FINAL REPORT
SUPPLEMENTAL SITE INVESTIGATION

VOLUME I - TEXT

TONAWANDA COKE CORPORATION
TONAWANDA, NEW YORK

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1.0 INTRODUCTION

A Supplemental Site Investigation of the Tonawanda Coke Corporation (TCC) facility located on River Road in Tonawanda, New York was conducted by Conestoga-Rovers & Associates (CRA). This investigation was conducted in order to supplement existing information regarding the hydrogeological and geochemical characteristics of the Site. The work was completed in accordance with the report entitled "Supplemental Site Investigation, Tonawanda Coke Corporation" (hereinafter "Work Plan"), dated February 13, 1989, and the CRA responses to the New York State Department of Environmental Conservation's (DEC) April 21, 1989 comments, dated May 9, 1989. The CRA responses are included in Appendix A.

This report details all of the field activities and presents documented logs of the acquired information. The geologic, hydrogeologic and analytical information is discussed as it pertains to the TCC facility operations and an assessment of the data is included. Finally, recommendations for further action are made to address questions raised by this Supplemental Site Investigation.

2.0 BACKGROUND INFORMATION

Several sampling events and two major investigations have been undertaken at the Site, focusing primarily on the former on-Site disposal areas. The results of the investigations were presented in the reports entitled "Tonawanda Coke Corporation - New York State Superfund Phase I Summary Report - November 18, 1983" prepared by Recra Research Inc. and "Phase II Site Investigation - Tonawanda Coke Site - December 1986" prepared by Malcolm-Pirnie, Inc.

In summary, these reports have concluded the following:

- air emission sources are in compliance with permit and regulatory requirements;
- some chemicals were found in the groundwater flow regime in certain areas. However, some of these occurrences are difficult to explain in the context of the waste disposal areas;
- the groundwater zone of concern is the uppermost soil/fill horizon;
- some chemicals were found in the surface water on Site; and
- the greatest potential for environmental impact is in the surface water discharges.

As the initial step in the Supplementary Site Investigation process, CRA has reviewed the previous investigation reports and is in agreement with the findings of the previous two studies. Specifically, CRA concludes the following:

- air emission sources are adequately controlled by air permitting standards which TCC meets;
- the chemical concentrations observed in the groundwater in certain areas may be explained by the possibility of waste or other material present in areas other than the identified former waste disposal areas;
- the groundwater interval monitored is limited to surficial layers of fill and permeable strata in the upper soil. Below this, the soil consists of a massive layer of low permeability clay that acts as an aquitard restricting both the vertical and horizontal components of groundwater flow. Thus, chemicals discharged into the groundwater are similarly restricted to this upper perched strata. Due to this lack of mobility, localized areas of groundwater within the surficial waterbearing zone containing elevated chemical concentrations leached from the fill and surface materials may exist. More importantly, however, the areal extent of environmental concern related to such conditions is expected to be limited; and
- surface water courses provide a pathway for migration of and subsequent exposure to chemicals which may be present at the Site. Consequently, the surface water conditions at and adjacent to the Site should be investigated further.

The initial step in the Supplemental Site Investigation involved the generation of a Site Base Plan. An aerial survey firm was contracted to perform an aerial survey of the TCC Site and produce a topographic plan of the entire Site. CRA has incorporated this aerial survey topographic base into a Site Base Plan including all the well and sampling locations. The enclosed Plan 1 is this Site Base Plan.

The Supplemental Site Investigation was completed in three phases as initially outlined in the Work Plan. In late June 1989, test pits were excavated for soil samples and monitoring wells were installed to augment the existing well network. Immediately after the well installations the wells were developed and a groundwater sampling program was initiated. In October 1989, a second visit included some additional borings in the test pit areas, a replacement well installation, a second round of groundwater sampling and a surface water sampling program. A third visit in December 1989 was for the purpose of a third round of groundwater sampling, some additional surface water sampling and a sediment sampling program. Due to frozen conditions, it was not possible to collect all of the surface water and sediment samples at this time. The remaining samples were subsequently collected on March 15, 1990.

3.0 TEST PIT INVESTIGATION PROGRAM

On June 19, 1989, a test pit and soil sampling program was conducted in order to characterize the materials which have been deposited at the TCC facility. The investigation was conducted in three areas of the facility; Site 108 on the west side of River Road, Site 110 in the northeast corner of the Site, and the coal storage area in the center of the Site. Two test pits were located in each of Sites 108 (TP-Q and S) and 110 (TP-M and N) and four test pits were located in the coal storage area (TP-T, U, V and W) as shown on Figure 3.1.

The test pits were excavated using a rubber-tired backhoe subcontracted from Brite Associates by TCC. The depth of each test pit extended to the fill/native soil interface and the materials encountered were logged by CRA personnel. Following sample collection from each test pit, the excavation was backfilled with the excavated material in the reverse order from which it was originally removed with the original surface material being exposed. The stratigraphic and instrumentation logs for the test pits are contained in Appendix B.

Each test pit soil sample was collected by scraping the freshly exposed face of the excavation with a precleaned stainless steel sampling trowel/spatula in order to remove material which may have been contacted by the backhoe bucket. A sufficient sample volume was collected representative of the entire depth of fill material encountered. Groundwater filled the test excavations at TP-S and TP-Q, making sample collection from the excavation impossible. Therefore, the samples were collected with the

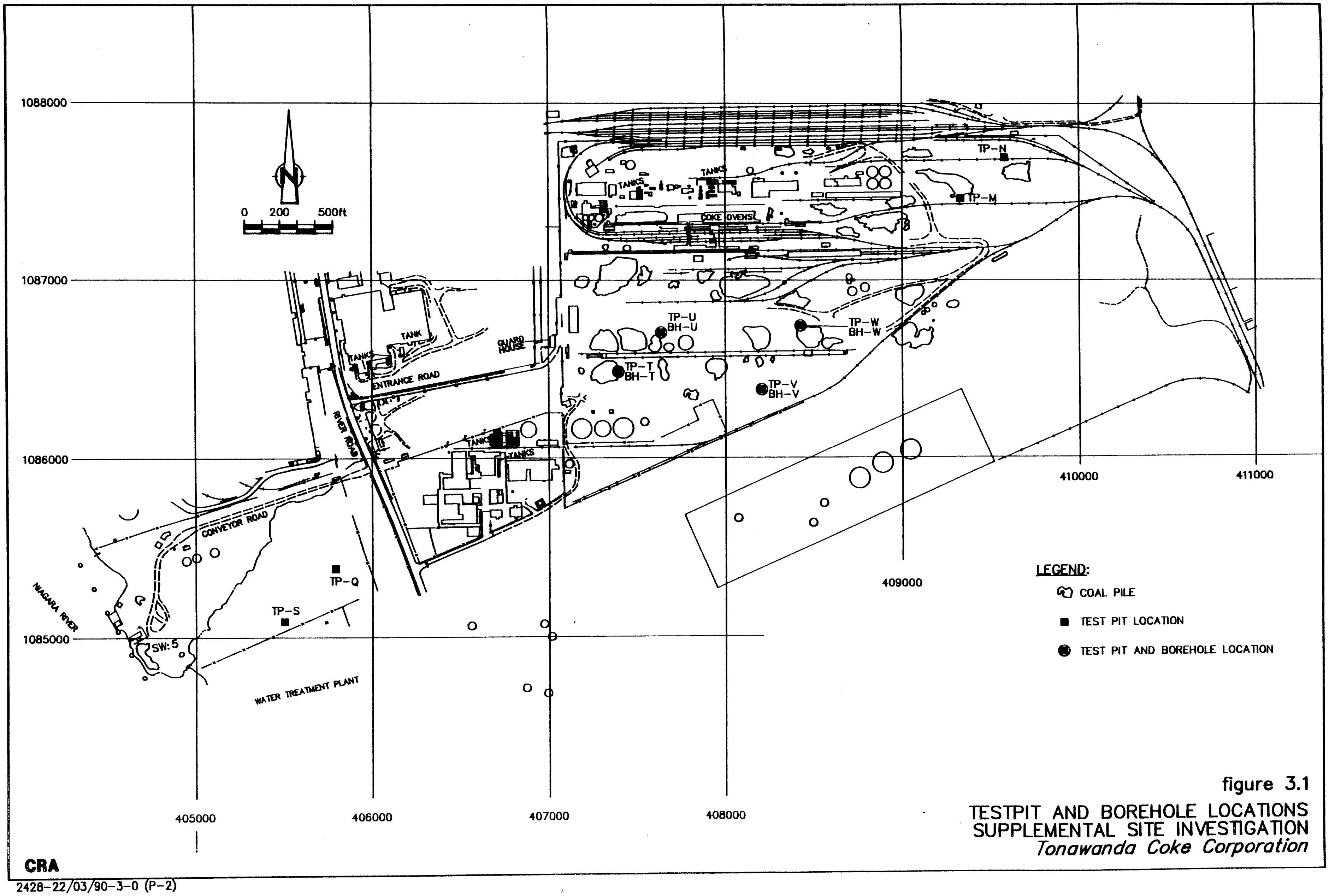

figure 3.1

TESTPIT AND BOREHOLE LOCATIONS
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

2428-22/03/90-3-0 (P-2)

sampling tool from the pile of excavated material representative of the entire soils encountered. Also, because groundwater filled the excavation, it was not possible to determine the fill/native contact at TP-S and TP-Q.

Following sample collection from the test pits, composite soil samples were field produced by filling each sample jar with equal portions of homogenized soil material from two test pits in the same area. The sample compositions were as follows:

TP-Q and TP-S (Site 108) = sample TP-1
TP-T and TP-U (coal storage area) = sample TP-2
TP-V and TP-W (coal storage area) = sample TP-3
TP-M and TP-N (Site 110) = sample TP-4

Each composite sample consisted of two 1-liter and two 4-ounce glass jars of soil. The sample containers were handled and transported according to the appropriate chain-of-custody procedures and submitted, along with a Quality Assurance duplicate sample from TP-1, to CompuChem Corp. for analysis. The soil samples were analyzed for the following groups of parameters with reporting by Contract Laboratory Procedures (CLP) for the Target Compound List parameters:

Target Compound List (TCL)

- Volatile Organic Compounds (VOCs)
- Base/Neutral and Acid Extractables (BNAs)
- Inorganic Compounds (Metals and Cyanide)

Toxicity Characteristics Leaching Procedure (TCLP)

- Volatile Organic Compounds (VOCs)
- Base/Neutral and Acid Extractables (BNAs)
- Inorganic Compounds (Metals and Cyanide)

Oil and Grease

Hexavalent Chromium (Cr+6)

Table 3.1 presents a summary of the test pit soil sample handling details.

3.1 CHEMICAL SAMPLING OF UNDERLYING SOIL

As a follow-up to the test pit investigation in the coal storage area, a soil sampling program of the underlying native clay materials was conducted. At the same locations as the previous test pit excavations, four boreholes were drilled on October 16, 1989 by Earth Dimensions of East Aurora, New York. The boreholes were drilled to a depth necessary to collect a sample of the native clay beneath the coal storage area. The borehole locations are indicated on Figure 3.1 along with the test pit locations.

Each borehole was augered into the native clay using 6.5-inch outside diameter hollow stem augers. Continuous split spoon sampling was conducted in order to identify the geologic strata and confirm the native clay/fill interface. Once the native clay was observed in a split

TABLE 3.1

TEST PIT SOIL SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
TP-1	2428-DT-001	6-19-89	1345	6-19-89	4375	Composite of TP-Q and TP-S
TP-2	2428-DT-002	6-19-89	1050	6-19-89	4375	Composite of TP-T and TP-U
TP-3	2428-DT-003	6-19-89	1005	6-19-89	4375	Composite of TP-V and TP-W
TP-4	2428-DT-004	6-19-89	0920	6-19-89	4375	Composite of TP-M and TP-N
TP-5	2428-DT-005	6-19-89	1450	6-19-89	4375	Duplicate of TP-1

spoon, a subsequent precleaned split spoon was driven and a soil sample collected for chemical analysis (see Figure 3.2). The remaining soil was placed in a clear glass sample jar and stored on Site for geologic reference. Following sample collection, the borehole was grouted to ground surface. The stratigraphic and instrumentation logs for the boreholes are contained in Appendix B along with the test pit logs.

The sample volume collected from each borehole was placed in a 1-liter glass sample jar and handled and transported in the same manner as the test pit samples. CompuChem Corp., upon receipt of the four sample jars, composited the samples similar to the previous test pit samples; BH-T with BH-U and BH-V with BH-W. The composite samples were then analyzed for the same parameter groups as the previous test pit samples except for TCLP analyses. Reporting followed non-CLP procedures for this data set.

Table 3.2 presents a summary of the borehole soil sample handling details.

TABLE 3.2

BORHOLE SOIL SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
BH-T	S-2428-DT-021	10-16-89	1010	10-16-89	7632	4.6 ft - 6.0 ft BGS Composited with BH-U in lab
BH-U	S-2428-DT-021	10-16-89	1050	10-16-89	7632	6.0 ft - 8.0 ft BGS Composited with BH-T in lab
BH-V	S-2428-DT-022	10-16-89	1400	10-16-89	7632	6.0 ft - 8.0 ft BGS Composited with BH-W in lab
BH-W	S-2428-DT-022	10-16-89	1200	10-16-89	7632	10.0 ft - 12.0 ft BGS Composited with BH-V in lab

4.0 MONITORING WELL INSTALLATIONS

In order to evaluate the groundwater conditions beneath the TCC facility, additional well installations were required to supplement the six existing wells. Ten additional overburden groundwater monitoring wells were installed around the perimeter of the Site during the period of June 12-14, 1989. The locations of the newly installed and previously existing monitoring wells are identified on Figure 4.1.

Earth Dimensions of East Aurora, New York, was contracted to provide the drilling services for the monitoring well installations. Boreholes for the well installations were advanced using a truck-mounted Dietrich D-50 drill rig and 4 1/4-inch inside diameter hollow stem augers to a depth of approximately two feet beyond the top surface of the water table. Continuous split spoon samples of the overburden material were collected in advance of the augering operations to define the overburden geologic stratigraphy. A soil sample from each split spoon was placed in a clear glass sample jar and stored on Site for geologic reference. The stratigraphic and instrumentation logs for the installed monitoring wells are presented in Appendix B along with the borehole and test pits logs.

