	10	Pump	1
GW-10S	12/11/87	2" SS	8.83	14.74	1.0	8.0	Pump	1
GW-11S	12/17/87	2" SS	8.22	11.43	0.5	5.0	Pump	2

* Recharge Rates

1. Rapid - Recharges continuously
2. Moderate - Recharges within several hours
3. Slow - Recharges after 24 hours

TABLE E.2-1 (b)

GRATWICK-RIVERSIDE PARK

WELL EVACUATION INFORMATION (2nd Round of Sampling)

Well	Date	Size/Type Casing	Water Level (Feet Below Top of Riser)	Well Depth (Feet Below Top of Riser)	Volume of Standing Water (Gals.)	Volume of Water Purged (Gals.)	Method of Purging	Recharge Rate*
GW-1S	8/9/88	2" SS	6.03	15.46	1.54	1.54	Pump	3
GW-1D	8/9/88	2" SS	12.10	47.73	5.81	30	Pump	1
GW-2D	8/9/88	2" SS	6.75	46.90	6.55	30	Pump	1
GW-3S	8/10/88	2" SS	8.56	13.41	0.79	3.0	Pump	1
GW-4S	8/10/88	2" SS	10.23	15.11	0.80	0.80	Pump	3
GW-5S	8/11/88	2" SS	5.05	14.38	1.60	1.6	Pump	3
GW-5D	8/11/88	2" SS	6.31	68.13	10.1	40	Pump	1
GW-6S	8/10/88	2" SS	8.43	15.75	1.20	4.0	Pump	2
GW-6D	8/10/88	2" SS	7.96	46.63	6.31	30	Pump	1
GW-7S-B	8/12/88	2" SS	5.79	14.97	1.50	1.5	Pump	3
GW-8S	8/11/88	2" SS	8.99	17.02	1.31	3.0	Pump	2
GW-9S-B	8/11/88	2" SS	8.29	20.09	1.93	3.5	Pump	2
GW-10S	8/9/88	2" SS	8.24	13.91	0.93	3.0	Pump	2
GW-11S	8/11/88	2" SS	8.95	11.13	0.36	0.36	Pump	3

(B - Bottom Sample)

* Recharge Rates
1. Rapid - Recharges continuously
2. Moderate - Recharges within several hours
3. Slow - Recharges after 24 hours

slow to recharge and it was necessary to evacuate these wells over several days to remove three or more well volumes.

E.2.2.2 MONITORING WELL SAMPLING

Groundwater samples wre collected on two occasions (December, 1987 and August 1988). Sampling details are presented in Appendices E.2.3 and E.2-4. Groundwater samples were generally collected within approximately four hours after evacuating each well. Some of the wells (GW-1S, GW-4S, and GW-5S) are low yielding wells and therefore to obtain sufficient sample volume, it was necessary to collect successive aliquots over a period of two to several days. Samples were collected using dedicated one-inch diameter by two foot long stainless steel bailers. Each bailer was precleaned prior to sampling using the protocol outlined in Appendix K of the Work/QA Project Plan. Each bailer was attached to a polypropylene "leader" of three or four feet which was tied to new, clean, dedicated nylon rope. A trip blank of laboratory-supplied deionized water accompanied the water samples during each shipment and was analyzed for volatile organic compounds.

E.2.2.3 SURFACE WATER SAMPLING

Surface water samples were collected at seven locations on November 11 and 12, 1987 and at four locations on August 8, 1988. Sampling details are presented in Appendices E.2.3 and E.2.4. A trip blank of laboratory-supplied deionized water accompanied the samples during shipment to the laboratory.

Appropriate sample containers were submerged just below the water surface with the opening facing upstream, at a point of highest velocity, greatest turbulence, and center of flow. Sample containers into which preservatives were added by the laboratory prior to sample collection were not lowered into the stream. These containers were filled by pouring sample aliquots previously collected in bottles containing no preservatives.

During the first round of sampling, at GRP-SP3-SW, debris was blocking the flow out of the storm drain outfall. The debris was removed, restoring flow out of the outfall and the sample was collected about five minutes later. Also during the first round, at GRP-SP4-SW, it was necessary to dig a channel at the outfall to restore flow. The sample was collected about 20 minutes after flow was restored.

A sample was not collected at GRP-SP10-SW because it was not possible to locate the upstream surface source.

E.2.2.4 SHORELINE SOIL/WASTE SAMPLING

On October 27, 1987, shoreline soil/waste samples were collected at eight areas along the Niagara River (details in Appendix E.2.3). Each sample is a composite of several smaller subsamples collected from the same general area along the shoreline. The subsamples were collected from fill material which outcrops along the shoreline. Samples were collected with a dedicated, precleaned, stainless steel hand trowel and placed in appropriate sample containers.

E.2.2.5 SHALLOW SOIL SAMPLING

A total of 20 shallow soil samples were collected October 28-30, 1987 (details in Appendix E.2.3). The sample locations corresponded with suspect areas of contamination identified from the results of previous sampling programs conducted at Gratwick Park and the results of the soil gas screening undertaken during the RI.

Each sample was collected with a precleaned hand auger (bucket type) constructed of stainless steel. Using a pre-cleaned stainless steel scoop, the grass layer was first removed and the hand auger was advanced into the soil until the bucket was full (approximately six inches). Using a pre-cleaned stainless steel spatula, the contents was removed from the bottom of the auger into a pre-cleaned stainless steel bowl. The auger was advanced into the soil one more time and emptied into the bowl to get a sample representing approximately the first twelve inches under the surface of the soil. The contents of the stainless steel bowl was thoroughly mixed prior to filling the appropriate sample containers. The auger was decontaminated after use and between sample locations as outlined in Appendix K of the Work/QA Project Plan.

E.2.2.6 SOIL BORING SAMPLING

A total of thirteen soil composite samples were collected from seven subsurface borings between October 29 and December 7, 1987 (details in Appendix E.2.3). Samples were recovered from subsurface zones exhibiting high organic vapor readings or physical indications of possible contaminants. Soil samples were composited to represent each of the subsurface units (i.e., fill, clay or till) at selected boring locations on and offsite.

