

# **POST-REMEDIAL ACTION CONSTRUCTION GROUNDWATER MONITORING PROGRAM**

**Gratwick-Riverside Park Site  
North Tonawanda, New York**

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## 1.0 INTRODUCTION

Section 14.1 of the Preliminary (30%) Design Report for the Gratwick-Riverside Park Site (Site) requires that a groundwater monitoring program be established to monitor the effectiveness of the overburden groundwater withdrawal system. The objective of the monitoring program is to provide data for the demonstration of hydraulic containment, collection, and withdrawal of overburden groundwater with Site-related chemical presence.

The groundwater monitoring program described below will be conducted for a period of 5 years after completion of construction. After the initial 5-year period, an assessment of the groundwater monitoring program will be performed to determine the suitability of the monitoring program and the need for modification. The program will be assessed every five years until groundwater quality monitoring is no longer required.

The groundwater monitoring program also includes protocols to monitor the effluent from the Site to ensure that the discharge requirements of the City of North Tonawanda Publicly Owned Treatment Works (POTW) permit are met.

## 2.0 HYDRAULIC MONITORING PROGRAM

The purpose of the Hydraulic Monitoring Program is to monitor:

- i) the achievement and maintenance of an inward gradient from the Niagara River to the groundwater withdrawal system; and
- ii) the achievement of an upward gradient from the fill/alluvium layer beneath the groundwater withdrawal system.

The water levels in the withdrawal system and in the Niagara River will be monitored to show an inward gradient. The water levels in the withdrawal system and in monitoring wells located in close proximity to the withdrawal system alignment in the materials directly overlying the confining unit will be monitored to confirm that an upward gradient exists.

## 2.1 MONITORING FREQUENCY

Changes in the groundwater levels in the vicinity of the groundwater withdrawal system will occur relatively quickly at the beginning of groundwater removal and then achieve a relatively stabilized state after the initial period of time. Thus, the following frequency for both the upward and inward gradient components of the groundwater level monitoring program will be used:

<i>Years after RA Construction</i>	<i>Frequency</i>
0 to 1	Monthly
2 to 3	Quarterly
4 to 5	Semi-annually

## 2.2 MONITORING LOCATIONS

### 2.2.1 Inward Gradient Component

The groundwater withdrawal system consists of a perforated HDPE pipe and manholes. Monitoring of only a few manholes is necessary to determine if the system is operating properly because the system is operated as a submerged system and the hydraulic head loss will be relatively constant along the length of the system providing a relatively smooth hydraulic head profile. Thus, the following manholes will be monitored at the frequencies specified in Section 2.1; MH1, MH11, and MH18 (see Figures 2.1 and 2.2). In addition, the wet well and the Niagara River water levels also will be monitored.

If the above monitoring shows a discontinuity in the hydraulic head profile, water levels in additional manholes upstream and downstream of the discontinuity will be measured to determine which segment of the groundwater system is not performing properly and the appropriate maintenance will be performed.

### 2.2.2 Upward Gradient Component

Hydraulic monitoring to show an upward gradient from the fill materials in the area beneath the withdrawal system is only necessary where the bottom of the system does not extend to within  $3\pm$  feet of the top of the confining unit. The distance of  $3\pm$  feet was selected because it is believed that proper monitoring for an upward gradient from the lower fill to the withdrawal system would require the installation of monitoring wells which monitor only a small thickness of the fill/alluvium (i.e., one to two feet) which directly overlies the confining unit. Based on the thickness of the interval monitored by the well, it does not make sense to install a well where the monitored thickness essentially covers the distance between the top of the confining layer and the bottom of the withdrawal system trench. The areas where the thickness of fill/alluvium beneath the bottom of the withdrawal system trench is on the order of 3 feet or greater is approximately from Station 109+50 to 112+00 and Station 121+50 to 151+00 (see Figures 2.3 and 2.4).

Monitoring will be performed at the locations shown on Figures 2.1 and 2.2. Four locations are sufficient to monitor the upward gradient based on the relatively smooth hydraulic head profile which will exist in the withdrawal system. Hydraulic monitoring at each location will be performed at a well and in an adjacent withdrawal system manhole.

The installation details of existing overburden wells in the vicinity of the withdrawal system alignment which would be on the landward side of the barrier wall are shown in Table 2.1. Wells GW-6S, PW-1, PW-2, MW-1, MW-2, MW-5SR are set at a depth where the bottom of the monitored intervals is near the top of the confining unit. However, the intervals monitored by the wells are too large (i.e., on the order of 8.5 to 13 feet in length) and thus are not appropriate for upward hydraulic gradient monitoring wells. Wells GW-5I and GW-6I are installed in the confining unit and thus are too deep. Therefore, no existing well is appropriate for upward hydraulic gradient monitoring and wells will need to be installed. In any event, the wells would need to be close enough to the withdrawal system to properly monitor the hydraulic effect and as a result, if an appropriate well did exist, it probably would not survive during the barrier wall construction, consequently new wells will be required. Typical installation details of the proposed upward hydraulic gradient monitoring wells are shown on Figure 2.5. These wells will also be used for the chemical monitoring described in Section 3.2.

### 3.0 CHEMICAL MONITORING PROGRAM

The purpose of the groundwater chemical monitoring program is to monitor the quality of the overburden groundwater:

- i) between the barrier wall and the Niagara River;
- ii) in the fill/alluvium beneath the groundwater withdrawal system; and
- iii) being discharged to the City POTW for treatment.

Monitoring of the overburden groundwater quality within the Site is not necessary to demonstrate the effectiveness of the Remedial Action in preventing chemical migration to the River.

#### 3.1 OVERBURDEN GROUNDWATER BETWEEN THE BARRIER WALL AND THE NIAGARA RIVER

The maintenance of an inward gradient from the Niagara River to the groundwater withdrawal system prevents Site chemicals from migrating through the barrier wall to the River. Thus, the chemical concentrations in the groundwater between the barrier wall and the River should reduce with time.

##### 3.1.1 Sampling Locations

Overburden groundwater samples will be collected from four overburden wells installed along the Niagara River at the locations shown on Figures 2.1 and 2.2. The base of the wells will be installed to the top of the confining unit. Typical monitoring well details are shown on Figure 2.6.