In conjunction with the monitoring well installations, four undisturbed Shelby tube samples were collected of the native clay. These samples were collected in order to determine the hydraulic conductivity of the aquitard strata underlying the Site. The tube samples were submitted to a soil testing laboratory by Earth Dimensions for hydraulic conductivity analysis. The monitoring wells and depths at which the Shelby tube samples

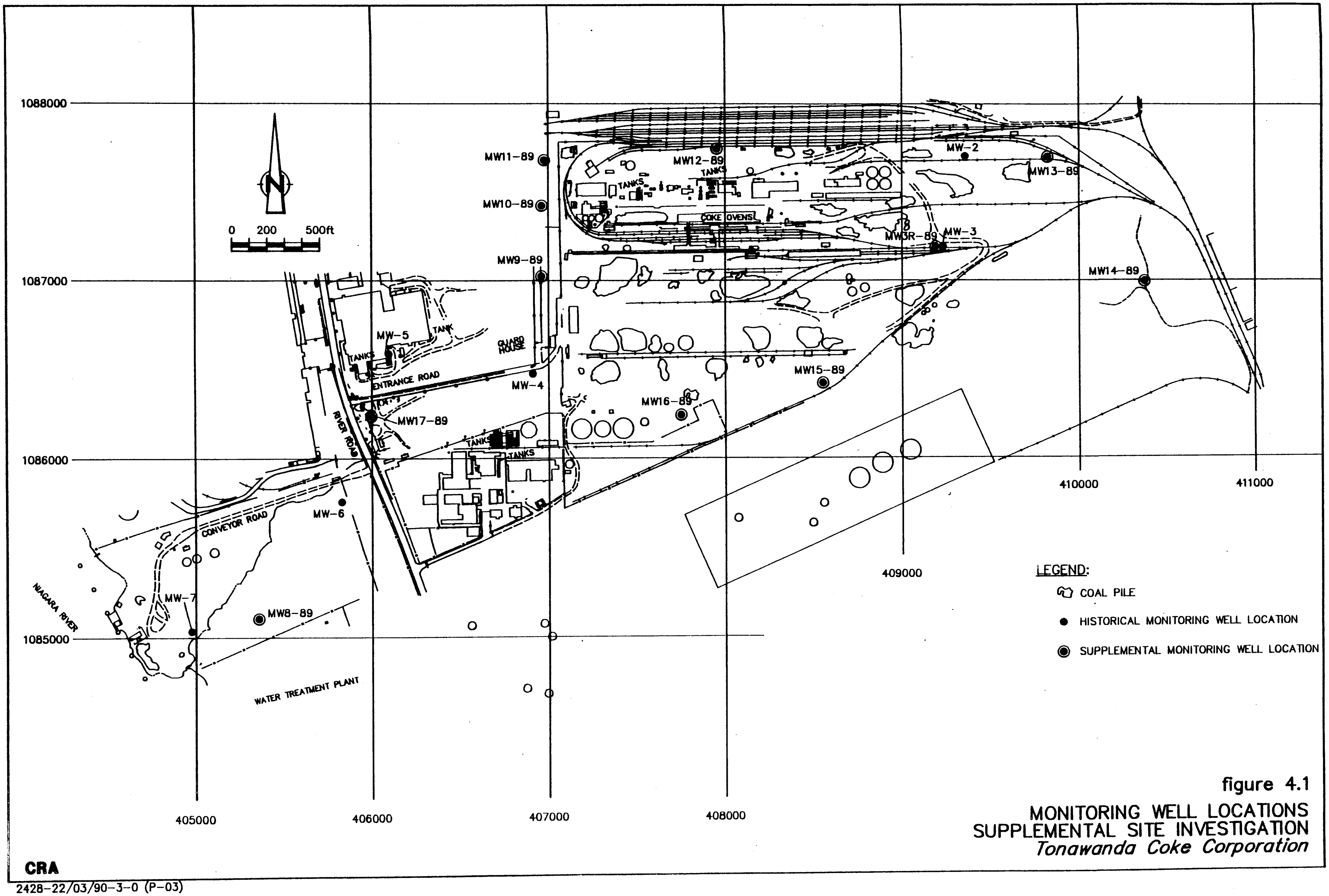

figure 4.1

MONITORING WELL LOCATIONS
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

CRA

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were collected and the resultant hydraulic conductivity test results are as follows:

MW11-89 (4.0 ft - 6.0 ft)	3.3×10^{-6} cm/sec
MW13-89 (6.0 ft - 8.0 ft)	2.9×10^{-8} cm/sec
MW14-89 (4.0 ft - 6.0 ft)	1.6×10^{-8} cm/sec
MW17-89 (6.0 ft - 8.0 ft)	sample disturbed

It should be noted that the Shelby tube sample identified as being from MW17-89 was actually collected from an additional borehole drilled five feet south of MW17-89. From the hydraulic conductivity test values it can be seen that the clay beneath the TCC Site has a low hydraulic conductivity and thus acts as a barrier to groundwater flow.

Within the augered boreholes, the overburden groundwater monitoring wells, designated MW8-89 through MW17-89, were installed as follows:

i) A 2-foot length of 2-inch inside diameter stainless steel screen (#10 slot) threaded and coupled to an appropriate length of 2-inch diameter black steel riser pipe was installed through the hollow stem augers.

ii) A measured quartzite sandpack (QROC #2) was placed around the well screen over the saturated interval. The sandpack was poured into place between the inside of the augers and the outside of the riser pipe. The augers were extracted as the backfilling progressed.

iii) A measured bentonite pellet plug was placed over the sandpack. The thickness of the plug was determined in the field on an individual well basis.

iv) Cement grout was placed in the remaining borehole annular space to the ground surface. Three percent bentonite was added to the grout to control shrinkage.

v) Each riser pipe was allowed to stick up approximately two feet above the ground surface and was equipped with a lockable cap and lock.

Figure 4.2 illustrates a typical monitoring well installation. The monitoring well completion details for the ten newly installed wells are summarized on Table 4.1.

During the supplemental investigation, it was discovered that one of the previously existing wells, MW-3, had been severely damaged. Although attempts were made to repair the well installation, it was decided to install an adjacent replacement well due to a lack of confidence in the integrity of the existing well. On October 16, 1989, Earth Dimensions installed a replacement well, MW3R-89. The same augering, soil sampling and well installation procedures were followed as used for the ten newly installed monitoring wells. The selected depth of the well installation was chosen to monitor the same interval as the original MW-3 monitoring well. Table 4.1 also presents the well completion details for the replacement well, MW3R-89.

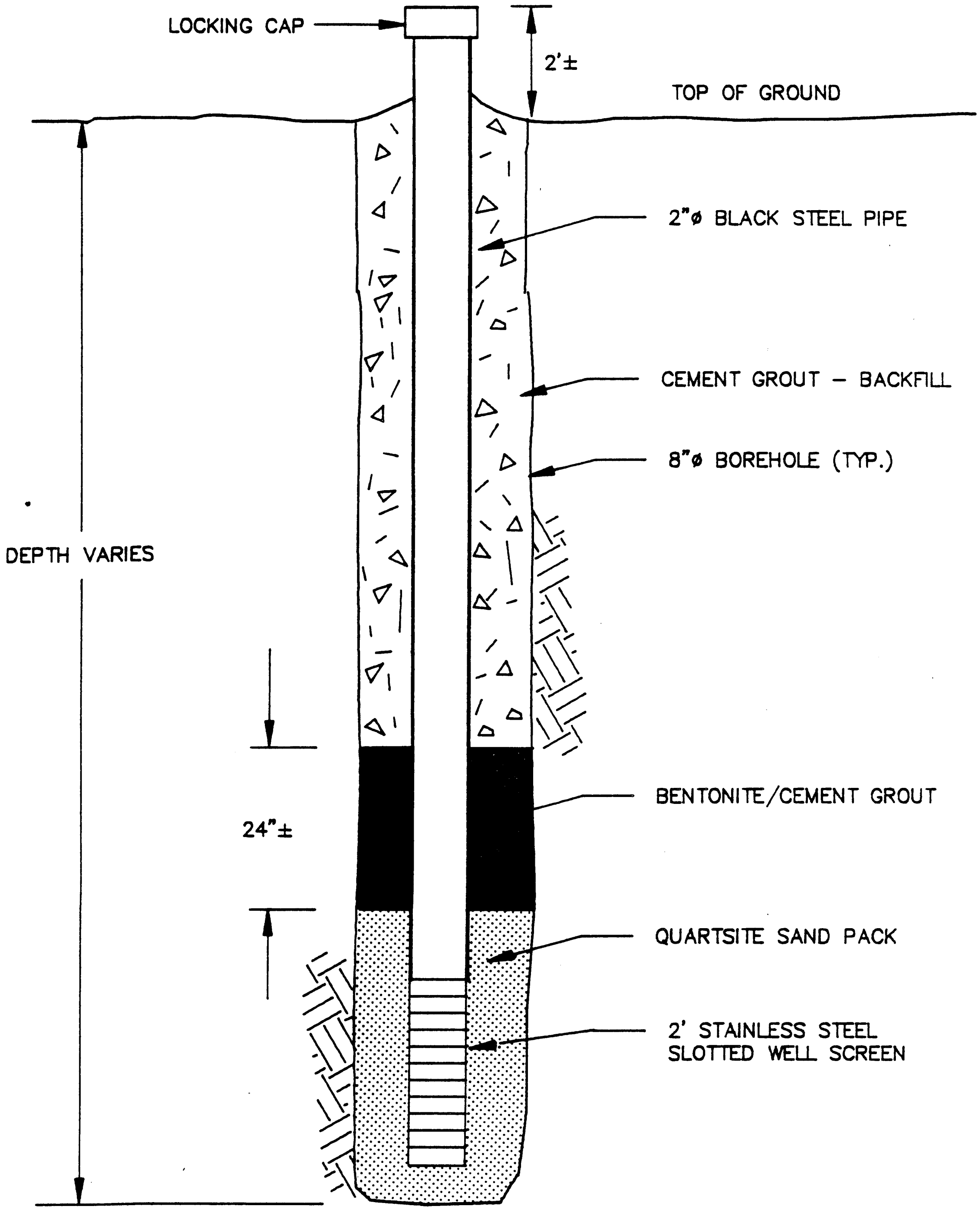

figure4.2

TYPICAL MONITORING WELL INSTALLATION
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

CRA

TABLE 4.1

MONITORING WELL COMPLETION DETAILS
TONAWANDA COKE CORPORATION

Well No.	*Ground Elevation (ft AMSL)*	*Top of Casing (ft AMSL)*	*Depth of Hole (ft BGS)*	*Screened Interval (ft AMSL)*	*Sandpack Interval (ft AMSL)*	*Bentonite Plug Interval (ft AMSL)*
MW8-89	576.7	578.99	10.0	566.7-568.7	566.7-571.2	571.2-573.5
MW9-89	602.8	604.92	6.0	598.8-600.8	596.8-601.0	601.0-602.0
MW10-89	603.9	605.54	6.0	599.4-601.4	597.9-601.9	601.9-603.0
MW11-89	602.0	603.77	6.0	598.5-600.5	596.0-601.0	601.0-601.5
MW12-89	606.3	609.19	6.0	601.3-603.3	600.3-603.8	603.8-605.5
MW13-89	606.2	608.39	8.0	600.2-602.2	598.2-603.2	603.2-605.2
MW14-89	603.6	605.57	6.0	599.6-601.6	597.6-602.1	602.1-603.1
MW15-89	603.8	605.99	4.0	599.8-601.8	599.8-602.3	602.3-603.3
MW16-89	599.9	603.46	4.0	596.4-598.4	595.9-598.9	598.9-599.4
MW17-89	576.9	579.15	6.0	571.9-573.9	570.9-574.4	574.4-575.9
MW3R-89	609.0	611.16	8.0	602.8-604.8	601.0-606.5	606.5-608.0

Notes:

AMSL	Above mean sea level (based on NGVD 1929 datum).
BGS	Below ground surface.

4.1 WELL DEVELOPMENT

Following completion of the well installations, the wells were developed in order to draw water through the sandpack and remove any fines from the sandpack. Development was accomplished using a peristaltic pump with new teflon tubing inserted into each well. During purging, the tubing was agitated in the well screen to promote fines removal.

A minimum of ten well volumes were removed from each well in an attempt to bring the wells to a silt-free condition. Wells that went dry and could not be sufficiently developed in one day were purged until dry on three consecutive days. The evacuated water was measured for pH, conductivity and temperature after each successive well volume in order to determine chemical stability. Turbidity was also measured to monitor water clarity and to aid in determining sediment presence. All of the wells achieved chemical stability during development, determined as three consecutive, consistent (+/- 10 percent of the median) readings for each of the stabilization parameters. However, the turbidity criteria of 50 NTU or less was not achievable at every well.

The water generated during well development was contained in a 55-gallon drum at each individual well location. The contained water was discharged to the ground surface adjacent to each clean well following the receipt of the analytical results for the groundwater samples.

The well development information, including the stabilization parameter values, is summarized on the development logs contained in Appendix C.

5.0 GROUNDWATER SAMPLING PROGRAMS

The scope of the groundwater quality monitoring program was to collect two sets of analytical data for each monitoring well, both historical and newly installed. The initial round of sample collection involved a limited number of wells (eight) for which the groundwater samples collected were analyzed for the complete set of Target Compound List (TCL) and Target Analyte List (TAL) parameters except the pesticide fraction. The pesticides were not included because it is known that TCC and its predecessors have never used or handled pesticides at this facility. Following the analysis of the Round 1 samples, a reduced list of parameters, the Site-Specific Indicators (SSIs) was developed for use in subsequent sampling rounds. Thereafter, Round 2 sampling included all of the present monitoring wells (16 wells) and Round 3 sampling involved any well for which only one set of analytical data was available or for which the available data provided unresolved conflicting data.

5.1 ROUND 1 SAMPLING

The wells included in the initial groundwater sampling round included six of the newly installed monitoring wells (MW8-89, MW9-89, MW11-89, MW14-89, MW16-89 and MW17-89) and two of the historical monitoring wells (MW-2 and MW-3). Prior to sample collection, the wells were purged of a minimum of five well volumes of water (or until dry on three consecutive days) so as to remove any stagnant water and collect representative samples of the groundwater in the vicinity of each well installation. Water quality stability was verified by pH, temperature, conductivity and turbidity readings (similar to development) and additional water was purged when necessary. In several instances the purging of five well volumes was not necessary as the well was sampled immediately following well development of ten or more well volumes.

The well purging information is summarized on the purging logs contained in Appendix D.

For each sampling event at each individual well, the following protocols were observed:

i) an initial water level in the well was obtained using a precleaned water level indicator;

ii) the required purging volume (five well volumes) was calculated;

iii) a peristaltic pump was connected to well-dedicated teflon tubing and the required purging volume was removed from the well or the well pumped dry on three consecutive days;

iv) a precleaned bottom-loading stainless steel bailer attached to new nylon rope was lowered to collect the samples for VOC analysis (the dedicated bottom-loading PVC bailers were used at the historical wells);

v) the remainder of the samples were collected using the peristaltic pump and tubing from the well purging;

vi) blind duplicates and rinse blanks were collected at a rate of one for every ten samples in order to provide for Quality Assurance analyses; and

vii) all samples were properly preserved and filtered (where necessary) and then packed on ice (to 4°C) in a sealed cooler and transported to the designated analytical facility [both CompuChem Corp. and Advanced Environmental Services (AES) were used] under chain-of-custody to provide both sample identification and security.

Samples were collected at six of the preselected wells (MW11-89 and MW16-89 were not sampled due to insufficient sampling volume) for the following parameters:

Analysis	*Volume*	*Preservative*	*Laboratory*
TCL VOCs	2 x 40 mL	HCl	CompuChem
TCL BNAs	3 x 1 L	--	CompuChem
TAL Metals (filtered)	2 x 500 mL	HNO_3	CompuChem
TAL Metals (unfiltered)	2 x 500 mL	HNO_3	CompuChem
Cyanide	1 x 1 L	NaOH	CompuChem
Oil and Grease	1 x 1 L	H_2SO_4	AES
Hexavalent Chromium	1 x 250 mL	--	AES

Table 5.1 summarizes the Round 1 groundwater sampling activities.

TABLE 5.1

ROUND 1 WELL SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
MW-2	W-2428-DT-004	6-28-89	1010	6-28-89	4387/4386	--
MW-2MS	W-2428-DT-006	6-28-89	1115	6-28-89	4376	Sample for Cr+6 not collected
MW-2MSD	W-2428-DT-005	6-28-89	1040	6-28-89	4387/4376	Sample for Cr+6 not collected
MW-3	W-2428-DT-007	6-28-89	1350	6-28-89	4384/4386	--
MW-3 Dup.	W-2428-DT-008	6-28-89	1430	6-28-89	4385/4386	--
MW8-89	W-2428-DT-009	6-30-89	1020	6-30-89	4913/4906	--
MW9-89	W-2428-DT-001	6-26-89	1410	6-26-89	4378/4379	--
MW11-89	W-2428-DT-011	7-05-89	1430	7-05-89	4916	VOAs, 2 x 40 mL discarded due to insufficient sampling volume
MW14-89	W-2428-DT-010	7-05-89	1010	7-05-89	4917	Cr+6, 1 x 250 mL
		7-05-89	1010	7-05-89	4916	Cyanide, 1 x 1L VOCs, 2 x 40 mL
		7-05-89	1010	7-06-89	4919	BNAs, 1 x 1L Metals unfiltered, 1 x 500 mL
		7-06-89	0930	7-06-89	4919	Metals filtered, 1 x 500 mL BNAs, 2 x 1L
		7-07-89	0900	7-07-89	4920	Oil and grease, 1 x 1 L Metals filtered, 1 x 500 mL Metals unfiltered, 1 x 500 mL
MW17-89	W-2428-DT-002	6-27-89	1000	6-27-89	4380/4381	--
Rinse Blank	W-2428-DT-003	6-27-89	1055	6-27-89	4382/4381	Sample for filtered metals not collected

Notes:

MW11-89 and MW16-89 were not sampled due to insufficient sampling volume.

The purged groundwater was contained in a 55-gallon drum at each individual well location. The contained water was discharged to the ground surface adjacent to each clean well following receipt of the analytical results for the groundwater samples.

5.2 SSI PARAMETER SELECTION

Following completion of the analysis of the six Round 1 groundwater sample sets, the analytical data was reviewed. Table 5.2 presents a short review of the detected chemicals for each of the parameter groups.

In order to sufficiently determine the appropriate reduced parameter list, the analytical data for the five test pit soil samples (Section 3.0) were also reviewed. Table 5.2 also includes a short review of the detected chemicals in the soils for each of the parameter groups.