Individual samples were recovered by means of a split-spoon sampler using methods as described in Appendix B of the Work/QA Project Plan. The split-spoon sampler was cleaned according to protocols presented in Appendix K of the Work/QA Project Plan prior to recovery of each sample for chemical analysis. Individual samples selected for each composite sample were combined in a pre-cleaned stainless steel bowl and mixed thoroughly. The composite sample was then transferred to the appropriate sample containers for delivery to the analytical laboratory.

In addition to the composite sampling performed with the drilling program, one rinse blank sample was recovered from the split-spoon sampler. The rinse blank sample consisted of distilled water which was poured over the pre-cleaned split-spoon sampler and collected into the appropriate sample container. This sample was analyzed to identify the adequacy of the sampler cleaning protocols and possibility of cross-contamination resulting from sampling and cleaning procedures.

E.2.2.7 OFFSITE SHALLOW PROBE SAMPLING

A total of three soil composite samples were collected from the three offsite locations shown in Figure 5-2 of the RI/FS report. Five samples at each location were taken to make each composite on August 8, 1988 from depths ranging from zero to one foot.

E.2.2.8 FIELD MEASUREMENTS

Prior to evacuation of the monitoring wells, water levels below the top of casing were measured to the nearest hundredth of a foot using a Brainard Kilman Model 2220 water level detector in accordance with the procedures outlined in Appendix E-1 in the Work/QA Project Plan. The tip of the sensor was cleaned with soap and water, acetone rinsed, followed by a deionized water rinse between well measurements. All wells have protective casings with lockable caps. Wells were unlocked and opened only when performing work at the well.

The pH of the water samples was measured using an Extech portable pH meter. The meter was adjusted daily for slope with pH buffers of 7.00 and 10.00 and standardized to pH 7.00 buffer prior to each use.

Specific conductance was measured using an Extech Compact Conductivity Meter with automatic temperature compensation. The meter was calibrated daily with a standard KCl solution of 447 umhos/cm.

Turbidity was measured during well evacuation with an HF Scientific, Inc. Model DRT-15B portable turbidity meter with four ranges: 0-1, 0-10, 0-100, and 0-200 NTU.

The use of cement based grout to seal the annular space of the monitoring well above the sand pack and bentonite seal may adversely affect the pH of the groundwater collected from the well under circumstances where the seal does not set up prior to grouting. In anticipation of this potential problem, groundwater samples were collected during drilling from select boreholes prior to well construction grouting and analyzed for pH in the field. Results of pH analyses before grouting and after well completion (during groundwater sampling event) are presented below:

Well No.	Aquifer	pH results Prior to Grouting	pH results Prior to Sampling
GW-5I	Fill	11.71	11.50 (GW-5S)
GW-6S	Fill	11.70	11.76
GW-6D	Bedrock	6.90	7.12
GW-8I	Fill	12.25	11.66 (GW-8S)

It was concluded that the pH of the groundwater in the fill is elevated >11.0 and was not affected by well construction grouting procedures.

Field measurements at the time of sampling are presented in Tables E.2-2(a) and E.2-2(b).

E.2.2.9 SAMPLE HANDLING

Samples were collected into appropriate bottles (See Appendix J, Work/QA Project Plan) prepared by Ecology and Environment Inc. All preservatives were added prior to sampling. A separate water sample was collected into a clean 250 milliliter container for measurements of pH and specific conductance.

Samples were either shipped via Federal Express to CompuChem Laboratories (for dioxin analysis) or transported by URS personnel to Ecology and Environment, Inc. (for HSL and indicator parameter analysis) on a daily basis.

TABLE E.2-2(a)

GRATWICK-RIVERSIDE PARK

FIELD MEASUREMENTS (1st Round of Sampling)

Sample Point	Date	Method of Sampling	pH (Standard Units)	Specific Conductance (umhos/cm)
GW-1S	12/21/87	Bailer	7.72	860
GW-1D	12/03/87	Bailer	7.46	3030
GW-2S	12/11/87	Bailer	6.92	2510
GW-2D	12/03/87	Bailer	6.78	3200
GW-3S	12/11/87	Bailer	11.35	3940
GW-4S	12/17/87	Bailer	8.38	2020
GW-5S	12/17/87	Bailer	11.50	4220
GW-5D	12/03/87	Bailer	6.86	3780
GW-6S	12/11/87	Bailer	11.76	1710
GW-6D	12/03/87	Bailer	7.12	3530
GW-7S	12/11/87	Bailer	6.96	1750
GW-8S	12/11/87	Bailer	11.66	3990
GW-9S	12/11/87	Bailer	11.64	2470
GW-10S	12/11/87	Bailer	11.18	3240
GW-11S	12/17/87	Bailer	11.35	1670
SP1-SW	11/11/87	Direct	7.49	320
SP2-SW	11/11/87	Direct	7.71	920
SP3-SW	11/11/87	Direct	7.56	820
SP4-SW	11/11/87	Direct	8.12	1770
SP5-SW	11/11/87	Direct	8.60	330
SP9-SW	11/12/87	Direct	7.39	940
SP11-SW	11/12/87	Direct	7.64	1700
Drilling Water	11/12/87	Direct	7.51	300

TABLE E.2-2(b)

GRATWICK RIVERSIDE PARK

FIELD MEASUREMENTS (2nd Round of Sampling)

Sample Point	Date	Method of Sampling	pH Standard Units	Specific Conductance (umhos/cm)
GW-1S	8/19/88	Bailer	7.47	920
GW-1D	8/9/88	Bailer	11.13	3220
GW-2D	8/9/88	Bailer	8.19	2380
GW-3S	8/10/88	Bailer	8.47	(1)
GW-4S	8/19/88	Bailer	6.21	(2)
GW-5S	8/12/88	Bailer	11.59	4180
GW-5D	8/11/88	Bailer	7.25	2780
GW-6S	8/10/88	Bailer	11.28	(1)
GW-6D	8/10/88	Bailer	7.13	(1)
GW-7S(Bottom)	8/12/88	Bailer	4.62	12830
GW-7S	8/19/88	Bailer	4.67	(2)
GW-8S	8/12/88	Bailer	4.60	2580
GW-9S(Bottom)	8/11/88	Bailer	11.25	1890
GW-9S	8/12/88	Bailer	11.26	1870
GW-10S	8/9/88	Bailer	11.36	2360
GW-11S	8/19/88	Bailer	11.17	1540
SP2-SW	8/8/88	Direct	7.24	1020
SP3-SW	8/8/88	Direct	7.16	1130
SP4-SW	8/8/88	Direct	7.42	1940
SP9-SW	8/8/88	Direct	6.96	660
SP11-SW	Dry	----	----	----