##### 3.1.2 Sampling Frequency

Changes in groundwater concentrations at sites where groundwater removal is a component of the remedy occur relatively slowly, and



therefore sampling frequency is adequately measured by semi-annual to annual sampling. The proposed frequency for this Site is as follows:

<i>Years after RA Construction</i>	<i>Frequency</i>
0 to 3	Semi-Annually
4 to 5	Annually

### 3.1.3 Site-Specific Parameter List (SSPL)

The historical Site data collected from overburden groundwater samples are sufficient to determine a SSPL for this Site. The RI and 48-hour pumping test analytical results were reviewed and the compounds detected are listed in Table 3.1. Samples collected during the RI and pumping tests were analyzed for Target Compound List (TCL) volatile and semi-volatile compounds, pesticides and PCBs, and Target Analyte List (TAL) metals. Table 3.2 presents a summary of the detected compounds and lists each detected compound, the number of times analyzed, the number of samples in which the compound was detected, the number of sample locations where the parameter was detected, and the associated minimum and maximum concentrations.

The first step in determining the SSPL was to identify the chemical compound groups (e.g., VOCs, SVOCs, PAHs, etc.), which could be used to show the long-term cleanup of the Site groundwater. This objective would require both chemicals which migrate relatively quickly (i.e., those that migrate at or near the speed of groundwater flow), and those that migrate slower due to adsorption/desorption processes.

Compounds with higher solubilities and lower soil adsorption coefficients (i.e.,  $K_{oc}$ ) are more mobile than those with lower solubilities and higher  $K_{oc}$ . The solubility and  $K_{oc}$  values listed in Table 3.2, show that the VOC and SVOC compound groups contain compounds which cover the range of mobility. Because the range of mobility is covered by the VOCs and

SVOCs, it is not necessary to monitor the metals to show compliance with the RA objectives. Thus, the metals will not be included in the SSPL.

The next step in determining the SSPL was to identify which VOC and SVOC compounds were detected at concentrations exceeding Class GA (potable water) levels. Compounds not exceeding Class GA levels need not be analyzed to ensure that the RA objectives have been met. Compounds for which a Class GA level was not available were not included in the SSPL.

Next, the frequency of occurrence of VOCs and SVOCs at the Site was evaluated. Parameters that were detected in 10 percent or more of the samples were considered significant and included on the SSPL.

In general, the majority of the parameters that were included in the SSPL due to the frequency of detection, also exhibited elevated concentrations for most of the samples. There were some parameters detected in less than 10 percent of the samples which were detected at concentrations greater than Class GA levels (i.e., 1,2-dichloroethane, 1,1,1-trichloroethane, and styrene). All of these compounds were detected in only one sample, except for styrene which was detected in two samples at concentrations of 4 and 7 µg/L (the Class GA level is 5 µg/L). Monitoring of these compounds is not needed to monitor compliance with the RA objectives.

Based on the above mentioned procedure, the proposed SSPL is presented in Table 3.3.

### 3.2 AREA BENEATH GROUNDWATER WITHDRAWAL SYSTEM

The pumping of groundwater from the Site fill is expected to slowly reduce the overburden groundwater chemical concentrations with time by flushing the chemicals from the fill and treating the collected groundwater at the POTW. The rate of reduction in chemical concentrations in the fill/alluvium beneath the groundwater withdrawal system will be monitored by the chemical monitoring described below.

### 3.2.1 Sampling Location

Overburden groundwater samples will be collected from the four overburden wells (MW-6, MW-7, MW-8, and MW-9) shown on Figures 2.1 and 2.2.

### 3.2.2 Sampling Frequency

The wells will be completed at the frequency described in Section 3.1.2.

### 3.2.3 Analytical Parameters

The samples will be analyzed for the SSPL described in Section 3.1.3.

## 3.3 DISCHARGE TO POTW

Monitoring of the discharge will be performed to ensure that the discharge requirements of the POTW permit are met and to allow evaluation of the trend in Site overburden groundwater concentrations with time. Monitoring of the discharge to the POTW will be sufficient to show compliance with the RA objective of reducing chemical concentrations in the on-Site groundwater in order to achieve groundwater standards.

### 3.3.1 Sampling Location

Samples of the extracted groundwater will be collected from a sampling port in the forcemain which discharges to the City sanitary sewer.

### 3.3.2 Sampling Frequency

The sampling frequency will be pursuant to the City's permit, the scope of which is currently being determined.

### 3.3.3 Analytical Parameters

The analytical parameters will be those required by the City's permit, the scope of which is currently being determined.

## 3.4 SAMPLING PROCEDURES

Sampling will follow the procedures described in the Field Operations Plan (FOP) [Appendix A of the Remedial Design Work Plan (RDWP) dated June 1996] with the following additions which were not specified in the FOP.

### 3.4.1 Monitoring Well Purging

The following procedures will be used to purge monitoring wells prior to sampling.

1. All personnel involved in purging or sampling must wear protective clothing as specified in the Health and Safety Plan (HASP) (Appendix C of the RDWP).
2. Inspect the well. Determine if the cap and lock are secure or if they have been tampered with. If the well is unlocked, replace the lock. Note any cracks in the protective casing and/or surface seal as well as any subsidence in the vicinity of the well. Note the results of the inspection even if the well is in perfect condition.

3. Measure the water level in the well to an accuracy of within  $\pm 0.01$  foot prior to purging. Compare these results to previous water level measurements to ensure that the correct well is being purged for sampling. Record the water level.
4. The objective of purging is to extract a sufficient volume of water prior to sampling to ensure that the sample is representative of the actual groundwater conditions.

Remove a minimum of three well volumes of water when possible. A 2-inch diameter well contains 0.16 gallons of water per foot of casing below the water level. After each well volume is removed, collect and field analyze a purge water sample for temperature, pH, conductivity, and turbidity. Calibrate field instruments as described in the Quality Assurance Project Plan (QAPP) (Appendix B of the RDWP) prior to analysis. Record all readings. Continue purging until a maximum of five well volumes have been removed or until three consecutive, consistent readings of conductivity, temperature, and pH are obtained and the turbidity is less than 50 NTU. Conductivity, temperature, and pH readings are consistent if conductivity and temperature readings are within 10 percent of the average value or pH readings are within  $\pm 1$  pH unit of the average value. If the above criteria have not been met after the maximum five well volumes have been removed, a decision will be made by the DEC and the sampling personnel regarding sampling of the well. Record the number of well volumes required to purge the well.

5. If recharge is insufficient to conduct the purging protocols described in Step 4 above, the well will be pumped/bailed to dryness on three consecutive days prior to sampling.
6. Acceptable equipment for water extraction during purging includes bailers, peristaltic pumps, bladder pumps, Waterra™ pumps, centrifugal, and submersible pumps.

7. Clean all water extraction equipment and field instruments (including the water level measuring device) prior to use at each new location in accordance with the protocols described in Section 3.6.
8. Collect and store all purge waters for later disposal as described in Section 5.0.