Based on the summary of detected compounds in Table 5.2, the following list of Site-Specific Indicator (SSI) parameters was selected for future groundwater sampling events:

VOCs - 1,2-Dichloroethene (total)
- 1,1,1-Trichloroethane
- Benzene
- Toluene
- Ethylbenzene
- Total Xylenes

TABLE 5.2

SSI PARAMETER SELECTION
TONAWANDA COKE CORPORATION

	Detected Compounds (µg/L)	*Most Stringent MCL (µg/L)*	*Comments*
A. GROUNDWATER			
VOCs			
Acetone	34 - 240	50	detected in both rinse and lab blanks; assumed lab contamination
1,2-Dichloroethene (total)	6	5	MW8-89
1,1,1-Trichloroethane	7 - 8	5	MW-3
Benzene	41	ND	MW8-89
Toluene	16	5	MW8-89
Ethylbenzene	8	5	MW8-89
Total Xylenes	27	5	MW8-89
BNAs			
Naphthalene	73 - 1900	50	MW-3 and MW8-89
2-Methylnaphthalene	19 - 25	50	MW-3 and MW8-89
Acenaphthylene	30 - 31	50	MW-3
Fluorene	45 - 49	50	MW-3
Phenanthrene	29 - 38	50	MW-3
Fluoranthene	16 - 34	50	MW-3
Pyrene	15 - 21	50	MW-3
Benzo (b & k) fluoranthene	15	50	MW-3
Dibenzofuran	34 - 37	50	MW-3
Analytes			
Iron	28 - 33, 100	300	above MCL at four of six wells (filtered samples)
Manganese	801 - 3, 550	300	above MCL at all six wells (filtered samples)
Other Metals			all below MCL
Cyanide	13.8 - 3,730	100	above MCL at MW-2 to MW8-89
Cr+6	20	50	detected at three wells
Oil & Grease	1,500 - 7,400		MW-2 and MW8-89

TABLE 5.2

SSI PARAMETER SELECTION
TONAWANDA COKE CORPORATION

	Detected Concentrations (µg/L)	*Background Concentration (µg/L)*	*Comments*
B. SOILS			
VOCs			
Methylene Chloride	29 - 110		probable lab contamination
Acetone	24 - 260		probable lab contamination
Toluene	8 - 9		TP-1
Total Xylenes	11		TP-1
BNAs			
Total PAHs	19,040 - 165,500		all five samples
Dibenzofuran	640		TP-1
Analytes			
Arsenic	0.59 - 10.6	<1 - 9.3	above at TP-1
Lead	3.2 - 81.8	<10 - 70	above at TP-1
Other Metals			all below background
Cyanide	0.68 - 271		three of four TPs
Oil & Grease	180 - 38,000		all five samples

PAHs
Cyanide
Cr+6
Oil and grease

5.3 ROUND 2 SAMPLING

Following selection of the SSIs, a second round of groundwater samples was collected. This event included sample collection at all of the historical and newly installed monitoring wells. Also sampled was the new well, MW3R-89, which was installed to replace the damaged MW-3 well. Prior to sample collection, the wells were again purged of a minimum of five well volumes of water (or until dry on three consecutive days) with the exception of MW3R-89. MW3R-89 was sampled immediately following the removal of greater than ten well volumes during well development and therefore purging of a minimum of five well volumes was not necessitated.

The well purging information is summarized on the purging logs contained in Appendix D.

The purging and sampling protocols established in Round 1 were again observed for the second sampling round with the exception of three of the historical wells (MW-4, MW-5 and MW-6) where the dedicated PVC bailer was used for purging and complete sample collection. Samples in Round 2 were collected for the following parameters:

Analysis	*Volume*	*Preservative*	*Laboratory*
SSI VOCs	2 x 40 mL	HCl	AES
PAHs	1 x 1 L	--	AES
Cyanide	1 x 500 mL	NaOH	AES
Cr+6	1 x 500 mL	--	AES
Oil and Grease	1 x 1 L	HCl	AES

Table 5.3 summarizes the Round 2 groundwater sampling activities. During this sampling round, several wells (MW8-89, MW9-89, MW10-89, MW14-89 and MW17-89) were not sampled due to insufficient sampling volume.

All contained groundwater was handled similar to Round 1.

5.4 ROUND 3 SAMPLING

The final round of groundwater samples was intended to complete the analytical data collection such that all of the on-Site wells would have two sets of analytical results. This was intended to only include the remaining wells not sampled in Round 1, however during Round 2 only two wells from Round 1 (MW-2 and MW-3) contained sufficient volume for sampling and therefore all wells with the exception of MW-2 and MW-3, were again visited for the purpose of groundwater sample collection. The

TABLE 5.3

ROUND 2 WELL SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
MW-2	W-2428-DT-017	10-11-89	1120	10-11-89	7137	--
MW-2MS	W-2428-DT-017MS	10-11-89	1120	10-11-89	7138	--
MW-2MSD	W-2428-DT-017MSD	10-11-89	1120	10-11-89	7138	--
MW-3	W-2428-DT-032	10-18-89	1140	10-18-89	7635	Well sampled even though damaged and replaced by MW3R-89
MW3R-89	W-2428-DT-033	10-18-89	1225	10-18-89	7636	--
MW3R-89 Dup.	W-2428-DT-034	10-18-89	1440	10-18-89	7636	--
MW-4	W-2428-DT-015	10-11-89	0905	10-11-89	7137	--
MW-5	W-2428-DT-019	10-12-89	1525	10-12-89	7631	--
MW-6	W-2428-DT-014	10-10-89	1350	10-10-89	7136	--
MW-7	W-2428-DT-012	10-09-89	1505	10-09-89	4921	--
		10-12-89	0905	10-12-89	7631	Cr+6 resampled
MW-7 Dup.	W-2428-DT-013	10-09-89	1400	10-09-89	4921	--
		10-12-89	1000	10-12-89	7631	Cr+6 resampled
MW11-89	W-2428-DT-026	10-17-89	1050	10-17-89	7633	--
MW12-89	W-2428-DT-030	10-18-89	1005	10-18-89	7635	--
MW13-89	W-2428-DT-016	10-11-89	1430	10-11-89	7239	--
MW15-89	W-2428-DT-025	10-17-89	1010	10-17-89	7634	--
MW16-89	W-2428-DT-020	10-17-89	0950	10-17-89	7634	--
Rinse Blank	W-2428-DT-018	10-11-89	1500	10-11-89	7139	--
Rinse Blank	W-2428-DT-035	10-18-89	1430	10-18-89	7637	--

Notes:

MW8-89, MW9-89, MW10-89, MW14-89 and MW17-89 were not sampled due to insufficient sampling volume.

wells were again purged of a minimum of five well volumes (or until dry on three consecutive days) prior to sample collection.

The well purging information is summarized on the purging logs contained in Appendix D.

The purging and sampling protocols established in Round 1 were again observed with the exception of the historical well MW-4 where the dedicated PVC bailer was used for complete sample collection. Samples in Round 3 were again collected for the SSI parameters as detailed in the previous Round 2 discussion.

Table 5.4 summarizes the Round 3 groundwater sampling activities. During this sampling round, MW8-89 was again not sampled due to insufficient sampling volume.

All contained groundwater was handled similar to Round 1.

TABLE 5.4

ROUND 3 WELL SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
MW3R-89	W-2428-DT-049	12-13-89	1100	12-13-89	7781	–
MW-4	W-2428-DT-058	12-15-89	0945	12-15-89	7786	–
MW-5	W-2428-DT-053	12-13-89	1530	12-13-89	7782	–
MW-5MS	W-2428-DT-053MS	12-13-89	1530	12-13-89	7782	–
MW-5MSD	W-2428-DT-053MSD	12-13-89	1530	12-13-89	7783	–
MW-6	W-2428-DT-055	12-14-89	1045	12-14-89	7784	–
MW-7	W-2428-DT-051	12-13-89	1415	12-13-89	7781	–
MW-7 Dup.	W-2428-DT-052	12-13-89	1500	12-13-89	7782	–
MW9-89	W-2428-DT-061	12-19-89	1110	12-19-89	7947	–
MW10-89	W-2428-DT-060	12-19-89	1045	12-19-89	7946	–
MW11-89	W-2428-DT-059	12-19-89	1020	12-19-89	7946	–
MW12-89	W-2428-DT-048	12-12-89	1630	12-12-89	7645	–
MW13-89	W-2428-DT-046	12-12-89	1430	12-12-89	7644	–
MW13-89 Dup.	W-2428-DT-047	12-12-89	1500	12-12-89	7644	–
MW14-89	W-2428-DT-063	12-20-89	1010	12-20-89	7953	–
MW15-89	W-2428-DT-054	12-14-89	0900	12-14-89	7784	–
MW16-89	W-2428-DT-062	12-19-89	1145	12-19-89	7951	–
MW17-89	W-2428-DT-057	12-15-89	0915	12-15-89	7785	–
Rinse Blank	W-2428-DT-050	12-13-89	1130	12-13-89	7781	–
Rinse Blank	W-2428-DT-056	12-15-89	0900	12-15-89	7785	–

Notes:

MW8-89 was not sampled due to insufficient sampling volume.

6.0 SURFACE WATER/SEDIMENT SAMPLING PROGRAMS

Following establishment of the SSI parameter list, a surface water sampling program was conducted at the same time as the Round 2 groundwater sampling. Surface water samples were collected at nine locations around the Site during the period of October 16-19, 1989. The locations were selected based on expected and observed surface water pathways. Following evaluation of the analytical data, additional samples were collected during Round 3 groundwater sampling (December 19-20, 1989). Sediment samples were collected at selected locations beneath previous surface water locations and supplemental surface water samples were collected at additional locations to better evaluate the Site conditions. During this visit, several locations were frozen and sampling was completed on March 15, 1990.

6.1 ROUND 1 SURFACE WATER SAMPLING

The initial surface water sampling event was conducted in conjunction with the second round of groundwater samples. Eleven surface water sampling locations (SW-5 through SW-15) were preselected as representative of surface water pathways discharging from the Site and from adjacent sites. Figure 6.1 presents the surface water sampling locations.

At each sampling location, surface water samples were collected by lowering one clean sample jar beneath the water surface and transferring the collected water into the respective sample containers. A

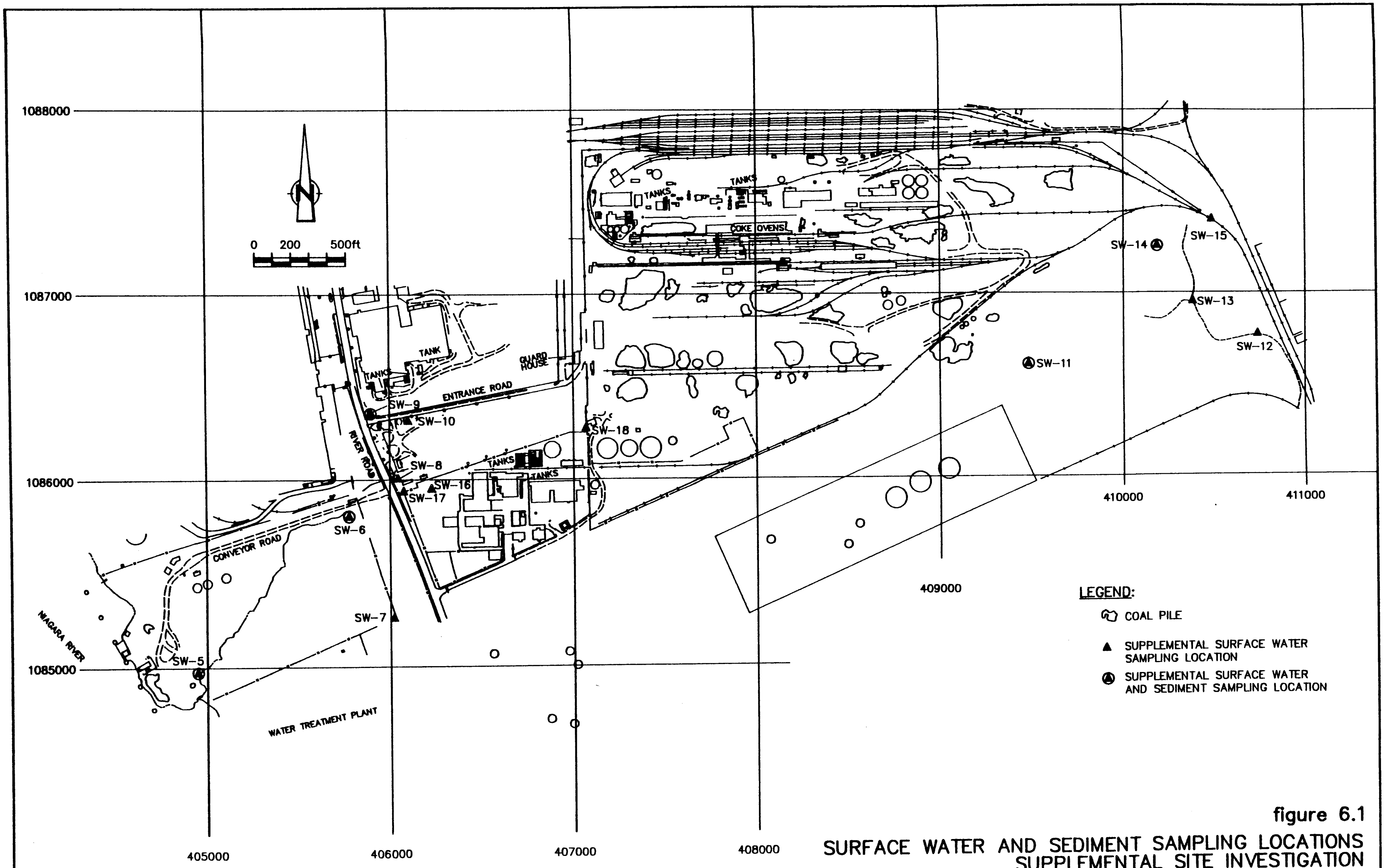

figure 6.1

SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

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2428-22/03/90-3-0 (P-04)

separate clean jar was used for sample retrieval at each location. Samples were obtained from beneath the water surface in the main flow of moving water or from the perimeter of the marshy areas.

Surface water samples were collected from all but two of the locations. At SW-7 and SW-13, there was no visible standing or moving water although there had been a considerable amount of precipitation over the previous two days. The surface water sampling information is summarized on the surface water sampling logs contained in Appendix E.

The surface water samples were divided into two groups for analysis. Five of the sample locations (SW-5, SW-6, SW-8, SW-10 and SW-14) were analyzed for the full parameter list initially used for the Round 1 groundwater samples. The samples collected at each location were as follows:

Analysis	*Volume*	*Preservative*	*Laboratory*
TCL VOCs	2 x 40 mL	HCl	AES
TCL BNAs	1 x 1 L	--	AES
Cyanide	1 x 500 mL	NaOH	AES
Cr+6	1 x 500 mL	--	AES
Oil and Grease	1 x 1 L	HCl	AES

At the remaining locations (SW-9, SW-11, SW-12 and SW-15) the analysis was conducted for the SSIs as follows:

Analysis	*Volume*	*Preservative*	*Laboratory*
SSI VOCs	2 x 40 mL	HCl	AES
PAHs	1 x 1 L	--	AES
Cyanide	1 x 500 mL	NaOH	AES
Cr+6	1 x 500 mL	--	AES
Oil and Grease	1 x 1 L	HCl	AES

As part of this first round of surface water samples, a blind duplicate, rinse blank, and MS/MSD sample were collected for Quality Assurance purposes. It should be noted that samples for TAL metals were inadvertently not collected at the five surface water locations for which the full TCL parameter list was to be analyzed for. These samples were collected during the next round of surface water sampling.

Table 6.1 summarizes the Round 1 surface water sampling activities.