(1) Conductivity meter malfunction

(2) Parameter not measured, insufficient sample

E.2.3 ENVIRONMENTAL SAMPLING

SUMMARY - FIRST ROUND OF SAMPLING

DATA SUMMARY - GROUNDWATER SAMPLES

I.D. No.	Date Sampled	Location	Comments
GRP- GW-1S	12-15-87 5:00 pm and 12-21-87 11:00 am	Well No. GW-1S	o well recovery very slow, purged to dryness 12-15-87 o water initially clear, turned tan with continued bailing o metals/VOA sampled on 12-15-87 o remainder sampled on 12-21-87
GRP- GW-1D	12-3-87 9:40	Well No. GW-1D	o productive well, purged 12-3-87 o water clear
GRP GW-2S	12-11-87 4:40 pm	Well No. GW-2S	o well recovery slow, purged to dryness on 12-11-87 o water initially clear with oily sheen, turned tan/ black with continued bailing
GRP GW-2D	12-3-87 10:34	Well No. GW-2D	o productive well, purged 12-3-87 o water clear
GRP GW-3S	12-15-87 11:00 am and 4:30 pm	Well No. GW-3S	o well recovery slow, purged to dryness on 12-15-87 o water initially clear, turned black during continued bailing
GRP GW-4S	12-17-87 3:00 pm and 12-18-87 10:00 am	Well No. GW-4S	o well recovery moderate, purged on 12-18-87 o water clear turned tan with continued bailing o VOA/Pest/BNA sampled on 12-17-87, metals during initial bailing on 12-18-87, followed by remainder of sample
GRP GW-5S	12-17-87 2:30 pm and 12-18-87 10:15 am	Well No. GW-5S	o well recovery slow, purged on 12-17-87 o water initially clear turned bluish with sulphur odor o VOA/Pest/BNA/BOD sampled on 12-17-87, remainder of sample on 12-18-87

DATA SUMMARY - GROUNDWATER SAMPLES (Cont.)

I.D. No.	Date Sampled	Location	Comments
GRP GW-5D	12-3-87	Well No. GW-5D	o productive well, purged on 12-3-87 o water characteristics not noted (pH - 6.86, cond. 3780, Turb. 32 NTu)
GRP GW-6S	12-15-87 11:45 am and 4:30 pm	Well No. GW-6S	o well recovery moderate, purged on 12-15-87 o water initially gray turned clear with bailing in am and became gray/black with bailing in pm
GRP GW-6D	12-3-87	Well No. GW-6D	o productive well, purged on 12-3-87 o water initially clear, turned turbid
GRP GW-7S	12-15-87 12:40 pm and 5:15 pm	Well No. GW-7S	o well recovery moderate, purged on 12-15-87 o water initially hazy, cleared with continued bailing, whitish precipitant, turned tan in pm
GRP GW-8S	12-11-87 11:50 pm	Well No. GW-8S	o well recovery good, purged on 12-11-87 o water clear, turned slightly gray/tan with bailing
GRP GW-9S	12-11-87 2:55 pm	Well No. GW-9S	o well recovery good, purged on 12-11-87 o water initially clear, turned slightly gray/tan with continued bailing
GRP GW-10S	12-11-87 3:45 pm	Well No. GW-10S	o well recovery good, purged on 12-11-87 o water initially clear, turned tan/black with continued bailing
GRP GW-11S	12-17-87 1:45	Well No. GW-11S	o well recovery good, purged on 12-17-87 o water initially clear, turned turbid with continued bailing
GRP GW-RP	12-21-87		Rinse blank of bailer

DATA SUMMARY - SURFACE WATER SAMPLES

ID. No.	Date Sampled	Location	Comments
GRP SP1-SW	11-11-87 1:45 pm	Niagara River (near southern most end of park)	o River water sample
GRP SP2-SW	11-11-87 2:05 pm	At outfall of 5-foot diameter concrete stormdrain (along Niagara River near Ward Rd.)	o sample of flow from outfall
GRP SP3-SW	11-11-87 2:30 pm	At outfall of 36-inch drain which channels flow of unnamed stream (along Niagara River near park dock)	o removed debris blocking outfall resulted in flow o sampled 5 minutes after flow restored
GRP SP4-SW	11-11-87 3:35 pm	At outfall of 12-inch stormdrain (along Niagara River near Witmer Rd.)	o no flow out of outfall due to infilling with sediment, dug channel promoting flow o sampled 20 minutes after flow restored
GRP SP5-SW	11-11-87 3:10 pm	Niagara River (near northern most end of park)	o River water sample
GRP SP9-SW	11-12-87 1:30 pm	Unnamed stream tributary upstream of 36-inch storm drain which traverses park (east of River Rd.)	o water taken from stream o sample discolored (cloudy/tan)
GRP SP11-SW	11-12-87 2:10 pm	Roadside drainage ditch along south side of Witmer Rd.	o water from drainage ditch o sample clear

DATA SUMMARY - SURFACE WATER SAMPLES (Cont.)

ID. No.	Date Sampled	Location	Comments
GRP Drill Water	11-12-87 2:40 pm	Municipal water supply (near Ward Rd. west of River Rd)	o sample collected from hose attached to municipal water distribution system and connected to pressure o water allowed to run for 5 minutes prior to sampling