#### 3.4.2 Monitoring Well Sampling

Following well purging, carry out sampling of the monitoring well according to the following protocols:

1. Collect samples as soon after purging as possible.
2. Use a new pair of disposable nitrile gloves for sampling each well. Undertake additional glove changes as conditions warrant.
3. Collect samples from the monitoring well using either a bottom filling bailer with a stainless steel leader attached to a nylon or polypropylene rope or using a suitable sample pump. Use sampling bailers constructed of either Teflon or stainless steel and use a new length of rope at each well. Suitable sampling pumps include peristaltic pumps (for the semi-volatiles) and bladder pumps. If peristaltic pumps are used, collect the volatile portion using a bottom loading bailer prior to collection of the sample portion for the remaining parameters.
4. Prior to use at each new sampling location, clean the bailer or pump as described in Section 3.6.
5. Collect a sufficient volume of groundwater for chemical analysis. Collect all required QA/QC samples as described in the FOP.
6. Label sample containers and maintain a hard-cover, bound field book to record all groundwater samples and sampling events as described in the QAPP.

7. Clean all field equipment and instruments at the conclusion of sampling in accordance with the protocols described in Section 3.6.

### 3.5 QA/QC PROCEDURES

QA/QC will follow the procedures described in the QAPP.

### 3.6 SAMPLE COLLECTION EQUIPMENT CLEANING PROTOCOLS

Clean all equipment used for the collection of samples for chemical analysis including bailers and pumps according to the following protocol:

- i) wash and scrub with low phosphate detergent;
- ii) rinse with tap water;
- iii) rinse with tap water;
- iv) rinse with methanol followed by hexane (solvents must be pesticide grade or better);
- v) rinse thoroughly with deionized demonstrated-analyte-free water supplied by the lab. The volume of water used must at least be five times the volume of solvent used in the above step;
- vi) air dry; and
- vii) wrap in aluminum foil.

Dedicated sampling equipment which is left in the well will be either precleaned by the manufacturer or cleaned prior to its first use. Dedicated equipment will not require cleaning between sampling rounds unless the equipment becomes unsafe to handle. The use of dedicated equipment will result in the generation of only minimal volumes of spent solvent and thus is preferred.

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

Place all cleaned equipment on clean polyethylene sheeting or aluminum foil in order to avoid contacting a contaminated surface before use.

Before use and between each well, clean the water level measuring device, pH meter, conductivity meter, thermometer, and turbidity meter (nephelometer) by rinsing with detergent solution followed by a deionized water rinse. Solvent rinses must not be used because of their potential to damage the instruments.

Treat/dispose the water washes and spent cleaning solvents using the procedures presented in Section 5.0.



#### 4.0 HEALTH AND SAFETY

Health and Safety will follow the procedures described in the Health and Safety Plan (HASP) (Appendix C of the RDWP).

## 5.0 HANDLING OF MATERIALS GENERATED DURING GROUNDWATER MONITORING

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Personal Protective Equipment (PPE) and sampling refuse (i.e., paper towels, used tin foil) generated during the sampling activities will be placed in clear plastic bags and disposed at a sanitary landfill.

All groundwater and withdrawal system effluent extracted during monitoring activities will be discharged to the wet well of the overburden groundwater withdrawal system. The volume of spent solvents generated during sampling activities will be very small based on the use of dedicated sampling equipment. This small volume will be discharged to the groundwater withdrawal system wet well for treatment at the POTW.

## 6.0 EVALUATION OF MONITORING RESULTS

Upon receipt of groundwater and discharge analytical results, including the QA/QC review, the results will be evaluated to determine if they are acceptable for use in the respective monitoring programs. All data deemed to be acceptable, including QA/QC results, will be entered into a computer database. Raw data packages resulting from groundwater monitoring will be sent to the DEC for QA review within 30 days of completion of internal QA/QC validation (upon request).

Raw data packages resulting from effluent monitoring will be sent to the City of North Tonawanda for QA review within 30 days of completion of internal QA/QC validation (upon request).

The procedures for evaluating analytical data resulting from Site monitoring activities are detailed in the QAPP.

The computer database will provide summary tables of the analyses, including a separate listing of QA/QC results. The summarized data will be used to evaluate the performance of the remedy. As additional data are generated, graphic representations of concentrations versus time will be prepared to show temporal variations in groundwater and effluent chemical concentrations.

Hydraulic data will be converted to elevations and entered into a computer database. The water level data will be listed in tabular form for each round of data collected.

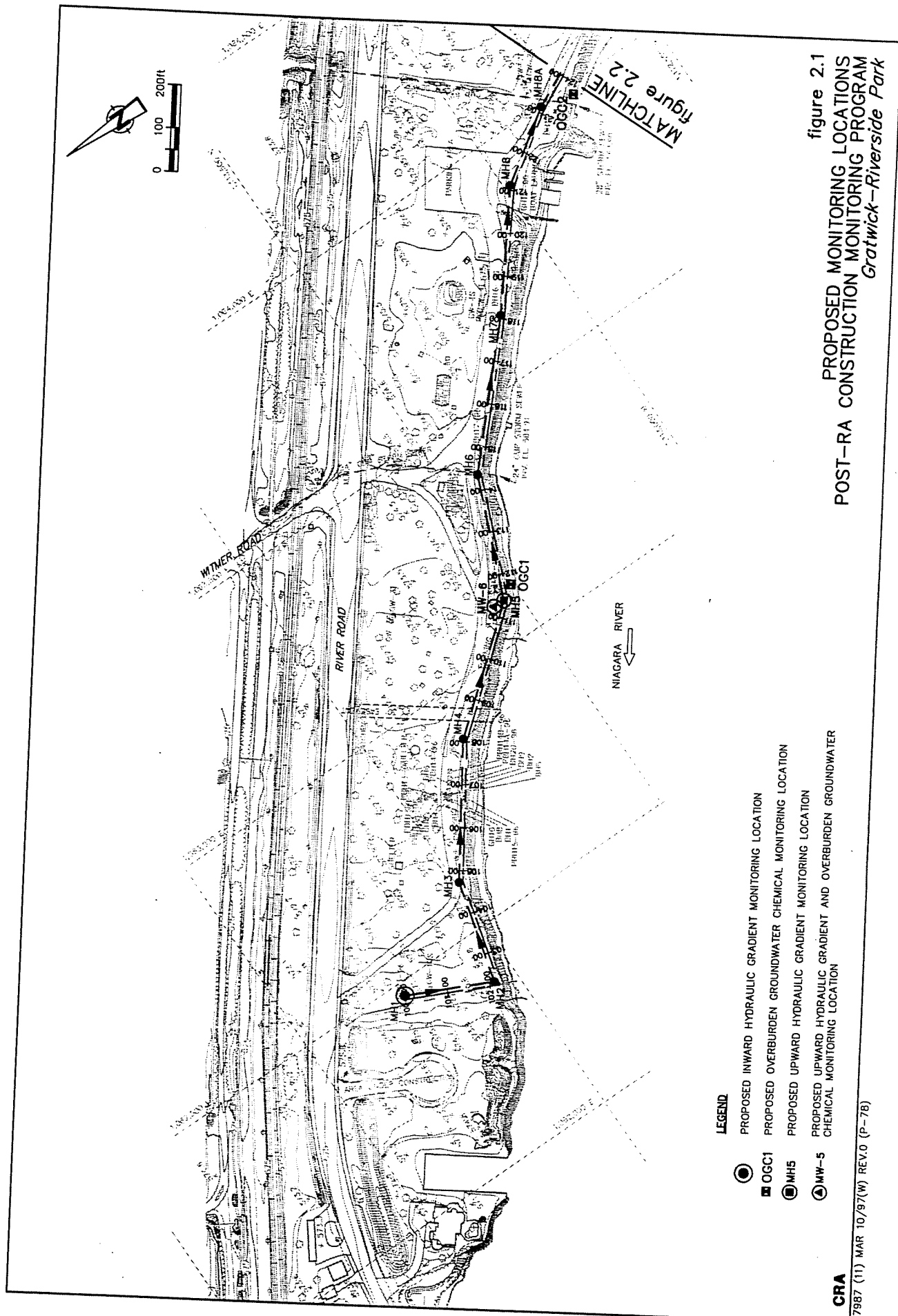
The evaluation of the hydraulic and water quality data will be used to determine if corrective contingency measures are required and when the system operations can be terminated.