6.2 ROUND 2 SURFACE WATER SAMPLING

Coincident with the third round of groundwater sampling, a second round of surface water sampling was conducted. All of the surface water locations were revisited. On December 19 and 20, 1989, samples were collected from SW-5, SW-6, SW-8 and SW-10 using the same sampling protocols as described previously. As the surface water was frozen at SW-9, SW-11, SW-12, SW-14 and SW-15, the metals samples at these locations were

TABLE 6.1

ROUND 1 SURFACE WATER SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
SW-5	SW-2428-DT-036	10-19-89	0920	10-19-89	7638	TCL analysis
SW-5MS	SW-2428-DT-036MS	10-19-89	0920	10-19-89	7638	TCL analysis
SW-5MSD	SW-2428-DT-036MSD	10-19-89	0920	10-19-89	7639	TCL analysis
SW-6	SW-2428-DT-037	10-19-89	0940	10-19-89	7639	TCL analysis
SW-6 Dup.	SW-2428-DT-038	10-19-89	1000	10-19-89	7640	TCL analysis
SW-8	SW-2428-DT-039	10-19-89	1020	10-19-89	7640	TCL analysis
SW-9	SW-2428-DT-024	10-16-89	1430	10-16-89	7140	SSI analysis
SW-10	SW-2428-DT-023	10-16-89	1445	10-16-89	7140	TCL analysis
SW-11	SW-2428-DT-042	10-19-89	1315	10-19-89	7642	SSI analysis
SW-12	SW-2428-DT-043	10-19-89	1330	10-19-89	7642	SSI analysis
SW-14	SW-2428-DT-040	10-19-89	1110	10-19-89	7641	TCL analysis
SW-15	SW-2428-DT-041	10-19-89	1120	10-19-89	7641	SSI analysis
Rinse Blank	SW-2428-DT-044	10-19-89	1350	10-19-89	7643	TCL analysis

Notes:

SW-7 and SW-13 were not sampled due to no visible standing water present in area of these locations.

not collected until March 15, 1990. The surface water sampling information is summarized on the surface water sampling logs contained in Appendix E. No visible water was again present at SW-7 and SW-13 during the revisit sampling. The sample volumes collected at each location were as follows:

Analysis	*Volume*	*Preservative*	*Laboratory*
TAL Metals	1 x 500 mL	HNO_3	AES
Cyanide	1 x 500 mL	NaOH	AES

It should be noted that the resampling for TAL metals was extended to include cyanide to provide confirmatory results. As well, the revisit to the surface water locations for metals sampling was extended to all of the previously sampled locations .

Three new sampling locations, SW-16, SW-17 and SW-18 were also added to the surface water sampling program during Round 2. These locations were selected to better evaluate the surface water pathways contributing to the water entering the culvert crossing under River Road and discharging in the area of SW-6. This was necessitated by the analytical results indicating chemical presence at SW-6 but not at SW-8. These three additional locations were sampled observing the same protocols as established during the first round sampling, and the collected samples were analyzed for the full TCL parameter list (including TAL metals). The surface water sampling information is summarized on the surface water sampling logs contained in Appendix E. The volumes collected at each location were as follows:

Analysis	*Volume*	*Preservative*	*Laboratory*
TCL VOCs	2 x 40 mL	HCl	AES
TCL BNAs	1 x 1 L	--	AES
TAL Metals	1 x 500 mL	HNO_3	AES
Cyanide	1 x 500 mL	NaOH	AES
Cr+6	1 x 500 mL	--	AES
Oil and Grease	1 x 1 L	HCl	AES

During the Round 2 sampling of surface waters, two blind duplicate, two rinse blanks and a MS/MSD sample were also collected for Quality Assurance purposes. Table 6.2 summarizes the Round 2 surface water sampling activities.

6.3 SEDIMENT SAMPLING

Following review of the Round 1 surface water analytical data, a decision was made to sample the sediment at and downstream of surface water sampling locations which had chemistry present. Five sediment sampling locations were selected corresponding to the surface water sampling locations SW-5, SW-6, SW-9, SW-11 and SW-14. On December 20, 1989, sediment samples were collected at SW-5, SW-6 and SW-9, however, frozen ground and surface water conditions postponed the collection of the remaining two sediment samples until March 15, 1990. Figure 6.1 presents the sediment sampling locations.

TABLE 6.2

ROUND 2 SURFACE WATER SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
SW-5	SW-2428-DT-075	12-20-89	1415	12-20-89	7954	Metals and cyanide
SW-5 Dup.	SW-2428-DT-076	12-20-89	1430	12-20-89	7954	Metals and cyanide
SW-6	SW-2428-DT-079	12-20-89	1520	12-20-89	7955	Metals and cyanide
SW-8	SW-2428-DT-074	12-20-89	1345	12-20-89	7953	Metals and cyanide
SW-8MS	SW-2428-DT-074MS	12-20-89	1345	12-20-89	7954	Metals and cyanide
SW-8MSD	SW-2428-DT-074MSD	12-20-89	1345	12-20-89	7954	Metals and cyanide
SW-10	SW-2428-DT-069	12-20-89	1110	12-20-89	7953	Metals and cyanide
SW-16	SW-2428-DT-064	12-19-89	1450	12-19-89	7947	TCL analysis
SW-16MS	SW-2428-DT-064MS	12-19-89	1450	12-19-89	7948	TCL analysis
SW-16MSD	SW-2428-DT-064MSD	12-19-89	1450	12-19-89	7948	TCL analysis
SW-17	SW-2428-DT-066	12-19-89	1545	12-19-89	7949	TCL analysis
SW-17 Dup.	SW-2428-DT-067	12-19-89	1600	12-19-89	7950	TCL analysis
SW-18	SW-2428-DT-068	12-19-89	1610	12-19-89	7950	TCL analysis
Rinse Blank	SW-2428-DT-078	12-20-89	1515	12-20-89	7955	Metals and cyanide
Rinse Blank	SW-2428-DT-065	12-19-89	1530	12-19-89	7949	TCL analysis
Supplemental Samples						
SW-9	SW-2428-DT-090	03-15-89	1650	03-15-89	7748	Metals and cyanide
SW-11	SW-2428-DT-086	03-15-89	1600	03-15-89	7747	Metals and cyanide
SW-12	SW-2428-DT-089	03-15-89	1630	03-15-89	7748	Metals and cyanide
SW-14	SW-2428-DT-082	03-15-89	1500	03-15-89	7747	Metals and cyanide
SW-15	SW-2428-DT-084	03-15-89	1520	03-15-89	7747	Metals and cyanide
SW-15 Dup.	SW-2428-DT-085	03-15-89	1530	03-15-89	7747	Metals and cyanide

At each sampling location, sediment samples were collected from below the water surface. Samples were collected as a composite of the two sides and the middle of the surface water pathway, and placed into a clean sample container. The sediment samples were collected using a precleaned stainless steel sampling trowel. The sediment sampling information, including soil descriptions, is summarized on the sediment sampling logs contained in Appendix F.

The collected sediment samples were submitted to the analytical facility for analysis for the SSI parameters (VOCs, PAHs, Cyanide, Cr+6, Oil and grease). The sample volume collected at each sample location was one liter. Two blind duplicate, a rinse blank and a MS/MSD sample were also collected for Quality Assurance purposes.

Table 6.3 summarizes the sediment sampling activities.

TABLE 6.3

SEDIMENT SAMPLING SUMMARY
TONAWANDA COKE CORPORATION

Sample Location	*Sample Number*	*Sample Date*	*Sample Time*	*Shipping Date*	*Chain-of-Custody Number*	*Comments*
SW-5	S-2428-DT-077	12-20-89	1440	12-20-89	7952	–
SW-6	S-2428-DT-080	12-20-89	1545	12-20-89	7952	–
SW-6MS	S-2428-DT-080MS	12-20-89	1545	12-20-89	7952	–
SW-6MSD	S-2428-DT-080MSD	12-20-89	1545	12-20-89	7952	–
SW-9	S-2428-DT-072	12-20-89	1135	12-20-89	7952	–
SW-9 Dup.	S-2428-DT-073	12-20-89	1150	12-20-89	7952	–
Field Blank	S-2428-DT-081	12-20-89	1715	12-20-89	7952	–
SW-11	S-2428-DT-087	3-15-90	1600	3-15-90	7747	Ground frozen on 12-20-89
SW-11 Dup.	S-2428-DT-088	3-15-90	1610	3-15-90	7747	Ground frozen on 12-20-89
SW-14	S-2428-DT-083	3-15-90	1500	3-15-90	7747	Ground frozen on 12-20-89

7.0 EQUIPMENT CLEANING

All downhole equipment used in the installation of the wells, boreholes and test pits was cleaned prior to each use. The cleaning procedure used for this equipment involved removal of all soil with a wire brush followed by a pressurized hot water wash. The well casings and screens and were also cleaned by a pressurized hot water wash prior to installation as well as the split spoon sampling equipment when chemical samples were not being collected.

All sampling equipment including split spoons for chemical sampling, soil sampling spatulas, sampling bailers and water level indicators were cleaned prior to each usage. The cleaning procedure for this equipment was as follows:

i) rinse with isopropanol,
ii) rinse with hexane,
iii) rinse with isopropanol,
iv) rinse with distilled deionized water, and
v) air dry.

The large equipment, backhoe and drill rig, had all loose fill type material removed from the wheels and undercarriage prior to driving to the next well, borehole or test pit in order to prevent tracking of the material over the Site. Prior to leaving the Site, this equipment was completely cleaned, including pressurized water wash, and inspected by the Site representative.

8.0 HEALTH AND SAFETY

The Health and Safety Plan designed for the field activities at the TCC facility and contained in the Work Plan was administered by the CRA Site representative during all of the Site investigation activities. All personnel actively involved with the drilling and well installations and the various groundwater, surface water, soil and sediment sample collection programs were required to wear the following personal protective equipment:

- hardhats,
- safety work shoes,
- safety glasses with side shields
- disposable Tyvek coveralls,
- rubber gloves,
- rubber boots, and
- half-face respirator (available for use when organic vapors were detected).

During some sampling activities, the larger rubber gloves were replaced by latex sampling gloves. In all cases, a new pair of latex gloves was worn for each individual sample set collected.

During all active well drilling and test pit excavation work an air monitoring program was conducted by the Site representative. Periodic measurements of the levels of organic vapors and air particulates were taken using an HNu photoionization detector and a Sibata dust indicator, respectively. Prior to the initiation of each well installation or test pit excavation, measurements were taken to establish background organic vapor and air particulate levels. During actual construction, the levels were monitored approximately hourly. For the test pit excavations only one set of readings was recorded due to the short duration of each excavation. For the well installations readings were only taken during active drilling operations resulting in one or two sets of readings at each location except at MW9-89, MW10-89 and MW11-89 where rainy weather prevented the use of the air monitoring equipment entirely. Table 8.1 presents a summary of the air monitoring readings for each well/test pit with only the highest recorded level noted when more than one set of readings were taken.

No excursions above specified levels were noted. Although the organic vapor level was greater than 5 ppm above background at TP-N, a subsequent check of the upwind levels indicated that background levels were also exceeded 5 ppm. Thus, TP-N was not the source of the elevated organic vapor levels.

TABLE 8.1

AIR MONITORING DATA SUMMARY
TONAWANDA COKE CORPORATION

	HNU Photoionization Detector (ppm)		*Sibata Dust Indicator (cpm)*	
Location	*Background*	*Reading Downwind*	*Background*	*Reading Downwind*
MW8-89	0.2	0.2	24	25
MW12-89	0.4	0.4	2	5
MW13-89	0.5	0.5	2	5
MW14-89	0.2	0.2	24	25
MW15-89	0.2	0.2	19	18
MW16-89	0.3	0.3	16	16
MW17-89	0.2	0.2	19	21
TP-M	4.2	4.2	38	44
TP-N	1.2*	6.4	38	40
TP-Q	0.6	0.6	44	45
TP-S	0.4	0.4	56	57
TP-T	5.0	5.6	38	32
TP-U	5.0	5.4	38	47
TP-V	5.0	5.0	38	33
TP-W	5.0	5.0	38	38

Note: No air monitoring occurred at MW9-89, MW10-89 or MW11-89 due to rain.

* Following the initiation of this test pit, the background levels were revised to 6.4 ppm by checking upwind.

9.0 SITE GEOLOGY AND HYDROGEOLOGY

9.1 SITE GEOLOGY

The geology at the TCC facility has been determined from the soil samples collected during monitoring well installations and test pit excavations and boreholes during both historic and current investigations conducted by TCC. The soil encountered beneath the Site can be divided into two types of material or stratigraphic units: fill material and glaciolacustrine clay.

Fill material is present as the uppermost stratigraphic unit over the entire Site as noted at all of the monitoring well and test pit locations. The fill unit typically consists of mixtures of silt, clay and gravel along with some slag, cinders and coke ranging in thickness from 0.9 to 6.3 feet. However, MW8-89, TP-Q and TP-S were located in the former disposal area (Site 108) east of River Road and at these locations the fill unit exceed 10.5 feet in thickness. The fill encountered in this area was a composite of the following: silt, sand, gravel, clay, cinders, slag, coke, brick, wood, concrete, glass, plastic, metal and rubber.

Underlying the fill material is a native glaciolacustrine deposit. This unit, which is present over the entire Site, is composed primarily of a red-brown silty clay with some silt and gravel lenses. Native clayey soil was encountered at all monitoring well and test pit locations with the exception of MW8-89, TP-Q and TP-S where the total depth of the fill unit was not penetrated. MW8-89 was completed in the uppermost waterbearing unit and groundwater infiltration at TP-Q and TP-S prevented test pit excavation to the native clay material. The thickness of the native glaciolacustrine clay unit beneath the Site is unknown as the monitoring wells and test pits were completed in the fill unit. The Malcolm-Pirnie Phase II report indicates that borings completed approximately 300 feet east of the Site indicated that the clay stratum averages more than 50 feet in thickness.

Directly adjacent to the Niagara River, some alluvial sands were observed beneath the fill during the previous installation of MW-7. None of the well installations during this investigation revealed this alluvial stratum.

Figure 9.1 presents the location of a geologic cross-section which is illustrated in Figure 9.2. Table 9.1 summarizes the stratigraphic information collected at the monitoring well and test pit/borehole locations.

9.2 SITE HYDROGEOLOGY

Beneath the TCC Site, the fill strata contains the uppermost waterbearing unit although this unit is not extensive in depth due to the shallow fill depth across the Site. This waterbearing unit is not suitable for use as a source of drinking water. The underlying clay strata acts as a significant aquitard to both horizontal and vertical groundwater movement. Due to the extensive depth of the clay and its low hydraulic conductivity, the groundwater within the fill unit is effectively isolated from the much larger

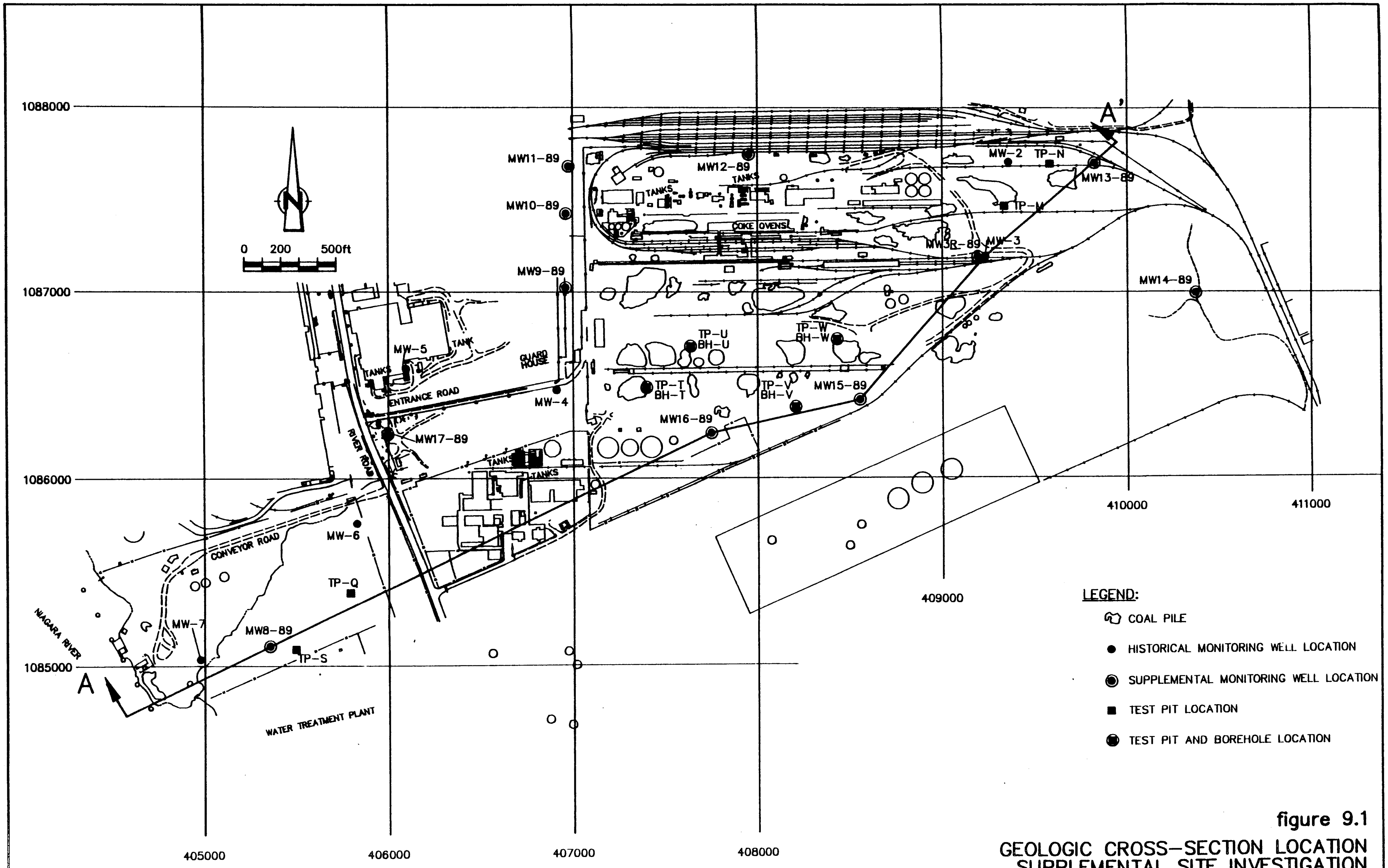

figure 9.1

GEOLOGIC CROSS-SECTION LOCATION
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