DATA SUMMARY - SHORELINE SOIL/WASTE SAMPLES

ID. No.	Date Sampled	Location	Comments
GRP SP1-SS	10-27-87 10:25 am	Niagara River Shoreline (centered on P24+80, 290L)*	o composit of sediment between waterline and shore bank
GRP SP2-5S	10-27-87 11:30 am	Niagara River Shoreline (centered on P38+75, 205L)*	o sampled fines deposited at outfall of 5-foot concrete stormdrain
GRP SP3-SS	10-27-87 2:00 pm	Niagara River Shoreline (centered on P51+95, 120L)*	o sampled fines within stormdrain at outfall of 36-inch stormdrain
GRP SP4-5S	10-27-87 2:15 pm	Niagara River Shoreline (centered on P65+90, 210L)*	o sampled fines deposited at outfall of 12-inch storm-drain
GRP SP5-SS	10-27-87 3:15 pm	Niagara River Shoreline (centered on P71 +00, 250L)*	o composit of waste debris (fines) from base of of shore bank o specific sampling of tan (cream) colored material
GRP SP6-SS	10-27-87	Niagara River Shoreline (centered on P44+75,315L)*	o composit of waste debris (fines) from base of shore bank o specific sampling of bluish granular soil
GRP SP7-SS	10-27-87 12:00 pm	Niagara River Shoreline (centered on P30+50,210L)*	o composit of sediment (fines) between waterline bank o specific sampling of discolored (reddish brown) material
GRP SP8-SS	10-27-87	Niagara River Shoreline (centered on P30+50,210L)*	o composit of sediment (fines) between waterline and bank o specific sampling of fines around phenolic resin and other waste like substances

DATA SUMMARY - SHALLOW SOIL SAMPLES

ID No.	Date Sampled	Location	Comments
GRP SPS-1	10-29-87 1:10 pm	South central portion of site (P24+40, 80L)*	o sampled o-14 inch interval, o clay fill, few stones, o corresponds with TIP** measurement of 500 ppm
GRP SPS-2	10-29-87 1:45 pm	South central portion of site (P29+20, 40R)*	o sampled 0-14 inch interval, o clay/sand fill, o corresponds with TIP** measurement of 31.7 ppm
GRP SPS-3	10-28-87 2:00 pm	Central portion of site within "dog run" area (P35+20, 240R)*	o sampled 0-18 inch interval o black soil fill, some stones, o corresponds with TIP** measurement of 69.5 ppm
GRP SPS-4	10-28-87 2:35 pm	Central portion of site west of "dog run" (P37+20, 160L)*	o sampled 0-14 inch interval o black soil fill, glass, metal fragments o corresponds with TIP** measurement of 463.0 ppm
GRP SPS-5	10-28-87 3:35 pm	Central portion of site near Niagara River (P44+00,200L)*	o sampled 0-14 inch interval o brown/black soil fill, glass, metal fragments o corresponds with TIP** measurement of 43.9 ppm
GRP SPS-6	10-28-87 3:05 pm	Central portion of site near River Rd. (P47+20, 240R)*	o sampled 0-18 inch interval o black topsoil fill o corresponds with TIP** measurement of 55.0 ppm
GRP SPS-7	10-29-87 2:25 pm	Central portion of site (P49+20,120R)*	o sampled 0-15 inch interval o clay fill with black granular material at 10 inches o corresponds with TIP** measurement of 666.0 ppm
GRP SPS-8	10-29-87 2:45 pm	Central portion of site south of boat launch parking lot (p52+80,160T)*	o sampled 0-12 inch interval o black granular fill, some blue particles o corresponds with TIP** measurement of 49.6 ppm

DATA SUMMARY - SHALLOW SOIL SAMPLES (Cont.)

ID No.	Date Sampled	Location	Comments
GRP SPS-9	10-29-87 3:00 pm	Northern portion of site north of Witmer Rd. park entrance road (P65+20, 120:)*	o sampled 0-14 inch interval o no sample description o corresponds with TIP** measurement of 25.7 ppm
GRP SPS-10	10-29-87 3:30 pm	Northern portion of site (P71+60,240L)*	o sampled 0-22 inch interval o brown granular fill, metal, glass at 12 inches o corresponds with TIP** measurement of 17.1 ppm
GRP SPS-11	10-30-87 9:30 am	Northern portion of site, north of Witmer Rd. entrance (P68+ 40, 40L)*	o sample 0-18 inch interval o clayey fill 0-12 inch, sandy fill with glass debris 12-18 inch o corresponds with TIP** measurement of 23.4 ppm
GRP SPS-12	10-30-87 9:50 am	North central portion of site near Niagara River (P58+00,70L)*	o sample interval not specified (0-18 inch probable) o moist fill, brick and debris o TIP** measurement at P58+00, 65L was 30.5ppm
GRP SPS-13	10-30-87 10:05 am	North central portion of site, north of boat launch parking lot (P56+00,80R)*	o sample interval not specified (0-18 inch probable) o clay fill rocks no obvious debris o corresponds with TIP** measurement of 28.6 ppm
GRP SPS-14	10-30-87 10:20 am	Central portion of site (P48+80,00)*	o sample 0-18 inch interval o debris, wood fragments 0-12 inch, slag debris material 12-18 inch o corresponds with TIP** measurement of 135.6 ppm
GRP SPS-15	10-30-87 10:45 am	Central portion of site west of River Rd. (P42+80,200R)*	o sample 0-12 inch interval o clay fill rock, glass 0-12 inch, slag debris 12-18 inch o corresponds with TIP** measurement of 31.5 ppm

DATA SUMMARY - SHALLOW SOIL SAMPLES (Cont.)

ID No.	Date Sampled	Location	Comments
GRP SPS-16	10-30-87 11:10 am	Central portion of site near Niagara (P40+80,160L)*	o sample interval not specified (0-18 inch probable) o debris, wood fragments o corresponds with TIP** measurement of 74.0 ppm
GRP SPS-17	10-30-87 12:05 pm	Central portion of with within "dog run" area (P36+40, 80R)*	o sample interval not specified (0-18 inch probable) o clay fill, some rocks, no obvious debris o corresponds with TIP** measurement of 90.2 ppm
GRP SPS-18	10-30-87 3:05 pm	Central portion of site within "dog run" area (P35+ 60, 80L)*	o sample interval not specified (0-18 inch probable) o debris, slag, moist, metal fragments, rocks o corresponds with TIP** measurement of 97.5 ppm
GRP SPS-19	10-30-87 3:25 pm	Central portion of site south of "dog run" (P32+80, 160R)*	o sample interval not specified (0-18 inch probable) o clayey sand fill, moist o corresponds with TIP** measurement of 107.8 ppm
GRP SPS-20	10-30-87 3:50 pm	South central portion of site (P31+60, 40L)	o sample interval not specified (0-18 inch probable) o debris, slag o corresponds with TIP** measurement of 1,280.0 ppm