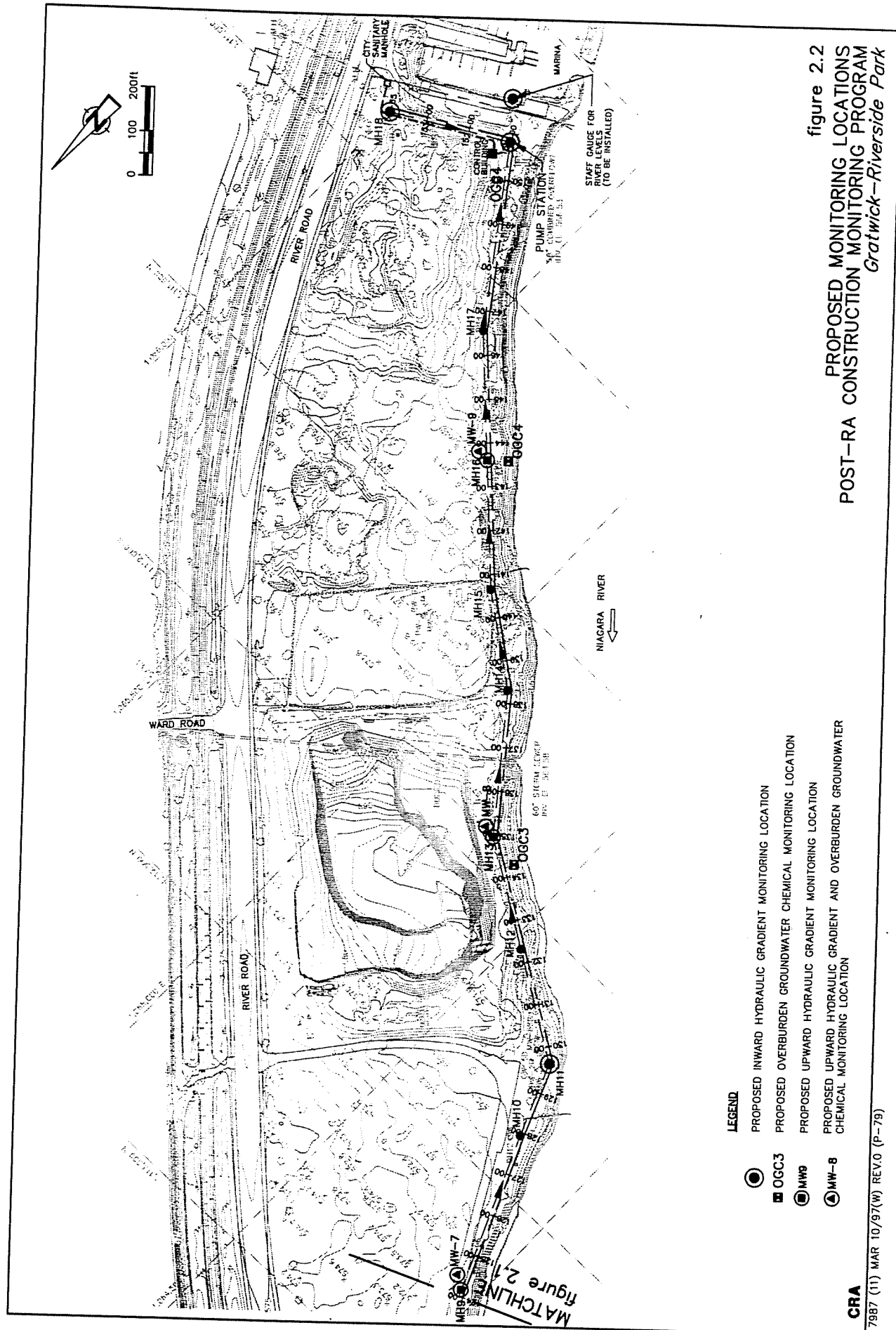
## 7.0 RECORDS AND REPORTS

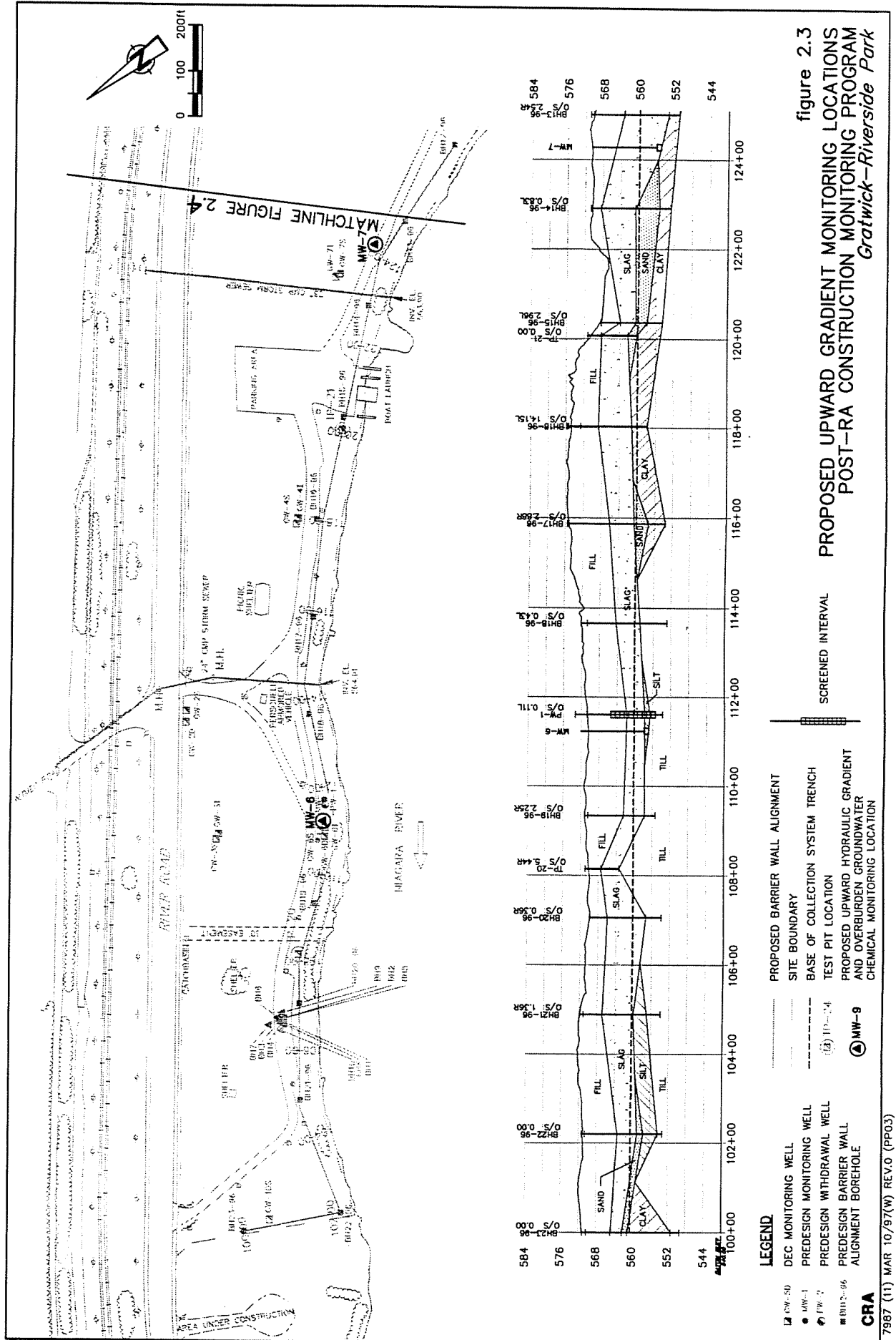
All field notes, field books, and completed forms will be stored at the POTW. A copy of all chains of custody, shipping manifests for analytical samples, and analytical results also will be stored there.

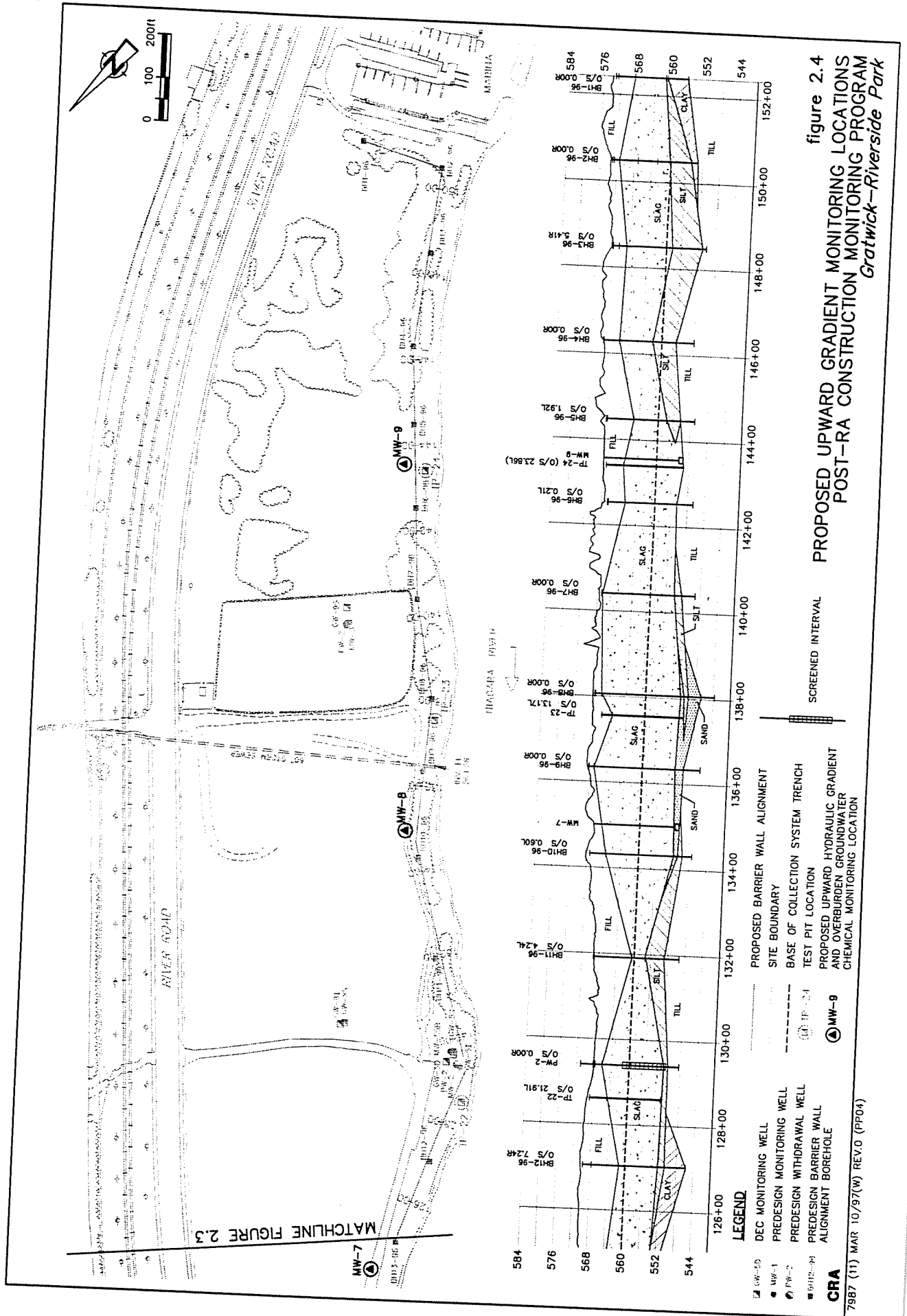
Monitoring reports will be submitted on a semi-annual basis to the DEC for the first three years and annually thereafter. These monitoring reports will include:

- i) analytical results and appropriate QA/QC data;
- ii) hydraulic monitoring data;
- iii) an evaluation of the effectiveness of the collection systems, including tables and figures generated; and
- iv) recommendations for program revisions or system revisions, if appropriate.