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2428-17/04/90-3-0 (P-06)

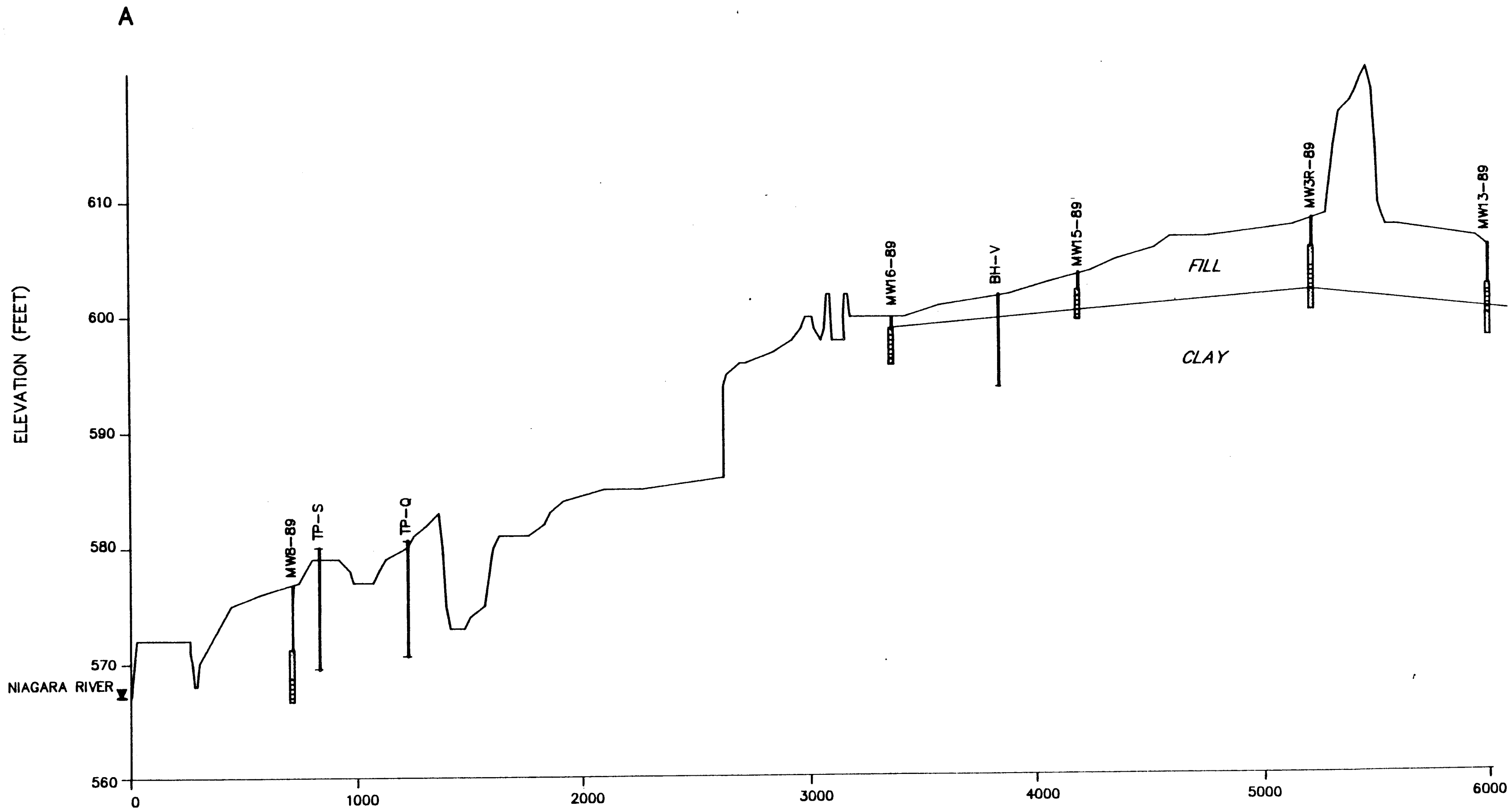

figure 9.2

GEOLOGIC CROSS-SECTION A-A'
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

CRA

2428-19/04/90-3-0 (X-01)

TABLE 9.1

STRATIGRAPHIC SUMMARY

Well/Test Pit Location	*Ground Elevation (ft.AMSL)*	*Depth of Fill (feet)*	*Top of Clay Elevation (ft. AMSL)*	*Depth of hole (feet)*
MW3R-89	609.0	6.3	602.7	8.0
MW8-89	576.7	>10.0	<566.7	10.0
MW9-89	602.8	4.1	598.7	6.0
MW10-89	603.9	4.5	599.4	6.0
MW11-89	602.0	2.1	599.9	6.0
MW12-89	606.3	5.0	601.3	6.0
MW13-89	606.2	5.5	600.7	8.0
MW14-89	603.6	2.1	601.5	6.0
MW15-89	603.8	3.3	600.5	4.0
MW16-89	599.9	0.9	599.0	4.0
MW17-89	576.9	4.9	572.0	6.0
TP-M	609.6	3.5	606.1	3.5
TP-N	606.9	5.0	601.9	5.0
TP-Q	580.6	>10.0	<570.6	10.0
TP-S	580.0	>10.5	<569.5	10.5
BH-T	602.1	4.6	597.5	6.0
BH-U	603.9	4.0	599.9	8.0
BH-V	601.9	2.0	599.9	8.0
BH-W	604.6	6.3	598.3	12.0

groundwater aquifer found within the upper bedrock. The primary regional source of drinking water is the Niagara River.

The groundwater flow in the fill strata at the TCC Site mimics the surface topography to a great extent. The general direction of groundwater flow is to the west towards the Niagara River as illustrated by Figure 9.3. The groundwater information on this figure was obtained prior to Round 3 sampling. Table 9.2 presents all the groundwater elevation data collected during this investigation. The gradient of the surface of the identified water table is very slight across most of the eastern portion of the Site (approximately 0.003 feet/foot) but increases significantly to approximately 0.025 feet/foot in the area between the TCC facility and River Road which coincides with a significant change in ground surface elevation. The groundwater gradient then decreases again to approximately 0.006 feet/foot across the remaining western portion of the Site leading to the Niagara River. In the east-central portion of the Site there is a slight groundwater mound with flow components towards the north, east and south however, this mound is expected to be very localized. For example, the groundwater flow component to the south corresponds to the slope of the ground surface as it dips toward a low marshy area southeast of the Site. The surface water within this marshy area is subsequently redirected to the west and therefore it is expected that the groundwater flow would also be directed to the west following the signficant ground surface dip.

In summary, most of the groundwater beneath the Site is directed to the west and toward the Niagara River. The flow component to the south is expected to be redirected to the west without any significant

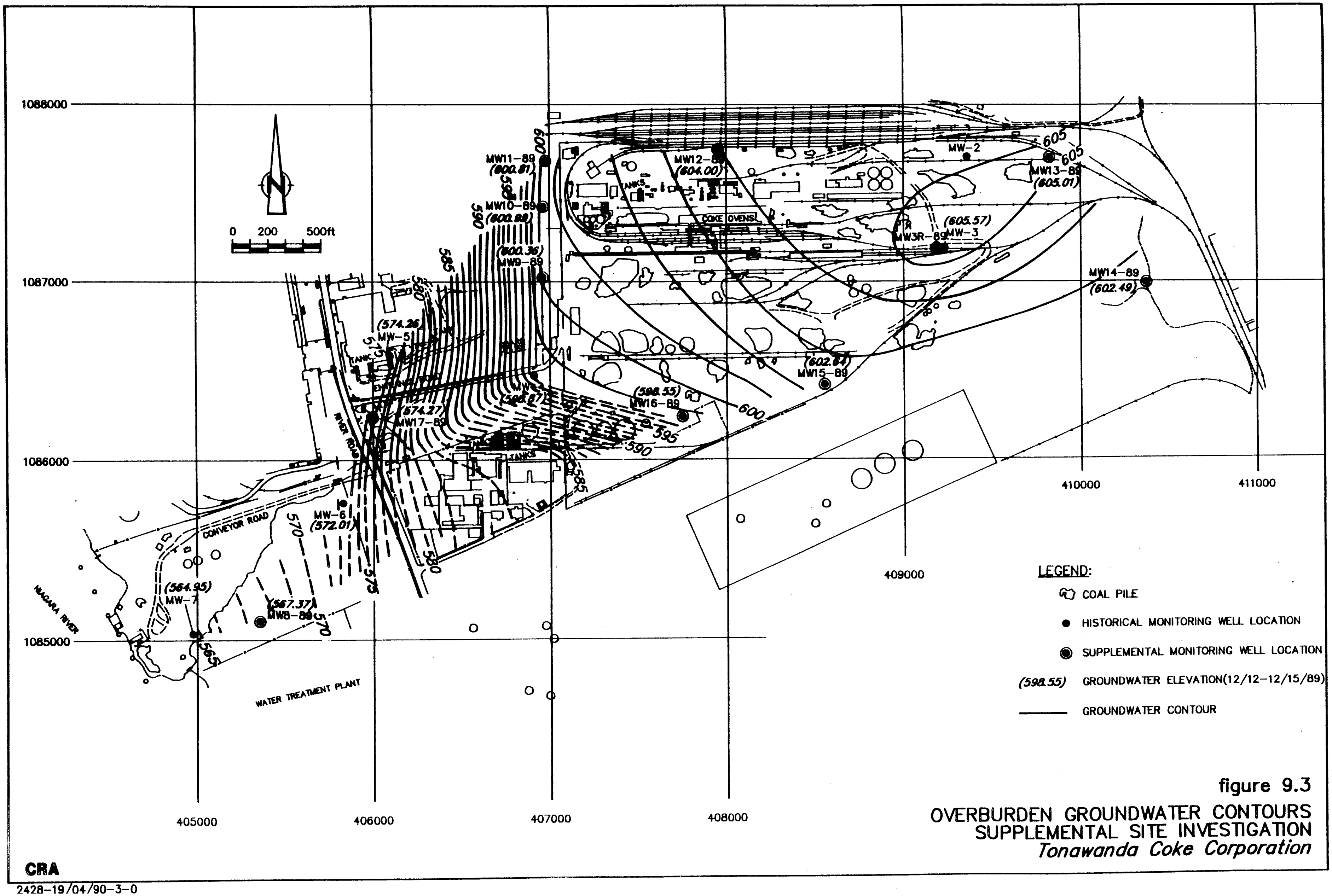

figure 9.3

OVERBURDEN GROUNDWATER CONTOURS
SUPPLEMENTAL SITE INVESTIGATION
Tonawanda Coke Corporation

2428-19/04/90-3-0

TABLE 9.2

GROUNDWATER ELEVATIONS

	Top of Casing Elevation	*Development (6/21 to 6/27/89)*	*Round 1 (6/26 to 6/28/89)*	*Round 2 (10/9 to 10/18/89)*	*Round 3 (12/12 to 12/15/89)*
MW-2	609.57		606.42	604.94	
MW-3	610.49		606.39	603.49	
MW3R-89	611.16	605.15			605.93
MW-4	602.84			598.52	598.87
MW-5	580.56			571.56	574.26
MW-6	579.78			569.21	572.01
MW-7	575.15			568.70	564.95
MW8-89	578.99	570.65	N/A	567.39	567.37
MW9-89	604.92	601.02	600.47	599.12	600.36
MW10-89	605.54	601.54		600.19	600.99
MW11-89	603.77	601.39	601.09	600.84	600.81
MW12-89	609.19	605.04		603.85	604.00
MW13-89	608.39	605.72		603.14	605.01
MW14-89	605.57	602.82	N/A	601.50	602.49
MW15-89	605.99	603.64		603.05	602.69
MW16-89	603.46	599.74	N/A	599.64	598.55
MW17-89	579.15	576.23	N/A	572.67	574.27

Notes:

1) N/A indicates initial water level not available as purging was completed coincident or as a continuation of development.
2) A blank indicates that the particular well was not visited during the particular sampling round.

impact on the groundwater regimes beneath the adjacent properties to the south. The extent of the flow component to the north and east is unknown, however, the gradient in this direction is very small and it is expected that the flow direction would eventually proceed west towards the Niagara River like the groundwater and surface water to the south of the Site.

9.3 RECOVERY TESTS

During the first and second round sampling events, each well was recovery tested once. The recovery tests were completed following development/purging and sampling. Each test was conducted by monitoring the water level within the well as it recovered to its natural static condition. The recovery data for all 17 monitoring wells at the TCC Site is presented in Appendix G.

The recovery tests were conducted in order to determine the hydraulic conductivity of the Site fill materials. As many of the Site wells had shallow water columns, the analytical technique proposed by Bouwer and Rice is the most appropriate. The equation used was as follows:

$$K = \frac{r_e^2 \ln (Re/R) \ln (y_1/y_2)}{2Lt}$$

where:

K = hydraulic conductivity (ft/min)

r_e = equivalent radius of well

Re = effective radius over which head loss is dissipated (feet)

R = radius of borehole (feet)

y_1 = water level at time t_1 (feet)

y_2 = water level at time t_2 (feet)

L = length of saturated interval (feet)

t = time between y_1 and y_2 (min)

The equivalent radius (r_e) is required as the recovery tests were conducted within the portion of the wells governed by the sandpack porosity (i.e. the dewatering involves both the water in the pipe and in the sandpack). This radius is calculated as follows:

$$r_e^2 = r_p^2 + n\,(r_b^2 - r_p^2)$$

where:

r_p = radius of the well pipe (feet)

n = porosity of the sandpack (assumed 0.3)

r_b = radius of the borehole

Using the above formulas, the hydraulic conductivity of each monitoring well was calculated and is listed below:

MW-2	1.3×10^{-3} cm/sec
MW-3	no drawdown during purging
MW3R-89	no drawdown during purging
MW-4	3.6×10^{-5} cm/sec
MW-5	5.8×10^{-5} cm/sec
MW-6	1.4×10^{-3} cm/sec
MW-7	3.9×10^{-4} cm/sec
MW8-89	2.0×10^{-3} cm/sec
MW9-89	4.4×10^{-5} cm/sec
MW10-89	3.2×10^{-5} cm/sec
MW11-89	4.3×10^{-4} cm/sec
MW12-89	1.1×10^{-2} cm/sec
MW13-89	2.3×10^{-3} cm/sec
MW14-89	8.6×10^{-5} cm/sec
MW15-89	7.4×10^{-4} cm/sec
MW16-89	3.8×10^{-4} cm/sec
MW17-89	2.3×10^{-4} cm/sec
geometric mean	3.6×10^{-4} cm/sec

10.0 ANALYTICAL RESULTS

The analytical results for the TCC Supplemental Site Investigation were made available to CRA following each sampling event and prior to commencing with the next field program. Appendices H, I and J present the analytical data for the sampling rounds one, two and three, respectively. Upon receipt of the analytical data report, CRA has performed a Quality Assurance/Quality Control (QA/QC) assessment of the data and the laboratory procedures. Each sampling round included the collection and analyses of field duplicate, rinsate blank, and field blank samples for ten percent of all samples collected for each group of samples. Matrix spike/matrix spike duplicate (MS/MSD) samples were submitted at a frequency of 20 percent for all samples collected during the Supplemental Site Investigation.