DATA SUMMARY - SOIL BORING SAMPLES

ID No.	Date Sampled	Location	Comments
GRP GW1-SB 0-1	10-29-87	Vicinity of Borehole GW-1D	o composited sample of shallow soil collected in vicinity of borehole
GRP GW2-SB 0-1	10-29-87	Vicinity of Borehole GW-2D	o composited sample of shallow soil collected in vicinity of borehole
GRP GW3-SB 4-12	12-1-87	Borehole GW-3I	o composite of split spoon samples S-3 through S-6 o fill
GRP GW3-SB 14-18	12-1-87	Borehole GW-3I	o composite of split spoon samples S-8 and S-9 o till (gravelly, clayey silt some sand)
GRP GW4-SB 8-12	11-30-87	Borehole GW-4S	o composite of split spoon samples S-1 through S-4 (poor sample recovery) o fill material, slag
GRP GW4-SB 20-22	11-30-87	Borehole GW-4I	o split spoon sample S-9, composite of full spoon sample o silty clay
GRP GW5-SB 12-18	11-17-87	Borehole GW-5I	o composite of split spoon samples S-1, S-2 and S-3 o dark blue-black granular fill
GRP GW5-SB 20-24	11-17-87	Borehole GW-5I	o composite of split spoon samples S-5 and S-6 o till
GRP GW5-SB 24-26	11-17-87	Borehole GW-5I	o Split spoon sample S-7, composite of full spoon sample o till

DATA SUMMARY - SOIL BORING SAMPLES (Cont.)

ID No.	Date Sampled	Location	Comments
GRP GW6-SB 10-15	11-15-87	Borehole GW-6I	o composite of split spoon samples S-1, S-2 and S-3 o fill
GRP GW6-SB 15-16	11-15-87	Borehole GW-6I(a)	o split spoon sample S-2, only used upper (shallow - 12 inch) portion of spoon o contact between fill and till unit o borehole abandoned
GRP GW6-SB 19-20	11-15-87	Borehole GW-6I	o split spoon sample S-5, composite o till
GRP GW8-SB 9-16	11-23-87	Borehole GW-8S	o composite of split spoon samples S-1 through S-4 o granular (gravel/sand) fill
GRP-SB-RB	12-1-87		Rinse blank of split spoon sample after cleaning

Notes: * Coordinates from established site grid, reference offset from "P" baseline which runs south to north through site (see Figure E-1)

** Photovac Tip - volatile organic vapor reading in ppm.

E.2.4 ENVIRONMENTAL SAMPLING SUMMARY

SECOND ROUND OF SAMPLING

DATA SUMMARY - GROUNDWATER SAMPLES

ID. No.	Date sampled	Location	Comments
GW-1S	8/19/88	Well No. GW-1S	o Well recovery was very slow, purged to dryness on 8/9/88 o Physical appearance - clear water white o Insufficient sample, collected VOA sample only
GW-1D	8/09/88	Well No. GW-1D	o Well recovery was fast, purged 30 gal. and well was recharged in 3 hours o Physical appearance - clear water white o Volatiles sampled first, then semi-volatiles
GW-2D	8/09/88	Well No. GW-2D	o Well recovery was moderate, purged and sampled on 8/9/88 o Physical appearance - clear water white with suspended white matter o Volatiles sampled first, then semi-volatiles
GW-3S	8/10/88	Well No. GW-3S	o Well recovery was fast, purged and sampled on 8/10/88 o Physical appearance - clear water white, $S^{=}$ odor, fine blank suspended matter o Volatiles sampled first, then semi-volatiles
GW-4S	8/19/88	Well No. GW-4S	o Well recovery was very slow, purged to dryness on 8/10/88 o Physical appearance - clear water white for volatile samples, then turned "muddy" o Volatile sampled only, insufficient sample for remaining parameters

DATA SUMMARY - GROUNDWATER SAMPLES (Cont.)

ID. No.	Date sampled	Location	Comments
GW-5S	8/12/88	Well No. GW-5S	o Well recovery was moderate, purged to dryness on 8/11/88 o Physical appearance - clear water white, $S^=$ odor o Insufficient sample for CN, O&G, and $S^=$
GW-5D	8/11/88	Well No. GW-5D	o Well recovery was very fast, purged 40 gallons and well was recharged in 4 hours o Physical appearance - clear water white o Volatiles sampled first, then semi-volatiles and remaining parameters
GW-6S	8/10/88	Well No. GW-6S	o Well recovery was fast, purged and sampled the same day o Physical appearance - clear water white, slight $S^=$ odor o Volatiles sampled first, then semi-volatiles and remaining parameters.
GW-6D	8/10/88	Well No. GW-6D	o Well recovery was very fast, purged 30 gallons and sampled in 3 hours o Physical appearance - clear water white, slight $S^=$ odor o Sample volatiles first, then semi-volatiles and remaining parameters
GW-7S Bottom	8/12/88	Well No. GW-7S	o Sample bottom of well before purging o Physical appearance - light tan color, aromatic odor o Sample volatiles, then semi-volatiles

DATA SUMMARY - GROUNDWATER SAMPLES (Cont.)

ID. No.	Date sampled	Location	Comments
GW-7S	8/19/88	Well No. GW-7S	o Well recovery was very slow, purged on 8/12/88 and sampled on 8/19/88 o Physical appearance - slight tan color o Sample volatiles first, then semi-volatiles and remaining parameters
GW-8S	8/12/88	Well No. GW-8S	o Well recovery was moderate, purged on 8/11/88 and sampled on 8/12/88 o Physical appearance - clear water white, sulfide odor o Sample volatiles first, then semi-volatiles and re-maining parameters
GW-9S Bottom	8/11/88	Well No. GW-9S	o Sampled bottom of well, then purged o Physical appearance - "muddy" color o Sample volatiles then semi-volatiles
GW-9S	8/12/88	Well No. GW-9S	o Well recovery was moderate, purged 8/11/88, sampled 8/12/88 o Physical appearance - clear water white, strong $S^{=}$ odor, turbidity increased as sample volume increased o Sample volatiles first then semi-volatiles and remaining parameters
GW-10S	8/09/88	Well No. GW-10S	o Well recovery was fast, purged and sampled the same day o Physical appearance - clear water white, strong $S^{=}$ odor, fine black suspended matter o Sample volatiles first, then metals-turbidity increased as sample was removed from well

DATA SUMMARY - GROUNDWATER SAMPLES (Cont.)