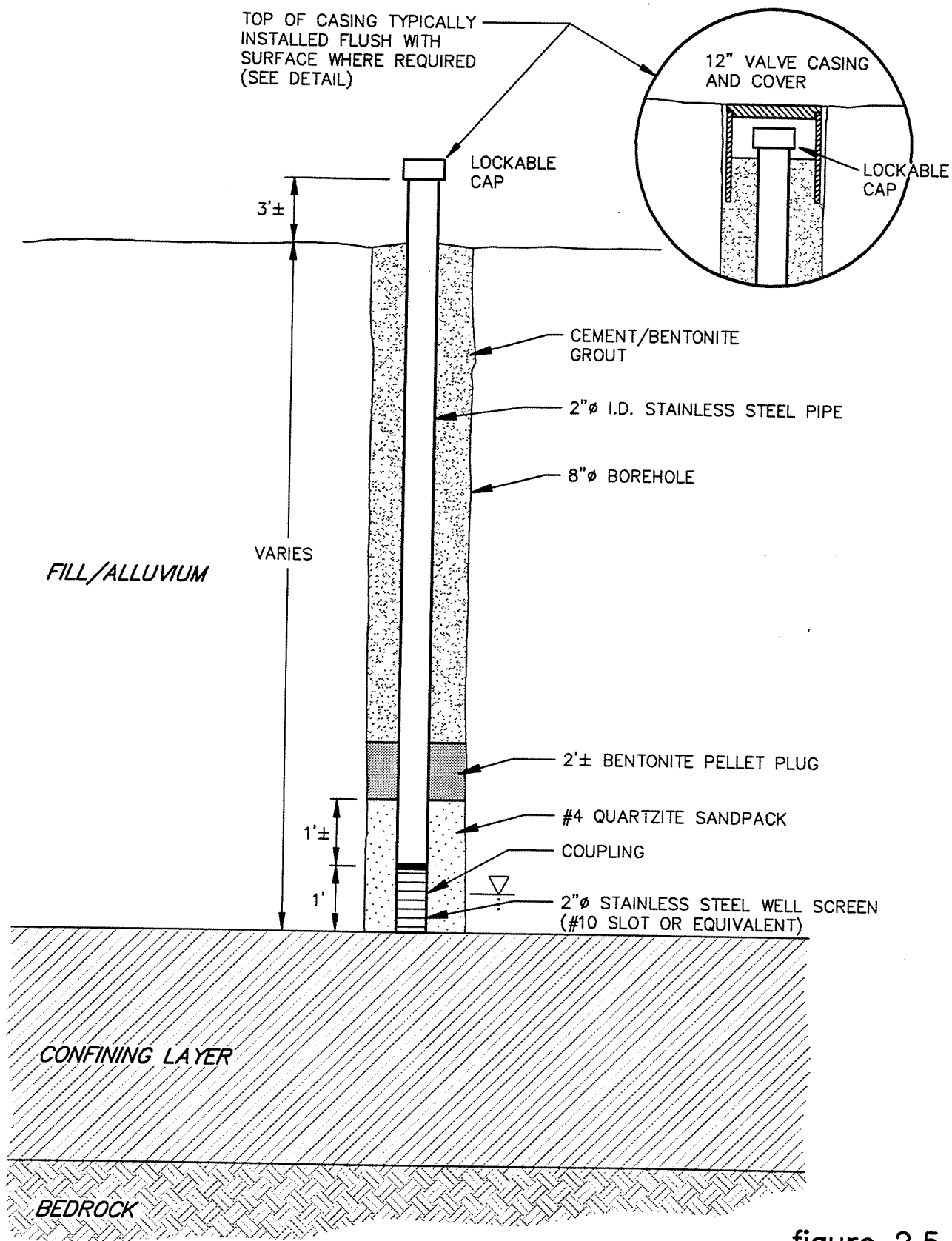


figure 2.5

TYPICAL UPWARD GRADIENT MONITORING WELL DETAIL  
POST-RA CONSTRUCTION MONITORING PROGRAM  
*Gratwick-Riverside Park*

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TABLE 2.1

SUMMARY OF INSTALLATION DETAILS  
FOR EXISTING OVERBURDEN WELLS ALONG THE  
PROPOSED GROUNDWATER WITHDRAWAL SYSTEM ALIGNMENT  
GRATWICK-RIVERSIDE PARK SITE

<i>Well</i>	<i>Monitored Interval (ft bgs)</i>	<i>Top of Confining Layer (ft bgs)</i>	<i>Notes</i>
GW-5S	5.0 to 15.0	see GW-5I	damaged, replaced by MW-5SR
GW-5I	22.4 to 31.0	20.0	
GW-6S	6.0 to 15.0	see GW-6I	
GW-6I	25.0 to 28.0	15.5	
PW-1	4.5 to 17.5	14.3	
PW-2	4.8 to 17.5	17.5	
MW-1	5.0 to 16.0	15.1	
MW-2	5.0 to 18.0	see GW-5I	
MW-5SR	6.0 to 14.5	see GW-5I	

TABLE 3.1

SUMMARY OF COMPOUNDS DETECTED IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