In addition to the above-mentioned QA/QC samples and investigative samples the laboratories analyzed the following analytical QA/QC samples:

i) laboratory blanks
ii) laboratory duplicates
iii) matrix spike/matrix spike duplicates
iv) surrogate spikes
v) laboratory check samples

Although various qualifers were required for some of the sample data, most of the sample data and associated QA/QC data was considered acceptable. The qualifiers identified some difficulties with the laboratory blanks, matrix spikes analyses and surrogate spikes analyses but the generated data is still valuable for use in evaluation as the values are correct in their order of magnitude. A detailed discussion of the QA/QC data review and the QA/QC data for the three sampling rounds is presented in Appendix K. The identified qualifiers have been included in all analytical data summary tables presented in this section of the report.

10.1 SOIL SAMPLES

10.1.1 Test Pit Excavations

Four test pit soil samples were submitted for analysis as described previously in Section 3.0. The soil samples were analyzed for the full TCL/TAL parameter list in order to fully characterize the fill materials encountered in the coal storage and former landfill areas. A summary of the analytical results for the four test pit samples is presented in Table 10.1 indicating only the detected compounds for each parameter group.

Some discussion of the analytical results has been presented previously in Section 5.2 which discusses the selection of the SSI parameters for subsequent sampling activities. Table 10.1 indicates that most of the detected VOCs were identified at TP-1 which is located in the former landfill area (Site 108). However, in all instances the detected concentrations were only marginally above the detection limit (6 µg/kg). Two exceptions to the above general statement include methylene chloride and acetone but both

TABLE 10.1

TEST PIT SOIL SAMPLE ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source	*TP-1(Q&S)*	*TP-1(Q&S) dup*	*TP-2(T&U)*	*TP-3(V&W)*	*TP-4(M&N)*	*Background*
Sample ID	*S-2428-DT-001*	*S-2428-DT-005*	*S-2428-DT-002/002re*	*S-2428-DT-003/003re*	*S-2428-DT-004/004re*	*Surface Soil*
Date	*6-19-89*	*6-19-89*	*6-19-89*	*6-19-89*	*6-19-89*	*Concentrations*
TCL VOCs (µg/Kg)						
Methylene Chloride	44*	29*	27*/110	46*/46*	30*/73*	
Acetone	42*	24*	–/260C	37*/21*	49*/94*	
Toluene	9	8	ND(7)	ND(6)	ND(7)	
Total Xylenes	11	11	ND(7)	ND(6)	ND(7)	
TCL BNAs (µg/Kg)						
Napthalene	14,000	21,000	ND(900)	ND(1,900)	ND(2,300)	
2-Methynapthalene	7,400	14,000	ND(900)	ND(1,900)	ND(2,300)	
Acenaphthylene	2,900	5,000	ND(900)	ND(1,900)	ND(2,300)	
Acenaphthene	970	ND(2,100)	ND(900)	ND(1,900)	ND(2,300)	
Dibenzofuran	640	ND(2,100)	ND(900)	ND(1,900)	ND(2,300)	
Fluorene	4,600	6,000	ND(900)	ND(1,900)	ND(2,300)	
Phenanthrene	17,000	29,000	1,800	4,400	5,200	
Anthracene	ND (4,200)	5,000	ND(900)	ND(1,900)	ND(2,300)	
Fluoranthene	8,800	20,000	3,600	14,000	9,900	
Pyrene	12,000	18,000	2,600	12,000	7,400	
Benzo(a)Anthracene	4,400	9,800	1,700	8,700	4,700	
Chrysene	5,700	11,000	2,200	11,000	5,600	
Benzo(b)Fluoranthene (1)	5,200	11,000	3,800	17,000	7,400	

TABLE 10.1

TEST PIT SOIL SAMPLE ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source	*TP-1(Q&S)*	*TP-1(Q&S) dup*	*TP-2(T&U)*	*TP-3(V&W)*	*TP-4(M&N)*	*Background*
Sample ID	*S-2428-DT-001*	*S-2428-DT-005*	*S-2428-DT-002/002re*	*S-2428-DT-003/003re*	*S-2428-DT-004/004re*	*Surface Soil*
Date	*6-19-89*	*6-19-89*	*6-19-89*	*6-19-89*	*6-19-89*	*Concentrations*
TCL BNAs (µg/Kg)						
Benzo(k)Fluoranthene (1)	5,200	11,000	3,800	17,000	7,400	
Benzo(a)Pyrene	4,800	8,700	2,400	11,000	4,400	
Indeno(1,2,3-cd)Pyrene	2,100	3,400	ND(900)	4,500	ND(2,300)	
Dibenzo(a,h)Anthracene	510	ND(2,100)	ND(900)	3,200	ND(2,300)	
Benzo(g,h,i)Perylene	2,100	3,600	940	6,200	2,500	
TAL Metals (mg/Kg)						
Aluminum	9,570	13,400	848	87.6	1,320	4,500-100,000
Arsenic	10.6	4.1	3.1	2.2	0.59	<1-9.3
Barium	118	105	28.6	9.0	40	10-3,000
Beryllium	0.69	0.7	ND(0.13)	ND(0.11)	ND(0.14)	<1-5
Calcium	27,100	41,600	750	405	792	
Chromium	116.1	17.6	6.7	4.8	5.2	7-1,500
Cobalt	10	12.1	3.8	ND(0.74)	3.3	3-50
Copper	43.2	68.7	11.2	10.0	16.4	3-300
Iron	35,700	21,800	3,210	329	6,730	5,000-50,000
Lead	81.8	36.3	3.2	5.8	10.1	<10-70
Magnesium	8,190	12,500	72.3	ND(15.4)	162	
Manganese	579	488	41.7M	39.0	109	20-3,000
Mercury	1.0	0.4	ND(0.11)	ND(0.11)	ND(0.14)	0.02-1.50
Nickel	16.4	22.2	7.1	8.9	ND(5.1)	<5-150

TABLE 10.1

TEST PIT SOIL SAMPLE ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source *Sample ID* *Date*	*TP-1(Q&S)* *S-2428-DT-001* *6-19-89*	*TP-1(Q&S) dup* *S-2428-DT-005* *6-19-89*	*TP-2(T&U)* *S-2428-DT-002/002re* *6-19-89*	*TP-3(V&W)* *S-2428-DT-003/003re* *6-19-89*	*TP-4(M&N)* *S-2428-DT-004/004re* *6-19-89*	*Background* *Surface Soil* *Concentrations*
TAL Metals (mg/Kg)						
Potassium	1290*	2,090*	3,430	ND(390)	522*	
Selenium	ND(0.74)	ND(1.3)	0.54W	0.31	ND(0.26)	0.1-4.0
Sodium	ND(361)	ND(399)	1,350	ND(349)	ND(429)	
Vanadium	46.7	33.5	9.9	28.8	9.4	0.7-98
Zinc	136	95.5	34.0	17.4	42.0	<5-300
Other Compounds (mg/Kg)						
Cyanide	186	271	0.68W	ND(0.56)	1.5	
Oil & Grease	3,300	38,000	180	240M	250	
Hexavalent Chromium	<0.5R**	<0.5R**	<0.5R**	<0.5R*	<0.5R**	
TCLP VOCs (μg/L)						
Benzene	4J	2J	ND(5)	ND(5)	ND(5)	
Methylene Chloride	31*	14*	15*	11*	15*	
2-Butanone	38	ND(10)	ND(10)	ND(10)	ND(10)	
Toluene	75	5	ND(5)	ND(5)	ND(5)	
TCLP BNAs (μg/L)						
3-MethylPhenol (1)	all phenolic data qualified X	ND(10)	all phenolic data qualified X	ND(10)	ND(10)	
4-MethylPhenol (1)		ND(10)		ND(10)	ND(10)	
Pentachlorophenol		ND (20)		ND(20)	ND(20)	

TABLE 10.1

TEST PIT SOIL SAMPLE ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source *Sample ID* *Date* *Concentration*	*TP-1(Q&S)* *S-2428-DT-001* *6-19-89*	*TP-1(Q&S) dup* *S-2428-DT-005* *6-19-89*	*TP-2(T&U)* *S-2428-DT-002/002re* *6-19-89*	*TP-3(V&W)* *S-2428-DT-003/003re* *6-19-89*	*TP-4(M&N)* *S-2428-DT-004/004re* *6-19-89*	***Background Surface Soil Concentrations***
TCLP Metals (µg/L)						
Arsenic	8.4	49.3	6.8	2.1	6	
Barium	769	679	329	101	288	
Chromium	4.8	132	ND(3.8)	16.9	9.8	
Lead	14.5	389	13.0	41.8	16.9	
Mercury	ND(0.20)	37.2	ND(0.20)	ND(0.20)	ND(0.20)	
Selenium	ND(10.0)	ND(5.0)	ND(10.0)	1.5	ND(10.0)	

Notes:

All other TCL/TAL/TCLP parameters were not detected in any samples.
re Samples S-2428-DT-002,003 and 004 were reanalyzed for VOCs (sample IDs noted with the suffix - re) due to outlying surrogate spike recoveries. The reanalyzed samples showed similar surrogate spike recoveries.
C Denotes a compound whose concentration is estimated due to unsatisfactory percent differences (%D's) in response factors determined from the calibration.
* Also present in laboratory blanks, indicating possible/probable laboratory contamination.
ND Not detected above quantifiable limits stated in parentheses.
R Unusable data due to holding time exceedence.
** The concentration of Cr+6 may have been equal to, however not greater than, the amount of total chrome detected in the associated sample.
M Indicated matrix spike recoveries were outside control limits and may reflect a high bias in sample data.
W Indicated spike recoveries were outside control limits and may reflect a low bias in sample data.
(1) Indistinguishable isomers, reported value is total concentration.
X Unusable data due to low surrogate spike recoveries. All sample data for the affected compounds were non-detected.

were also present in laboratory blanks indicating probable laboratory contamination. Thus VOCs are not present at significant levels.

The analytical results for the BNAs indicate that there is an assortment of PAH compounds present in all the test pits soil samples indicating widespread PAH presence as expected due to coal/coke production. Table 10.1 also indicates that dibenzofuran was detected at a concentration of 640 μg/kg at TP-1. This dibenzofuran concentration is low by comparison to the identified widespread PAH presence. The presence of the PAH compounds in the fill material is not unexpected as these compounds readily adsorb to the soil particles. However, this adsorption also virtually prevents the migration of the PAH compounds via the groundwater. This is proven by the results of the groundwater sampling program discussed in Section 10.2.

Table 10.1 also lists the detected inorganic analytes, specifically the heavy metals. Only arsenic and lead were detected (TP-1) at concentrations which were above the background surface soil concentrations listed in "Trace Elements in Soils and Plants" by Pendias and Pendias. Cyanide was detected at elevated levels at TP-1 and oil and grease was detected in all the test pit soil samples. The analytical results for Cr+6 indicated concentrations less than 0.5 mg/kg at all four test pits, however, the data must be used with caution due to holding time exceedence. The maximum expected Cr+6 concentration would, however, not be greater than the total chromium concentration (4.8 to 6.7 mg/kg except at TP-1 where 17.6 and 116.1 mg/kg were detected in the duplicate soil samples) for each test pit soil sample. It should be noted that Cr+6 was not detected in the underlying clay samples and only detected in six of the 36 groundwater samples but not above groundwater standards.

The TCLP analyses did not indicate any significant chemistry present. Some low level VOCs were present at TP-1 and several metals were detected in all four test pit soil samples. None of the parameters present exceeded the TCLP regulatory levels, however, estimated concentrations of benzene and detected levels of chromium, lead and mercury for the leachate collected from the TP-1 duplicate test pit soil sample did exceed drinking water standards.

In summary, the low levels of VOCs and metals in the fill materials are of no significance. PAHs and oil and grease are prevalent across the entire Site and cyanide is present in isolated instances and the presence of these compounds will be addressed in the Environmental Assessment in Section II. The determined SSIs for subsequent groundwater and surface water sampling programs includes all of the identified parameters characterizing the Site fill materials.

10.1.2 Clay Boreholes

Following the review of the test pit soil sample analytical results, it was decided to sample the clay underlying the fill in order to determine whether the chemicals present in the fill materials had migrated into the clay. Boreholes were located at similar locations to the initial test pits in the coal storage area (TP-T, U, V and W) and the two collected composite

TABLE 10.2

BOREHOLE SOIL SAMPLE ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Sample ID *Source* *Date*	*S-2428-DT-021* *BH-1(T&U)* *10-16-89*	*S-2428-DT-022* *BH-2(V&W)* *10-16-89*	*Background* *Surface Soil* *Concentrations*
TCL VOCs (µg/kg)	none detected		
TCL BNAs (µg/kg)			
Bis(2-ethylhexyl)phthalate	8.0	1.0	
TAL Metals (mg/kg)			
Aluminum	10,200	11,800	4,500-100,000
Arsenic	1.90	1.80	<1-9.3
Barium	47.0	30.0	10-3,000
Beryllium	1.60	1.60	<1-5
Cadmium	0.15	0.15	
Calcium	36,780	22,400	
Chromium	15.0	13.0	7-1,500
Copper	17.0	18.0	3-300
Cobalt	10.0	13.0	3-50
Iron	180	179	5,000-50,000
Lead	4.40	4.10	<10-70
Magnesium	16,500	16,500	
Manganese	530	480	20-3,000
Nickel	25.5	24.0	<5-150
Potassium	3,260	3,080	
Sodium	630	690	
Vanadium	17.7	14.0	0.7-98
Zinc	64.0	70.0	<5-300
Other Compounds (mg/kg)			
Oil and Grease	419	1050	

Note:

All other TCL/TAL parameters, cyanide and Cr+6 were not detected in any sample.

clay soil samples were analyzed for the full TCL/TAL parameters except for the TCLP analyses. Table 10.2 lists the detected compounds from each parameter group.

No VOCs were detected in either clay sample. One BNA [bis(2-ethylhexyl)phthalate] was detected at low-level concentrations (8.0 and 1.0 µg/L) in both clay samples. Various metals were detected in both clay samples but all concentrations were within expected background levels. There was also no significant difference in overall metals concentrations in comparison with the test pit fill soil sample analytical results. Oil and grease was detected in both clay samples but cyanide and Cr+6 were not detected in either.

In summary, no significant organic chemistry was noted in the clay underlying the fill in the coal storage area and the inorganic presence was within expected levels. It does not appear that the underlying clay has been permeated by the surface soil (fill) contamination present at the TCC Site.

10.2 GROUNDWATER SAMPLES

10.2.1 VOCs

During the initial round of groundwater sample collection, analysis was conducted for the full TCL list of volatile organic compounds. Following review of the Round 1 data, a set of Site-Specific

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source	*MW-2*	*MW-2 dup*	*MW-2 dup*	*MW-2*	*MW-3*	*MW-3 dup*	*MW-3*
Sample ID	*W-2428-DT-004*	*W-2428-DT-005*	*W-2428-DT-006*	*W-2428-DT-017*	*W-2428-DT-007*	*W-2428-DT-008*	*W-2428-DT-032*
Date	*6/28/89*	*6/28/89*	*6/28/89*	*10/11/89*	*6/28/89*	*6/28/89*	*10/18/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Methylene Chloride	ND(5)	ND(5)	ND(5)	NA	ND(5)	ND(5)	NA
Acetone	ND(10)	ND(10)	ND(10)	NA	ND(10)	ND(10)	NA
1,2-Dichloroethene (total)	ND(5)	ND(5)	ND(5)	ND(1.0)	ND(5)	ND(5)	ND(1.0)
1,1,1-Trichloroethane	ND(5)	ND(5)	ND(5)	ND(1.0)	7D	8D	12.2D
Benzene	ND(5)	ND(5)	ND(5)	ND(1.0)	ND(5)	ND(5)	2.71AE
Toluene	ND(5)	ND(5)	ND(5)	ND(1.0)	ND(5)	ND(5)	ND(1.0)
Ethylbenzene	ND(5)	ND(5)	ND(5)	ND(1.0)	ND(5)	ND(5)	1.66E
Total Xylenes	ND(5)	ND(5)	ND(5)	ND(1.0)	ND(5)	ND(5)	ND(1.0)