ID. No.	Date sampled	Location	Comments
GW-11S	8/19/88	Well No. GW-11S	o Well recovery was very slow, purged to dryness on 8/11/88 o Physical appearance - cloudy slighty blue color o Sample volatiles only

DATA SUMMARY - SURFACE WATER SAMPLES

ID No.	Date Sampled	Location	Comments
GRP SP2-SW	8/08/88 1315 hr.	At outfall of 5-foot diameter concrete storm drain (along Niagara River west of Ward Rd.)	o low flow at outfall, 3/4" on bottom of pipe o sample collected in storm drain at area of least turbulence o physical appearance - clear, water white
GRP SP3-SW	8/08/88 1340 hr.	At outfall of 36 inch drain which channels flow of unnamed stream (along Niagara River south of park dock)	o no flow from outfall, 4" of water in pipe, river was high o obtained sample immediately inside the outfall pipe o phsyical appearance - clear, water white
GRP SP4-SW	8/08/88 1400 hr.	At outfall of 12 inch storm drain (along Niagara River west of Witmer Rd.)	o low flow, 1/2" of water on bottom of pipe o sample collected immediately inside outfall in area of least turbulence. o physical appearance - clear, water white

DATA SUMMARY - SURFACE WATER SAMPLES (Cont.)

ID No.	Date Sampled	Location	Comments
GRP SP9-SW	8/08/88 1430 hr.	Unnamed stream tributary upstream of 36 inch storm drains which traverses park (east of River Rd.)	o no flow in pool where sample was collected o pool had an oil sheen covering entire surface, RR ties and other debris in pool o physical appearance - clear, light green tint
GRP SP11-SW	8/08/88 1500 - no sample collected	Roadside drainage ditch along south side of Witmer Rd.	o Sample point dry, water in ditch, east and west of sample point. o Physical appearance was gray/ greenish white with a heavy green moss covering water. Appearance of stagnant water. Did not sample. o Checked sample point on 8/12/88 after rainfall, sample point still dry.

DATA SUMMARY - OFFSITE SHALLOW PROBE SAMPLES

ID. No.	Date Sampled	Location	Comments
001	8/18/88	North property line of Gratwick Hose Company	o A total of 5 samples collected about 20 ft. apart and composited o Soil samples collected at 6-12 inches o Physical appearance - topsoil, stone and clay
002	8/18/88	150 feet west of GW-1D	o A total of 5 samples collected about 30 ft. apart and composited o Soil samples collected at 6-12 inches o Physical appearance - topsoil until 10" then clay
003	8/18/88	10 ft. east of road which leads to the Niagara County Refuse Disposal starting at corner of Witmer Rd.	o A total of 5 samples collected about 30 ft. apart and composited o Soil samples collected at 6-12 inches o Physical appearance - topsoil and stone

APPENDIX F

INDICATOR CHEMICAL PROFILE SHEETS

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INDICATOR CHEMICAL PROFILE SHEETS

Vinyl Chloride: Vinyl Chloride (chloroethene) is a colorless liquid or gas that has a faintly sweet odor. This compound is used in the production of polyvinyl chloride (PVC); in the plastics industry and as a refrigerant. Vinyl chloride has a relatively low organic carbon partition coefficient, indicating it is highly mobile in soil, and therefore, it may leach to the groundwater. Vinyl chloride was found in shallow groundwater samples only.

Vinyl chloride is known to cause skin burns by rapid evaporation and consequent freezing (SAX, 1987). Vinyl chloride is a severe irritant to eyes, skin, and mucous membranes by inhalation. It is a human brain carcinogen (SAX, 1987). Chronic exposure to this compound has shown liver injury. Inhalation is the major route of exposure. Dangerous fire hazard when exposed to heat, flame, or oxidizer.

1,1-Dichloroethane: This compound is a colorless liquid, with an odor similar to chloroform and a hot saccharine taste. It has limited use as a solvent and as a chemical intermediate. 1,1-Dichloroethane was detected in two shallow groundwater samples. A low Koc value indicates it will not readily adsorb to soil. Based on this fact and relatively high vapor pressure and Henry's Law constant, 1,1-dichloroethane would not be expected to be present in the soil/sediment at Gratwick Riverside Park.

1,1-Dichloroethane is moderately toxic by ingestion and has caused liver damage in experimental animals. It is an experimental teratogen and tumorigen (SAX, 1987) and can be narcotic in high concentrations. This compound is a dangerous fire hazard and when heated, can decompose to highly toxic fumes of phosgene.

Chloroform: Chloroform is a highly refractive, nonflammable, colorless liquid with an ethereal odor. This compound is used as a solvent for fats, oils, rubber, resins, and as a cleansing agent. Chloroform is moderately soluble in water and has high vapor pressure and Henry's Law constant values indicating this compounds is very volatile. It also has an intermediate organic carbon partition coefficient value. Chloroform was detected in some samples from all the environmental media, except the groundwater samples collected from the bedrock.

Inhalation of large doses of chloroform may cause respiratory and myocardial depression and death. It is a suspected human carcinogen. It is moderately toxic by intraperitoneal and subcutaneous routes (SAX, 1987). Chloroform had been widely used as an anesthetic, but not any longer. It is a poison by ingestion; effects the human central nervous system and systemic effects. When chloroform is heated to decomposition, it emits toxic chloride fumes.

2-Butanone (Methyl Ethyl Ketone): This compound is a colorless flammable liquid with an acetone-like odor. It is used as a solvent in the manufacturing of smokeless powder and in the surface coating industry. 2-Butanone has a very low organic carbon partition coefficient, a moderate vapor pressure and is relatively soluble in water. This compounds would be expected to leach out of the soil into the groundwater. 2-Butanone was present in most samples from all environmental media (i.e. soil and groundwater).

2-Butanone is moderately toxic by ingestion and dermal routes. This compound may cause fetal death or birth defects (experimental teratogen). It affects the peripheral and central nervous systems. 2-Butanone is a dangerous fire hazard when exposed to heat or flame (SAX, 1987).