Compound	Well:		GW-3S		GW-4S		GW-5S		GW-6S		GW-7S		GW-8S		GW-9S	
	Sample Date:	Dec-87	Aug-88	Dec-87	Aug-88	Dec-87	Aug-88	Dec-87	Aug-88	Dec-87	Aug-88	Dec-87	Aug-88	Dec-87	Aug-88	
Volatiles (µg/L)																
Vinyl Chloride			NS													
Chloroethane			NS				7	4	11			8				120
Methylene Chloride			NS									4				
Acetone	167		NS	202			1							15	43	
Carbon Disulfide			NS				293		684			163		340	1450	
1,1-Dichloroethene			NS									4				
1,1-Dichloroethane			NS													
trans-1,2-Dichloroethene			NS				25	18				32	320			
Chloroform			NS	3	2	2	180	89	58			142	350			1300
1,2-Dichloroethane			NS													
2-Butanone			NS													
1,1,1-Trichloroethane			NS													
Trichloroethene			NS	46	55		287	220	62			51	1300	75	170	
Benzene	1		NS				2		3			117	340			
4-Methyl-2-pentanone			NS									94	840	1190	2200	
Tetrachloroethene			NS					27				13	98			
Toluene	1		NS	5	6		11	7	43			22				930
Chlorobenzene			NS				75	49	16			89	370		420	81
Ethylbenzene			NS												31	35
Total Xylenes			NS				9	7	2			31	69		51	80
Styrene			NS				54	37	7			133	270		160	260
Semivolatiles (µg/L)																
Phenol	12		NS		NA		61	92	3			257	2800		660	280
2-Chlorophenol			NS		NA											1
2-Methylphenol	2		NS		NA		24	24	3			26	480		1500	340
4-Methylphenol	3		NS		NA		38		4			99	1200		180	160
1,4-Dichlorobenzene			NS		NA											7
1,3-Dichlorobenzene			NS		NA											
1,2-Dichlorobenzene			NS		NA											
Isophorone			NS		NA											
2,4-Dimethylphenol			NS		NA							2	30			4
1,2,4-Trichlorobenzene			NS		NA		10	11	5			34	610		40	50
Benzoic Acid			NS		NA											
Naphthalene	2		NS		NA											
2-Methylnaphthalene			NS		NA							20	30		5	5
Diethylphthalate			NS		NA							9	12		6	6
Di-n-butyl Phthalate	3		NS		NA		1									
Bis-(2-ethylhexyl)phthalate	6		NS	15	NA		3		4			14			2	
Di-n-octylphthalate			NS	9	NA		12		8			17			8	
n-Nitrosodiphenylamine			NS	22	NA		87		2			5			24	
			NS		NA											2

TABLE 3.1  
SUMMARY OF COMPOUNDS DETECTED IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

Metals (µg/L)													
Aluminum	548	NA	12400	NA	4540	4250	1240	36800	361000	39600	2440	92900	16300
Antimony		NA		NA									
Arsenic		NA	172	NA			7					14	
Barium	150	NA	373	NA	7130	7010	94	82	114	260	73	1060	297
Beryllium		NA		NA				4.6	40	3.6		13	
Cadmium		NA		NA				100	407				
Chromium	302000	NA	397000	NA	372000	412000	160000	593000	514000	374000	207000	648000	237000
Chromium		NA	18	NA				522000	1460	17		93	25
Cobalt		NA		NA				30	98			27	11
Copper		NA	36	NA					56	14	11	105	33
Iron	742	NA	7740	NA	120	142	1630	1763000	8900000	8500	1250	62200	13200
Lead		NA	31	NA			19	82	56	31		133	31
Magnesium	937	NA	101000	NA	212	143	684	89100	1670000	7920	874	41400	8920
Manganese	17	NA	1800	NA	43	19	37	56	204000	2030	221	4660	900
Mercury	0.81	NA		NA			0.37	0.33					
Nickel		NA		NA				242	827	19		92	30
Potassium	46600	NA	48600	NA	207000	241000	55200	6770	233000	21500	17600	28200	19700
Selenium		NA		NA									
Silver		NA		NA				33	74				
Sodium	605000	NA	45000	NA	156000	155000	122000	56200	1270000	296000	218000	189000	179000
Vanadium		NA		NA				447000	1950	11		57	11
Zinc	18	NA	199	NA		15	55	66	5980	67	19	375	100
Miscellaneous (µg/L)													
Cyanide	70000	NA		NA		NA							88

*Notes:*

NA - Not Analyzed  
 NS - Not Sampled  
 R - Data Rejected  
 Blank - Parameter not detected at or above  
 detection limit  
 (1) Total 1,2-Dichloroethene

TABLE 3.1

# SUMMARY OF COMPOUNDS DETECTED IN ON-SITE OVERBURDEN GROUNDWATER GRATWICK-RIVERSIDE PARK SITE

[illegible]

TABLE 3.1  
SUMMARY OF COMPOUNDS DETECTED IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

<i>Metals (µg/L)</i>													
Aluminum	8870	5160	446	NA	480	350	88	2000	580	420	660	120	140
Antimony				NA									40
Arsenic				NA	2	1	1	1					
Barium	279	196	102	NA	210	270	200	160	140	130	91	80	82
Beryllium				NA				0.5			0.2		
Cadmium				NA									
Calcium	258000	236000	125000	NA	110000	160000	130000	130000	140000	140000	150000	150000	160000
Chromium	33	39		NA									
Cobalt				NA									
Copper	40	30		NA	35	27	13	30		6		7	4
Iron	9980	6120	243	NA	2800	6600	4900	710	60	15	230	48	10
Lead	150	59		NA					2	6	35	7	58
Magnesium	5920	3430	226	NA	11000	16000	13000	480					8
Manganese	410	232	22	NA	150	180	120	85	10	2	270	1	2
Mercury				NA									
Nickel	22	26		NA									
Potassium	29800	29200	9010	NA	20000	31000	23000	18000	21000	23000	16000	15000	15000
Selenium				NA						72			
Silver				NA									
Sodium	158000	139000	96100	NA	57000	89000	66000	120000	120000	130000	120000	110000	8
Vanadium	13			NA	11	11	9	10	5	7			110000
Zinc	276	141		NA	70	49	37	24	4	5	2	6	4
<i>Miscellaneous (µg/L)</i>													
Cyanide		50000		NA									