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source	***MW3R-89***	***MW3R-89 dup***	***MW3R-89***	***MW-4***	***MW-4***	***MW-5***	***MW-5***
Sample ID	***W-2428-DT-033***	***W-2428-DT-034***	***W-2428-DT-049***	***W-2428-DT-015***	***W-2428-DT-058***	***W-2428-DT-019***	***W-2428-DT-053***
Date	***10/18/89***	***10/18/89***	***12/13/89***	***10/11/89***	***12/15/89***	***10/12/89***	***12/13/89***
Units	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Methylene Chloride	NA	NA	6.96*	NA	ND(5)	NA	8.04*
Acetone	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
1,1,1-Trichloroethane	11.4DE	10.6DE	12.2D	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Benzene	2.41AE	2.46AE	2.08A	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Toluene	1.10E	1.44E	1.24	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Ethylbenzene	ND(1.0)	1.80E	1.13	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Total Xylenes	2.34E	6.35DE	6.89D	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source	***MW-6***	***MW-6***	***MW-7***	***MW-7 dup***	***MW-7***	***MW-7 dup***	***MW8-89***
Sample ID	***W-2428-DT-014***	***W-2428-DT-055***	***W-2428-DT-012***	***W-2428-DT-013***	***W-2428-DT-051***	***W-2428-DT-052***	***W-2428-DT-009***
Date	***10/10/89***	***12/13/89***	***10/9/89***	***10/9/89***	***12/13/89***	***12/13/89***	***6/30/89***
Units	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Methylene Chloride	NA	ND(5)	NA	NA	ND(5)	5.61*	ND(5)
Acetone	NA	NA	NA	NA	NA	NA	34*
1,2-Dichloroethene (total)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	6D
1,1,1-Trichloroethane	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(5)
Benzene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	41AD
Toluene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	16D
Ethylbenzene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	8D
Total Xylenes	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	27D

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source	***MW9-89***	***MW9-89***	***MW10-89***	***MW11-89***	***MW11-89***	***MW12-89***	***MW12-89***
Sample ID	***W-2428-DT-001***	***W-2428-DT-061***	***W-2428-DT-060***	***W-2428-DT-026***	***W-2428-DT-059***	***W-2428-DT-030***	***W-2428-DT-048***
Date	***6/26/89***	***12/19/89***	***12/19/89***	***12/19/90***	***12/19/89***	***10/18/89***	***12/12/89***
Units	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Methylene Chloride	ND(5)	ND(5)	ND(5)	NA	ND(5)	NA	ND(5)
Acetone	ND(10)	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
1,1,1-Trichloroethane	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Benzene	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Toluene	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Ethylbenzene	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Total Xylenes	ND(5)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source	*MW13-89*	*MW13-89*	*MW13-89*	*MW14-89*	*MW14-89*	*MW15-89*	*MW15-89*
Sample ID	*W-2428-DT-016*	*W-2428-DT-046*	*W-2428-DT-047*	*W-2428-DT-010*	*W-2428-DT-063*	*W-2428-DT-025*	*W-2428-DT-054*
Date	*10/17/89*	*12/12/89*	*12/12/89*	*7/5/89*	*12/20/89*	*10/17/89*	*12/14/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Methylene Chloride	NA	ND(5)	ND(5)	ND(10)	5.15*	NA	ND(5)
Acetone	NA	NA	NA	240D	NA	NA	NA
1,2-Dichloroethene (total)	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)
1,1,1-Trichloroethane	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)
Benzene	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)
Toluene	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)
Ethylbenzene	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)
Total Xylenes	ND(1.0)	ND(1.0)	ND(1.0)	ND(10)	ND(1.0)	ND(10)	ND(1.0)

TABLE 10.3

GROUNDWATER ANALYTICAL RESULTS - VOCs
TONAWANDA COKE CORPORATION

Source ***Sample ID*** ***Date*** ***Units***	***MW16-89*** ***W-2428-DT-020*** ***10/17/89*** ***µg/L***	***MW16-89*** ***W-2428-DT-062*** ***12/19/89*** ***µg/L***	***MW17-89*** ***W-2428-DT-002*** ***6/27/89*** ***µg/L***	***MW17-89*** ***W-2428-DT-057*** ***12/15/89*** ***µg/L***	***Most Stringent MCL*** ***µg/L***
Methylene Chloride	NA	5.74*	ND(5)	ND(5)	5
Acetone	NA	NA	36*	NA	50
1,2-Dichloroethene (total)	ND(10)	ND(1.0)	ND(5)	ND(1.0)	5
1,1,1-Trichloroethane	ND(10)	ND(1.0)	ND(5)	ND(1.0)	5
Benzene	ND(10)	3.76A	ND(5)	ND(1.0)	ND
Toluene	ND(10)	ND(1.0)	ND(5)	ND(1.0)	5
Ethylbenzene	ND(10)	ND(1.0)	ND(5)	ND(1.0)	5
Total Xylenes	ND(10)	ND(1.0)	ND(5)	ND(1.0)	5

Notes:

	All other TCL VOCs were not detected during Round 1 (June 1989) sampling.
*	Also present in laboratory/reagent blank, indicating possible/probable laboratory contamination.
A	The associated value exceeded NYSDEC Class GA Groundwater Standards (6NYCRR Part 703.5).
D	The associated value exceeded NYSDOH Drinking Water Standards (Sanitary Code Part 5).
ND	Not detected above quantifiable limits stated in parentheses.
E	The associated data is estimated due to outlying surrogate recoveries.
NA	Not analyzed for the particular parameter as it was not included in the SSIs.

Indicator (SSI) parameters was developed (see Section 5.2) which included six VOCs: 1,2-dichloroethene (total); 1,1,1-trichloroethane; benzene; toluene; ethylbenzene and total xylenes. It is these six parameters for which data were collected in subsequent groundwater sampling rounds. Table 10.3 presents a summary of the VOC analytical data, including only those parameters which were detected in at least one sample.

Upon review of Table 10.3, it can be seen that there are two areas of chemical presence at the TCC Site. Analytical results of MW-3, the damaged well, and MW3R-89, the replacement well, show the presence of five of the six SSIs. The data from the two wells generally support each other for 1,1,1-trichloroethane, benzene and ethylbenzene, but MW3R-89 data indicates the presence of toluene and xylenes which were not identified at MW-3.

For discussion purposes, an additional column has been added to Table 10.3 which lists the most stringent Maximum Contaminant Level (MCL) as derived from the following four documents:

i) 6 NYCRR Part 703.5 (NYSDEC Class GA groundwater standards);
ii) Sanitary Code Part 5 (NYSDOH drinking water standards);
iii) 40 CFR Part 141 (EPA drinking water standards); and
iv) 10 NYCRR part 170 (NYSDEC raw water quality standards).

The VOC parameter which is present at the highest levels at MW3R-89 is 1,1,1-trichloroethane which was detected between 10 and 12 µg/L. This is approximately double the most stringent MCL of 5 µg/L.

Total xylenes were detected marginally above the most stringent MCL (5 µg/L) at 6 to 7 µg/L. Benzene was detected at lower levels (2 to 2.5 µg/L), however, the most stringent MCL, as derived from 6 NYCRR Part 703.5, is ND or not detected, and not the 5 µg/L limit as specified in the Sanitary Code Part 5. Toluene and ethylbenzene were present at levels (1 to 2 µg/L) below the most stringent MCL of 5 µg/L. The total VOCs concentration at MW3R-89 is approximately 22.5 µg/L.

The other area of noted VOC presence is the former landfill (Site 108) based upon the analytical results from the groundwater sample collected from MW8-89. Five of the six SSIs were present with all five being above the most stringent MCL. Benzene, toluene and total xylenes were present two or three times above the standards (5µg/L), while 1,2-dichloroethene and ethylbenzene were only marginally above. The total VOCs concentration at MW8-89 is only approximately 104 µg/L, however, MW8-89 was only sampled once as repeat attempts during the second and third sampling rounds did not yield enough water to complete sampling (only 0.1 gallons purged each day) as indicated on the purging logs contained in Appendix C. It should also be noted that the VOC presence is not widespread in this area as evidenced by the four "clean" samples collected from MW-7, only 500 feet downgradient from MW8-89.

Only one other groundwater sample revealed the presence of any of the six SSI VOCs. The third round sample of MW16-89 indicated benzene detected at 3.76 µg/L, however, the second round sample indicated benzene to be not detected. Although this concentration is above the most stringent MCL (ND), it is below the Sanitary Code Part 5 drinking water standard of 5 µg/L.

10.2.2 BNAs

As with the VOCs, a SSI list of BNAs was developed following round one sampling which, in this case, included all polynuclear aromatic hydrocarbons (PAHs). Table 10.4 presents a summary of the BNA analytical data for all three sampling rounds including only those parameters which were detected in at least one sample.

Table 10.4 shows that there are two areas of PAH presence; the same two areas as previously discussed for VOCs. MW-3 and MW3R-89 both indicate the presence of most PAH compounds. Analytical data is presented for MW3R-89 for two samples from round two and one sample from round three. As noted from Table 10.4, the data for the first two samples has been qualified as estimated due to outlying surrogate recoveries. In comparison with the round three sample, it can be seen that the concentration of each PAH compound is somewhat lower for the unqualified third round sample. From the round three data, the most prevalent PAH compound is naphthalene at 404 µg/L. This concentration is well above the most stringent MCL (50 µg/L). Two other PAH compounds, fluorene and phenanthrene, were detected slightly above the most stringent MCL (50 µg/L). The total PAH concentration at MW3R-89, using round three data, is approximately 693 µg/L.

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	*MW-2*	*MW-2 dup*	*MW-2 dup*	*MW-2*	*MW-3*	*MW-3 dup*	*MW-3*
Sample ID	*W-2428-DT-004*	*W-2428-DT-005*	*W-2428-DT-006*	*W-2428-DT-017*	*W-2428-DT-007*	*W-2428-DT-008*	*W-2428-DT-032*
Date	*6/28/89*	*6/28/89*	*6/28/89*	*10/11/89*	*6/28/89*	*6/28/89*	*10/18/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Naphthalene	ND(10)	ND(10)	ND(10)	ND(3)	73D	100D	ND(3)
2-Methylnaphthalene	ND(10)	ND(10)	ND(10)	ND(3)	25	ND(10)	3.71
Acenapthylene	ND(10)	ND(10)	ND(10)	ND(3)	30	31	62.1D
Acenaphthene	ND(10)	ND(10)	ND(10)	ND(3)	ND(10)	ND(10)	19.2
Fluorene	ND(10)	ND(10)	ND(10)	ND(3)	45	49	112D
Phenanthrene	ND(10)	ND(10)	ND(10)	ND(3)	29	38	148D
Anthracene	ND(10)	ND(10)	ND(10)	ND(3)	ND(10)	ND(10)	17.1
Fluoranthene	ND(10)	ND(10)	ND(10)	ND(3)	34	16	21.3
Pyrene	ND(10)	ND(10)	ND(10)	ND(3)	21	15	11.2
Benzo(a)anthracene	ND(10)	ND(10)	ND(10)	ND(3)	ND(10)	ND(10)	ND(3)
Chrysene	ND(10)	ND(10)	ND(10)	ND(3)	ND(10)	ND(10)	ND(3)
Benzo(b)fluoranthene (1)	ND(10)	ND(10)	ND(10)	ND(3)	15	ND(10)	ND(3)
Benzo(k)fluoranthene (1)	ND(10)	ND(10)	ND(10)	ND(3)	15	ND(10)	ND(3)
Benzo(a)pyrene	ND(10)	ND(10)	ND(10)	ND(3)	ND(10)	ND(10)	ND(3)
Dibenzofuran	ND(10)	ND(10)	ND(10)	NA	34	37	NA
Benzo(g,h,i)perylene	NA	NA	NA	ND(3)	NA	NA	ND(3)
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	ND(3)	NA	NA	ND(3)
2-Chloronaphthalene	NA	NA	NA	ND(3)	NA	NA	ND(3)

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	***MW3R-89***	***MW3R-89 dup***	***MW3R-89***	***MW-4***	***MW-4***	***MW-5***	***MW-5***
Sample ID	**W-2428-DT-033**	**W-2428-DT-034**	**W-2428-DT-049**	**W-2428-DT-015**	**W-2428-DT-058**	**W-2428-DT-019**	**W-2428-DT-053**
Date	***10/18/89***	***10/18/89***	***12/13/89***	***10/11/89***	***12/15/89***	***10/12/89***	***12/13/89***
Units	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Naphthalene	459ED	486ED	404D	ND(3)	ND(3)	ND(3)	ND(3)
2-Methylnaphthalene	57.1ED	80.6ED	33.5	ND(3)	ND(3)	ND(3)	ND(3)
Acenapthylene	64.0ED	83.1ED	40.1	ND(3)	ND(3)	ND(3)	ND(3)
Acenaphthene	55.5ED	72.3ED	34.2	ND(3)	ND(3)	ND(3)	ND(3)
Fluorene	124ED	154ED	61.2D	ND(3)	ND(3)	ND(3)	ND(3)
Phenanthrene	264ED	287ED	76.8D	ND(3)	ND(3)	ND(3)	ND(3)
Anthracene	55.0ED	36.8E	12.9	ND(3)	ND(3)	ND(3)	ND(3)
Fluoranthene	90.9ED	77.0ED	12.9	ND(3)	ND(3)	ND(3)	ND(3)
Pyrene	69.3ED	70.2ED	8.21	ND(3)	ND(3)	ND(3)	ND(3)
Benzo(a)anthracene	52.7ED	35.0E	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Chrysene	32.6E	18.8E	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Benzo(b)fluoranthene (1)	49.2E	27.0E	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Benzo(k)fluoranthene (1)	49.2E	27.0E	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Benzo(a)pyrene	28.8EA	13.2EA	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Indeno(1,2,3-c,d)pyrene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
2-Chloronaphthalene	16.7E	21.8E	9.34	ND(3)	ND(3)	ND(3)	ND(3)

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	***MW-6***	***MW-6***	***MW-7***	***MW-7 dup***	***MW-7***	***MW-7 dup***	***MW8-89***
Sample ID	***W-2428-DT-014***	***W-2428-DT-055***	***W-2428-DT-012***	***W-2428-DT-013***	***W-2428-DT-051***	***W-2428-DT-052***	***W-2428-DT-009***
Date	***10/10/89***	***12/13/89***	***10/9/89***	***10/9/89***	***12/13/89***	***12/13/89***	***6/30/89***
Units	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***
Naphthalene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	1,900D
2-Methylnaphthalene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	19
Acenapthylene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Acenaphthene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Fluorene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Phenanthrene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Anthracene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Fluoranthene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Pyrene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Benzo(a)anthracene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Chrysene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Benzo(b)fluoranthene (1)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Benzo(k)fluoranthene (1)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Benzo(a)pyrene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(10)
Dibenzofuran	NA	NA	NA	NA	NA	NA	ND(10)
Benzo(g,h,i)perylene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	NA
Indeno(1,2,3-c,d)pyrene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	NA
2-Chloronaphthalene	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	NA

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	*MW9-89*	*MW9-89*	*MW10-89*	*MW11-89*	*MW11-89*	*MW12-89*	*MW12-89*
Sample ID	*W-2428-DT-001*	*W-2428-DT-061*	*W-2428-DT-060*	*W-2428-DT-026*	*W-2428-DT-059*	*W-2428-DT-030*	*W-2428-DT-048*
Date	*6/26/89*	*12/19/89*	*12/19/89*	*10/17/89*	*12/19/89*	*10/18/89*	*12/12/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Naphthalene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
2-Methylnaphthalene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Acenapthylene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Acenaphthene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Fluorene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Phenanthrene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Anthracene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Fluoranthene	ND(10)	ND(3)	ND(3)	8.76	ND(3)	ND(3)	ND(3)
Pyrene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	10.4R	ND(3)
Benzo(a)anthracene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Chrysene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Benzo(b)fluoranthene (1)	ND(10)	ND(3)	ND(3)	4.26	ND(3)	ND(3)	ND(3)
Benzo(k)fluoranthene (1)	ND(10)	ND(3)	ND(3)	4.26	ND(3)	ND(3)	ND(3)
Benzo(a)pyrene	ND(10)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Dibenzofuran	ND(10)	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
Indeno(1,2,3-c,d)pyrene	NA	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)
2-Chloronaphthalene	NA	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)	ND(3)

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	*MW13-89*	*MW13-89*	*MW13-89 dup*	*MW14-89*	*MW14-89*	*MW15-89*	*MW15-89*
Sample ID	*W-2428-DT-016*	*W-2428-DT-046*	*W-2428-DT-047*	*W-2428-DT-010*	*W-2428-DT-063*	*W-2428-DT-025*	*W-2428-DT-054*
Date	*10/17/89*	*12/12/89*	*12/12/89*	*7/5/89*	*12/20/89*	*10/17/89*	*12/14/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Naphthalene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	7.46	ND(3)
2-Methylnaphthalene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	4.69	ND(3)
Acenapthylene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	ND(3)	ND(3)
Acenaphthene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	ND(3)	ND(3)
Fluorene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	6.49	ND(3)
Phenanthrene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	15.6	ND(3)
Anthracene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	ND(3)	ND(3)
Fluoranthene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	30.9	ND(3)
Pyrene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	18.8	ND(3)
Benzo(a)anthracene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	17.2	ND(3)
Chrysene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	10.5	ND(3)
Benzo(b)fluoranthene (1)	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	19.0	ND(3)
Benzo(k)fluoranthene(1)	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	19.0	ND(3)
Benzo(a)pyrene	ND(3)	ND(3)	ND(3)	ND(10)	ND(3)	12.4A	ND(3)
Dibenzofuran	NA	NA	NA	ND(10)	NA	NA	NA
Benzo(g,h,i)perylene	ND(3)	ND(3)	ND(3)	NA	ND(3)	9.17	ND(3)
Indeno(1,2,3-c,d)pyrene	ND(3)	ND(3)	ND(3)	NA	ND(3)	14.3	ND(3)
2-Chloronaphthalene	ND(3)	ND(3)	ND(3)	NA	ND(3)	3.47	ND(3)