Chlorobenzene: Chlorobenzene is a colorless liquid with a faint pleasant odor. It is used in the manufacturing of phenol, aniline, DDT, and as solvent for paints. This compound was detected in one shallow groundwater and one shoreline soil sample at Gratwick Riverside Park. It is insoluble in water, and has a low adsorption potential toward the organic carbon in soil indicating a faster leaching from soil into the aquifer. The value of Henry's Law constant suggests that volatilization of chlorobenzene would be significant from all bodies of water (Henry, 1989).

Chlorobenzene is a strong narcotic with slight irritant qualities. It is moderately toxic by ingestion. Prolonged exposure to chlorobenzene may cause kidney and liver damage. Also somnolence; cyanosis; deep, rapid respirations; and a small, irregular pulse are the chief symptoms occurring in acute exposures (SAX, 1987).

Tetrachloroethene: Tetrachloroethene is a colorless liquid with an ether-like odor. Uses of tetrachloroethene include: a dry cleaning solvent, a drying agent for metals, a heat transfer fluid, and in the manufacture of fluorocarbons. Tetrachloroethene has a lower vapor pressure and solubility in water than the other two chlorinated hydrocarbon indicator chemicals and a comparable Koc value. However, like trichloroethene and 1,1-dichloroethane, it should be expected to leach readily through soil into the groundwater. Its rate of biodegradation is presumed to be quite low (USEPA's Health Effects Assessment); the dominant loss mechanism from surface water is through evaporization. Tetrachloroethene has been found in some shallow groundwater, surface soil, and one soil boring sample collected at Gratwick Riverside Park.

Tetrachloroethene is moderately toxic by the inhalation, ingestion, and skin contact routes of exposure. Chronic exposures to this chemical can cause irritation of the respiratory tract (including bronchitis), nausea, headache, sleeplessness, abdominal pains, constipation, dizziness, increased perspiration, fatigue, skin infection, kidney and liver damage, fluid in the lungs, and coma. Most of these effects will reverse after exposure is stopped. Tetrachloroethene is considered to be a potential carcinogen (USEPA, 1984g). The chemical has caused cancer and birth defects in mice.

Polychlorinated-dibenzofurans (PCDFs): Polychlorinated-dibenzofurans (PCDFs) were detected in three shoreline soil samples at Gratwick Riverside Park. PCDFs are similarly toxic and closely related substances to dioxin. PCDFs are nearly insoluble in water, they are slightly more soluble in fats and have been isolated in fatty tissues of persons and animals who have suffered chronic exposure. PCDFs will adsorb tightly to particulate matter such as charcoal and soil, and even in very porous soil, no significant leaching has ever been detected. PCDFs are not easily degraded by microorganisms. The rate of removal from soil depends upon the concentration of PCDFs present, the climate, the soil type, and the numbers and species of microorganisms present. PCDFs can be degraded by either natural or artificial ultraviolet light if they are first dissolved in a suitable solvent such as herbicides. Polychlorinated biphenyls (PCBs) exhibit fairly high levels of furan (PCDFs) contamination. The most abundant furans in PCBs are the 2,3,7,8-TCDF and 2,3,4,7,8-PentaCDF. Scientists at the Dow Chemical Company have concluded that dioxin is an ubiquitous, "natural" substance that occurs as a trace component of fire . (It should be noted that the EPA disputes this claim.) Various chlorinated dibenzo-furans were found in the greatest concentrations in samples collected from municipal incinerators, chemical tar burners, fossil fuel power plants, vehicle mufflers, fireplaces, chimneys, cigarette smoke, and char-broiled steaks.

Researchers believe that PCDFs may be responsible for a number of pathological conditions in humans, including liver disease and immune system disfunction, but there is no conclusive evidence. PCDFs have caused a variety of problems in laboratory animals, which vary from species to species, and more research must be done before it can be determined with certainty the severity of the health threat to humans. PCDFs tend to accumulate in the liver of mammals, but the amount varies from species to species. The most common clinical problem associated with human dioxin exposure is a condition called chloracne. The condition is not considered a serious disease, but the psychological effects can be devastating. The most severe health effect that has been linked to dioxin exposure is the development of soft tissue sarcomas (STS). These are rare forms of cancer that affect connective tissue other than bone (Legislative Commission on Toxic Substances and Hazardous Wastes, March 1987).

Polynuclear Aromatic Hydrocarbons (PAHs): PAHs are a class of compounds that are formed during the incomplete combustion or pyrolysis of organic materials containing carbon and hydrogen. PAHs were found at Gratwick Riverside Park primarily in soil samples. The predominant mechanism for the removal of PAHs from soils is likely to be microbial degradation. Considering the soil sorption coefficient and water solubilities, these compounds are not expected to have high mobility in soils. Therefore, significant leaching of these compounds into groundwater is not expected, particularly from soils with higher organic carbon content (HEA, 1984).

The major issue of the PAH risk assessment is the potential carcinogenicity of these compounds. Many of the PAHs are still inadequately characterized in terms of the carcinogenic potential. PAHs are grouped into two (2) categories for the purpose of this report as evaluated by IARC (1983). Noncarcinogenic compounds detected at Gratwick Riverside Park and reported in this group are naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, pyrene, benzo(g,h,i)perylene, anthracene, and fluoranthene. Carcinogenic compounds found at the site include benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno (1,2,3-cd)pyrene, and dibenz(a,h)anthracene. These categories were developed by IARC based on sufficient animal evidence or limited human evidence. USEPA's Health Effects Assessments for PAHs state that data indicate benzo(a)pyrene is one of the most potent carcinogens of PAHs tested. It is suggested that the cumulative exposures to mixtures containing PAH concentrations may result in a risk that is less than that predicted for benzo(a)pyrene alone.

Antimony: Antimony is a silver-white, lustrous, hard, brittle metal. It does not tarnish by dry air and only slowly in moist air. Among the predominant uses of antimony in non-metal products are flameproof textiles, paints and lacquers, rubber compounds, and certain types of matches. It is insoluble in water and has a very low vapor pressure. Antimony was detected in two shoreline soil samples only.

Symptoms of acute antimony poisoning include weight loss, loss of hair, and dry, scaly appearance of the skin. Most antimony compounds are poisonous by ingestion, inhalation and intraperitoneal routes (Sax, 1987).