## Notes:

NA - Not Analyzed

NS - Not Sampled

R - Data Rejected

Blank - Parameter not detected at or above  
detection limit

(1) Total 1,2-Dichloroethene

TABLE 3.2

NUMBER OF COMPOUNDS DETECTED AND  
CONCENTRATION RANGE IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

Compound	Number of Samples Analyzed (1)	Number of Samples Where Detected (1)	Number of Locations	Number of Locations Where Detected	Concentration Range (µg/L)		Class GA Level (µg/L)	Solubility (mg/L)	Koc (ml/g)
					Min	Max			
<i>Volatiles</i>									
Vinyl Chloride	26	8	12	5	ND	120	2	2670 (2)	57 (2)
Chloroethane	26	1	12	1	ND	4	5	5740 (3)	17 (3)
Methylene Chloride	26	5	12	5	ND	43	5	17000 (3)	10 (3)
Acetone	26	12	12	10	ND	1450	50	1000 (2)	2.2 (2)
Carbon Disulfide	26	2	12	2	ND	20	NA	2940 (2)	54 (2)
1,1-Dichloroethene	26	2	12	1	ND	1	5	2250 (2)	65 (2)
1,1-Dichloroethane	26	10	12	4	ND	320	5	5500 (2)	30 (2)
trans-1,2-Dichloroethene	26	18	12	9	ND	1300	5	6300 (2)	59 (2)
Chloroform	26	2	12	1	ND	2	7	8200 (2)	31 (2)
1,2-Dichloroethane	26	1	12	1	ND	150	5	8520 (2)	14 (2)
2-Butanone	26	5	12	4	ND	1300	50	268000 (2)	4.5 (2)
1,1,1-Trichloroethane	26	1	12	1	ND	340	5	1500 (2)	152 (2)
Trichloroethene	26	16	12	8	ND	2200	5	1100 (2)	126 (2)
Benzene	26	7	12	5	ND	98	0.7	1750 (2)	83 (2)
4-Methyl-2-pentanone	26	1	12	1	ND	27	50	NA	NA
Tetrachloroethene	26	15	12	8	ND	930	5	150 (2)	364 (2)
Toluene	26	16	12	9	ND	370	5	535 (2)	300 (2)
Chlorobenzene	26	5	12	2	ND	35	5	466 (2)	330 (2)
Ethylbenzene	26	11	12	6	ND	80	5	152 (2)	100 (2)
Total Xylenes	26	13	12	6	ND	270	5	198 (2)	240 (2)
Styrene	26	2	12	1	ND	7	5	NA	NA



TABLE 3.2  
NUMBER OF COMPOUNDS DETECTED AND  
CONCENTRATION RANGE IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

Compound	Number of Samples Analyzed (1)	Number of Samples Where Detected (1)	Number of Locations	Number of Locations Where Detected	Concentration Range (µg/L)		Class GA Level (µg/L)	Solubility (mg/L)	Koc (ml/g)
					Min	Max			
<i>Semivolatiles</i>									
Phenol	23	15	11	8	ND	2800	1*	93000 (2)	14 (2)
2-Chlorophenol	23	1	11	1	ND	1	1*	29000 (3)	83 (3)
2-Methylphenol	23	14	11	7	ND	1500	1*	31000(2)	500 (2)
4-Methylphenol	23	13	11	7	ND	1200	1*	31000 (2)	500 (2)
1,4-Dichlorobenzene	23	4	11	2	ND	14	4.7**	79 (2)	1700 (2)
1,3-Dichlorobenzene	23	3	11	1	ND	1	5	123 (2)	1700 (2)
1,2-Dichlorobenzene	23	3	11	2	ND	12	4.7**	100 (2)	1700 (2)
Isophorone	23	1	11	1	ND	30	50	12000 (3)	100 (3)
2,4-Dimethylphenol	23	13	11	6	ND	610	1*	4200 (3)	347 (3)
1,2,4-Trichlorobenzene	23	5	11	2	ND	1	5	30 (2)	9200 (2)
Benzoic Acid	23	1	11	1	ND	180	NA	3000 (3)	NA
Naphthalene	23	8	11	4	ND	30	10	32 (3)	1070 (3)
2-Methylnaphthalene	23	7	11	3	ND	12	NA	NA	NA
Diethylphthalate	23	1	11	1	ND	1	50	896 (2)	142 (2)
Di-n-butyl Phthalate	23	9	11	9	ND	15	NA	13 (3)	1000 (3)
Bis-(2-ethylhexyl)phthalate	23	8	11	8	ND	17	50	0.4 (3)	7240 (3)
Di-n-octylphthalate	23	8	11	8	ND	87	50	0.3 (3)	2400 (3)
n-Nitrosodiphenylamine	23	2	11	2	ND	2	50	NA	2690 (3)
<i>Pesticides/PCB</i>									
None Detected									

TABLE 3.2

NUMBER OF COMPOUNDS DETECTED AND  
CONCENTRATION RANGE IN ON-SITE OVERBURDEN GROUNDWATER  
GRATWICK-RIVERSIDE PARK SITE

Compound	Number of Samples Analyzed (1)	Number of Samples Where Detected (1)	Number of Locations	Number of Locations Where Detected	Concentration Range (µg/L)	Class GA Level (µg/L)
<i>Metals Cont'd.</i>						
Aluminum	24	23	12	12	ND	NA
Antimony	24	1	12	1	ND	3
Arsenic	24	7	12	5	ND	25
Barium	24	23	12	12	ND	1000
Beryllium	24	6	12	5	ND	3
Cadmium	24	1	12	1	ND	10
Calcium	24	24	12	12	110000	NA
Chromium	24	8	12	5	ND	50
Cobalt	24	5	12	3	ND	NA
Copper	24	15	12	8	ND	200
Iron	24	24	12	12	15	300***
Lead	24	14	12	8	ND	25
Magnesium	24	20	12	12	ND	35000
Manganese	24	24	12	12	1	300***
Mercury	24	3	12	3	ND	2
Nickel	24	7	12	4	ND	NA
Potassium	24	24	12	12	6770	NA
Selenium	24	1	12	1	ND	10
Silver	24	3	12	2	ND	50
Sodium	24	24	12	12	45000	20000
Vanadium	24	11	12	5	ND	NA
Zinc	24	22	12	11	ND	300
<i>Miscellaneous</i>						
Cyanide	23	3	12	3	ND	100

## Note:

(1) Rejected Results not included

(2) Superfund Public Health Evaluation Manual October, 1986.

(3) Reference Constants for Priority Pollutants and Selected Chemicals, A.D. Little, March 1981.

\* Sum of Compounds

\*\* Sum of Compounds

\*\*\* Sum of Compounds = 500 µg/L

TABLE 3.3

GROUNDWATER SITE SPECIFIC  
PARAMETER LIST (SSPL)  
INITIAL 5-YEAR POST-RA PERIOD  
GRATWICK-RIVERSIDE PARK SITE

Volatiles

Vinyl Chloride  
Methylene Chloride  
Acetone  
1,1-Dichloroethane  
trans-1,2-Dichloroethene  
2-Butanone  
Trichloroethene  
Benzene  
Tetrachloroethene  
Toluene  
Chlorobenzene  
Ethylbenzene  
Total Xylenes

Semi-Volatiles

Phenol  
2-Methylphenol  
4-Methylphenol  
1,4-Dichlorobenzene  
1,2-Dichlorobenzene  
2,4-Dimethylphenol  
Naphthalene  
Di-n-octylphthalate