Cadmium: Cadmium is a silver-white, blue tinged, lustrous metal which is easily cut with a knife and is available in the form of bars, sheets of wire or a gray, granular powder. Cadmium is slowly oxidized by most air. It is insoluble in water. Cadmium does not occur naturally, instead it is derived from smelting of zinc, lead and copper ores. Cadmium was detected in one shallow groundwater well, surface soil, and shoreline soil samples.

Cadmium and cadmium compounds are a poison by ingestion, however, the irritating and emetic action is so violent that little of the cadmium has time to be absorbed, and fatal poisoning rarely occurs. Cases of human poisoning have been reported from ingestion of food or beverages prepared or stored in cadmium-plated containers. Inhalation of fumes or dusts affects the respiratory tract and the kidneys. Brief exposure to high concentrations may result in pulmonary edema and death (Sax, 1987).

Mercury: Mercury is found in rocks of all classes as mercury ore. It is a silver-white, heavy, mobile, liquid metal which is slightly volatile at ordinary temperatures. Mercury was detected in soil boring (GW4-8-12'), surface soils, shoreline soil, and in three (3) water samples from the upper aquifer. This metal has a low vapor pressure and is insoluble in water.

Metallic mercury as well as inorganic compounds are highly toxic by ingestion, inhalation, and skin absorption. Most organic compounds of mercury can be converted to methylmercury by bacteria in water. Acute toxicity of soluble salts of mercury have a violent corrosive effect on skin, mucous membrane; also causes severe nausea, vomiting, abdominal pain, kidney damage, and death usually within 10 days. Chronic poisoning results in inflammation of mouth and gums, kidney damage, personality changes, depression, instability and nervousness.

Benzene: Benzene is a clear, colorless, highly flammable liquid with a characteristic aromatic odor. Benzene has a relatively low solubility in water as well as a low organic carbon partition coefficient, indicating it is relatively mobile in soil media. It would be expected to find its way slowly into the groundwater. The half-life of benzene in surface water is estimated to be six (6) days at high concentrations. Benzene was detected in four shallow groundwater samples and two soil borings from monitoring well GW-3.

Benzene is a poison by intravenous route and is moderately toxic by inhalation, ingestion, and subcutaneous routes (Sax, 1987). It is a strong eye and mild skin irritant. Acute benzene poisoning from ingestion and inhalation results in the irritation of mucous membranes, restlessness, convulsions, excitement, depression. Death may follow from respiratory failure. The central nervous system and blood system are effected by inhalation and ingestion of benzene.

Phenol: Phenol is a white, crystalline solid which turns pink or red if it is not perfectly pure. Phenol has a distinctive odor and is described as having a burning taste. When exposed to air, phenol will absorb water from air and liquify. Phenol was found in water samples from the upper aquifer and two shoreline soil samples at Gratwick Riverside Park. Phenol is very soluble in water and has a low organic carbon partition coefficient, indicating it would leach relatively quickly into groundwater.

Phenol is described as a poison by ingestion and moderately toxic by skin contact (Sax, 1987). It is a severe skin and eye irritant. Acute phenol poisoning affects the central nervous system. Death has resulted from absorption of phenol (through a skin area of 64 square inches and from the ingestion of as little as 1.5 grams). Chronic poisoning, following prolonged exposures by any route, may result in digestive disturbances, nervous disorders, and skin symptoms. Chronic poisoning can also cause extensive damage to the kidneys or liver which may result in death.

<u>Trichloroethene</u>: Trichloroethene (TCE) is a nonflammable, mobile liquid with a characteristic odor of chloroform. TCE has a relatively low solubility in water as well as a low organic partition coefficient, indicating it is relatively mobile in soil media. TCE would be expected to find its way slowly into the groundwater. Trichloroethene slowly decomposes in the presence of moisture and when exposed to light. TCE was detected in some shallow groundwater, shoreline soil and shallow soil samples at Gratwick Riverside Park. The loss of TCE is primarily a result of vaporization from the water (ground and/or surface).

Trichloroethene is a poison by inhalation, intravenous and subcutaneous routes. It is an experimental teratogen, carcinogen, and tumorigen. TCE is a strong skin and eye irritant. Inhalation of high concentrations causes narcosis and anesthesia. Moderate exposure results in similar symptoms to alcohol inebriation. Fatalities following severe, acute exposure have been attributed to ventricular fibrillation resulting in cardiac failure. There is damage to the liver and other organs from chronic exposure (SAX, 1987).

Polychlorinated Biphenyl (Aroclor 1242): PCBs are colorless liquids which have been used extensively as heat exchange and insulating fluids. PCB-Aroclor 1242 was a commercially available blend of biphenyls on which two, three, four, and five chlorine atoms had been substituted for hydrogen atoms. PCB-Aroclor 1242 was found in one surficial soil sample collected at Gratwick Riverside Park. Aroclor 1242 has a low solubility in water, a very low vapor pressure, and high log Koc value. These physical properties make Aroclor 1242 relatively immobile in the environment.

PCBs in general have two distinct actions on the body. They cause skin lesions known as chloracne, and they have toxic effects on the liver. PCBs are readily absorbed into the body by all routes of exposure and they may persist in tissues for years after exposure stops. Aroclor 1242 is a poison by subcutaneous route. It is a suspected human carcinogen and moderately toxic by ingestion. Human systemic instant effects are by inhalation (Sax, 1987). PCBs may cause liver damage, digestive disturbances, or impair the functioning of the immune system.

Polychlorinated Biphenyl (Aroclor 1260): This compound is composed of 12% - penta -, 38% hexa-, 41% hepta- 8% octa-, chlorinated biphenyls. PCBs are colorless, highly toxic liquids which have been used extensively as heat exchange and insulating fluids. Aroclor 1260 was found in one surficial soil sample at Gratwick Riverside Park. This compound has a very low solubility in water, a very low vapor pressure, and a high organic carbon partition coefficient indicating tight bonding of this compound to the soil, and it is unlikely to leach into the groundwater.

Aroclor 1260 is a suspected human carcinogen. It is moderately toxic by ingestion and skin contact. PCBs in general have two distinct actions on the body. They cause skin lesions known as chloracne, and they have toxic effects on the liver. PCBs may also cause kidney damage, digestive disturbances, or impair the functioning of the immune system.

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