TABLE 10.4

GROUNDWATER ANALYTICAL RESULTS - BNAs
TONAWANDA COKE CORPORATION

Source	*MW16-89*	*MW16-89*	*MW17-89*	*MW17-89*	*Most*
Sample ID	*W-2428-DT-020*	*W-2428-DT-062*	*W-2428-DT-002*	*W-2428-DT-057*	*Stringent*
Date	*10/17/89*	*12/19/89*	*6/27/89*	*12/15/89*	*MCL*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Naphthalene	ND(3)	ND(3)	ND(10)	ND(3)	50
2-Methylnaphthalene	ND(3)	ND(3)	ND(10)	ND(3)	50
Acenapthylene	ND(3)	ND(3)	ND(10)	ND(3)	50
Acenaphthene	ND(3)	ND(3)	ND(10)	ND(3)	50
Fluorene	ND(3)	ND(3)	ND(10)	ND(3)	50
Phenanthrene	ND(3)	ND(3)	ND(10)	ND(3)	50
Anthracene	ND(3)	ND(3)	ND(10)	ND(3)	50
Fluoranthene	ND(3)	ND(3)	ND(10)	ND(3)	50
Pyrene	ND(3)	ND(3)	ND(10)	ND(3)	50
Benzo(a)anthracene	ND(3)	ND(3)	ND(10)	ND(3)	50
Chrysene	ND(3)	ND(3)	ND(10)	ND(3)	50
Benzo(b)fluoranthene (1)	ND(3)	ND(3)	ND(10)	ND(3)	50
Benzo(k)fluoranthene(1)	ND(3)	ND(3)	ND(10)	ND(3)	50
Benzo(a)pyrene	ND(3)	ND(3)	ND(10)	ND(3)	ND
Dibenzofuran	NA	NA	ND(10)	NA	50
Benzo(g,h,i)perylene	ND(3)	ND(3)	NA	ND(3)	50
Indeno(1,2,3-c,d)pyrene	ND(3)	ND(3)	NA	ND(3)	50
2-Chloronaphthalene	ND(3)	ND(3)	NA	ND(3)	50

Notes:

All other TCL BNAs were not detected during Round 1 (June 1989) sampling.

A	The associated value exceeded NYSDEC Class GA Groundwater Standards (6NYCRR Part 703.5).
D	The associated value exceeded NYSDOH Drinking Water Standards (Sanitary Code Part 5).
ND	Not detected above quantifiable limits stated in parentheses.
E	The associated data is estimated due to outlying surrogate recoveries.
NA	Not analyzed for the particular parameter as it was not included in the SSIs.
(1)	Indistinguishable isomers, reported value is total concentration.

The other area of PAH presence is, again, the former landfill represented by MW8-89. As with MW3R-89, the most prevalent PAH compound is naphthalene which is present well above the most stringent MCL (50 µg/L) at 1900 µg/L. The only other detected PAH compound was 2-methylphthalene at 19 µg/L,well below the most stringent MCL (50 µg/L). In fact, all but one compound have only an estimated concentration below the detection limit. The total PAH concentration at MW8-89 is 1919 µg/L but, as mentioned previously in the VOCs discussion, MW8-89 was only sampled once due to low recharge. Similar to the VOCs, no evidence of PAH presence was detected 500 feet downgradient at MW-7.

Two other samples indicated minor PAH concentrations at individual, isolated well locations. At MW15-89, the second round sample indicated an approximate total PAH concentration of 170 µg/L, but with no single PAH parameter exceeding 30 µg/L. Although MW15-89 is southwest and downgradient of MW3R-89 where there is higher PAH presence, the PAH presence at MW15-89 includes some parameters not detected in the MW3R-89 samples. Also, the subsequent third round sample from MW15-89 indicated non-detect for every SSI PAH compound.

At MW11-89, the second round sample indicated three PAH compounds (fluoranthene, benzo(b)fluoranthene and benzo(k)fluoranthene) were detected at a combined concentration of 13 µg/L. The detected levels are very low and the subsequent third round sample indicated non-detect for these and all other PAH compounds.

10.2.3 Metals

The analytical results for TAL metals analyses, as presented on Table 10.5, do not indicate any significant areas of metals presence. Only three parameters exceed the most stringent MCLs; iron, manganese and sodium which are all common compounds. Iron was detected at concentrations ranging from 2900 to 31300 µg/L in the unfiltered groundwater samples and 28 to 33100 µg/L in the filtered groundwater samples collected from the six specified monitoring wells. There was generally no significant reduction in iron concentrations for the filtered samples except at MW9-89 and MW14-89. The detected iron concentrations are generally about one to two orders of magnitude above the most stringent MCL (Class GA Groundwater). Manganese was detected at concentrations ranging from 801 to 3550 µg/L in the unfiltered groundwater samples and 1040 to 2430 µg/L in the filtered groundwater samples. There was generally no significant reduction in manganese concentrations for the filtered samples except at MW14-89. The detected manganese concentrations are generally one half to one order of magnitude above the most stringent MCL (Class GA Groundwater). Both iron and manganese are prevalent metal compounds.

Sodium was present in all of the samples at concentrations between 7360 and 188000 µg/L for the total unfiltered and filtered groundwater samples. The most stringent MCL for sodium is 20000 µg/L but, as stated in the Sanitary Code Part 5, this is only a level of concern for consumption by people on severely restricted sodium diets. None of the sodium concentrations exceeded the 270000 µg/L level specified

TABLE 10.5

GROUNDWATER ANALYTICAL RESULTS - METALS
TONAWANDA COKE CORPORATION

Source	***MW-2***	***MW-2 dup***	***MW-2 dup***	***MW-2 (filt.)***	***MW-2 (filt.) dup***	***MW-2 (filt.) dup***
Sample ID	***W-2428-DT-004***	***W-2428-DT-005***	***W-2428-DT-006***	***W-2428-DT-004***	***W-2428-DT-005***	***W-2428-DT-006***
Date	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***
Units	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***
Aluminum	163	226	98.5	ND(23.0)	35.1	ND(23.0)
Arsenic	1.9	2.1	1.4	3.6	3.8	3.3
Barium	48.9	51.3	49.4	47.0	47.0	42.8
Beryllium	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.70)	ND(0.70)	ND(0.70)
Calcium	120,000	120,000	123,000	149,000	140,000	140,000
Chromium	4.6	3.8	ND(3.8)	ND(6.2)	ND(6.2)	ND(6.2)
Cobalt	3.7	ND(3.3)	ND(3.3)	9.2	9.0	9.2
Copper	ND(7.3)	ND(7.3)	ND(7.3)	ND(7.2)	ND(7.2)	ND(7.2)
Iron	6,130A	6,290A	5,390A	15,800A	14,100A	14,800A
Lead	2.0	ND(0.90)	ND(0.90)W	ND(1.1)	ND(1.1)	ND(1.1)
Magnesium	12,700E	12,700E	12,800E	15,400E	14,600E	14,400E
Manganese	801A	894A	846A	1,510A	1,330A	1,420A
Mercury	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)X	ND(0.20)X	ND(0.20)X
Nickel	ND(18.6)	ND(18.6)	ND(18.6)	ND(35.8)	ND(35.8)	ND(35.8)
Potassium	2,810	2,460	1,950	6,190	6,200	5,970
Selenium	ND(10.0)E	ND(10.0)E	ND(10.0)Y	ND(16.0)	ND(16.0)	ND(16.0)
Silver	ND(4.9)	ND(4.9)	ND(4.9)	ND(5.7)	ND(5.7)	ND(5.7)
Sodium	10,700	10,500	10,000	12,500	11,800	12,100
Vanadium	ND(2.6)	ND(2.6)	ND(2.6)	8.1	7.8	8.2
Zinc	64.0	31.6	57.1	28.0	26.5	37.2

TABLE 10.5

GROUNDWATER ANALYTICAL RESULTS - METALS
TONAWANDA COKE CORPORATION

Source	***MW-3***	***MW-3 dup***	***MW-3 (filt.)***	***MW-3 (filt.) dup***	***MW8-89***	***MW8-89 (filt.)***
Sample ID	***W-2428-DT-007***	***W-2428-DT-008***	***W-2428-DT-007***	***W-2427-DT-008***	***W-2428-DT-009***	***W-2428-DT-009***
Date	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***	***6/28/89***
Units	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Aluminum	172	104	ND(23.0)	ND(23.0)	139	166
Arsenic	3.2	1.4	3.1	3.2	ND(1.2)	ND(1.2)
Barium	43.1	40.7	40.4	41.8	37.8E	39.4
Beryllium	ND(0.50)	ND(0.50)	ND(0.70)	ND(0.70)	3.6	ND(0.70)
Calcium	131,000	130,000	125,000	124,000	599,000E	626,000
Chromium	3.8	ND(3.8)	ND(6.2)	ND(6.2)	9.0	ND(6.2)
Cobalt	ND(3.3)	ND(3.3)	5.3	ND(3.9)	23.1	17.6
Copper	9.4	ND(7.3)	ND(7.2)	ND(7.2)	ND(7.3)	ND(7.2)
Iron	3,300A	2,900A	2,700A	2,590A	31,200EA	33,100A
Lead	11.8	ND(0.90)	ND(1.1)	ND(1.1)	ND(0.90)	1.4
Magnesium	19,500E	19,400E	18,000E	18,000E	53,300E	55,600
Manganese	1,070A	1,040A	1,050A	1,040A	2,340EA	2,430A
Mercury	ND(0.20)	ND(0.20)	ND(0.20)X	ND(0.20)X	ND(0.20)	ND(0.20)R
Nickel	ND(18.6)	ND(18.6)	ND(35.8)	ND(35.8)	ND(18.6)	ND(35.8)
Potassium	6,000	6,850	10,200	10,700	22,300	17,800
Selenium	ND(5.0)	ND(10.0)	ND(16.0)	ND(16.0)	ND(10.0)	ND(16.0)
Silver	ND(4.9)	ND(4.9)	ND(5.7)	ND(5.7)	5.4	ND(5.7)
Sodium	29,500B	29,800B	28,900B	28,100B	80,300EB	82,600B
Vanadium	ND(2.6)	ND(2.6)	4.6	5.0	77.8	64.0
Zinc	143	167	24	16.7	83.4E	87.9

TABLE 10.5

GROUNDWATER ANALYTICAL RESULTS - METALS
TONAWANDA COKE CORPORATION

Source	*MW9-89*	*MW9-89 (filt.)*	*MW14-89*	*MW14-89 (filt.)*	*MW17-89*	*MW17-89 (filt.)*	*Most*
Sample ID	**W-2428-DT-001**	**W-2428-DT-008**	**W-2428-DT-010**	**W-2428-DT-010**	**W-2428-DT-002**	**W-2428-DT-002**	***Stringent***
Date	*6/26/89*	*6/26/89*	*6/26/89*	*6/26/89*	*6/26/89*	*6/26/89*	***MCL***
Units	*μg/L*	*μg/L*	*μg/L*	*μg/L*	*μg/L*	*μg/L*	*μg/L*
Aluminum	5,190	49.1	8770	40.2	127	26.5	
Arsenic	6.1	4.6	3.6	1.7	4.9	9.3	25
Barium	177	80.7	145E	62.5E	92.9	93.9	1,000
Beryllium	ND(0.50)	ND(0.70)	3.7	ND(0.50)	ND(0.50)	ND(0.70)	
Calcium	162,000	161,000	196,000E	132,000	199,000	207,000	
Chromium	4.2	ND(6.2)	23.3	ND(3.8)	ND(3.8)	ND(6.2)	50
Cobalt	ND(3.3)	ND(3.9)	12.2	4.2	ND(3.3)	5.5	
Copper	ND(7.3)	ND(7.2)	10.2	24.5	ND(7.3)	ND(7.2)	200
Iron	7,630A	52.3	11,500EA	28	5,330A	3,300A	300
Lead	2.7	ND(1.1)W	5.8E	ND(4.5)	ND(0.9)	ND(1.1)	25
Magnesium	28,600E	28,500E	57,200E	34,500	56,100E	58,600E	
Manganese	1,850A	1,540A	3,550EA	1,080A	847A	1,050A	300
Mercury	ND(0.20)	0.32X	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)X	2
Nickel	30.2	ND(35.8)	153	32.6	52.0	64.1	
Potassium	2,680	5,910	5,630	ND(1,740)	9,680	13,400	
Selenium	11.6CDB	ND(16.0)W	ND(10.0)	ND(10.0)C	ND(10.0)C	ND(16.0)	10
Silver	ND(4.9)	ND(5.7)	ND(4.9)	ND(4.9)	ND(4.9)	ND(5.7)	50
Sodium	7,360C	10,100	188,000EB	151,000B	137,000CB	142,000B	20,000*
Vanadium	10.4	9.2	38.5	7.2	3.0	7.6	
Zinc	60.2	19.2	72.1E	21.2	46.3	11.8	300

Notes:

	All other TAL metals were not detected.
E	The associated data is estimated due to chemical and/or physical interferences.
X	The associated data is estimated due to holding time exceedences.
A	The associated value exceeded NYSDEC Class GA Groundwater Standards (6NYCRR Part 703.5).
D	The associated value exceeded NYSDOH Drinking Water Standards (Sanitary Code Part 5).
B	The associated value exceeded NYSDOH Raw Water Supply Standards (10NYCRR Part 170).
*	Water containing more than 20,000 μg/L of sodium should not be used for drinking by people on severely restricted sodium diets (270,000 μg/L for moderately restricted).
ND	Not detected above quantifiable limits stated in parentheses.
C	The associated data is estimated due to outlying calibration data.
R	Unusable data due to holding time exceedance.
W	Indicates low spike recoveries and may reflect a low bias in results.

for consumption by people on moderately restricted sodium diets. Also, the groundwater beneath the TCC Site is not used as a source of drinking water.

10.2.4 Other Compounds

The remaining compounds which were analyzed for during the groundwater sampling programs were cyanide, hexavalent chromium and oil and grease. The analytical results for these parameters are presented on Table 10.6. These parameters were included during both the full TCL/TAL analyses (round one) and the SSI analyses (rounds two and three). Cyanide concentrations exceeded the most stringent MCL (170 μg/L) in 18 samples from nine different wells. The highest cyanide levels were detected at MW8-89 (3730 μg/L) and MW13-89 (2750μg/L). The cyanide levels in the remaining seven wells were only marginally above the most stringent MCL, with some wells reporting data from other sampling events which were below the standard. In general, the cyanide levels at the Site boundaries are low-level except at MW13-89/MW-2 (Site 110) where there is a slight groundwater gradient to the northeast. No wells are located downgradient of this area in order to delineate the extent of the elevated cyanide presence.

Hexavalent chromium (Cr+6) was only detected in five samples from five separate wells. The highest reported value is 50 μg/L, which is equivalent to the most stringent MCL, and the remaining values are substantially lower. In all instances, the wells have other reported data (from another sampling round) which indicate Cr+6 was not present at a detection

TABLE 10.6

GROUNDWATER ANALYTICAL RESULTS - OTHER COMPOUNDS
TONAWANDA COKE CORPORATION

Source	***MW-2***	***MW-2 dup***	***MW-2 dup***	***MW-2***	***MW-3***	***MW-3 dup***	***MW-3***
Sample ID	***W-2428-DT-004***	***W-2428-DT-005***	***W-2428-DT-006***	***W-2428-DT-017***	***W-2428-DT-007***	***W-2428-DT-008***	***W-2428-DT-032***
Date	***6/28/89***	***6/28/89***	***6/28/89***	***10/11/89***	***6/28/89***	***6/28/89***	***10/18/89***
Units	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***
Cyanide	230AB	259AB	254AB	620AB	79.6	79.0	220AB
Hexavalent Chromium	ND(10)	NA	NA	ND(10)	ND(10)	ND(10)	ND(10)
Oil and Grease	1,500	ND(1,000)	ND(1,000)	3,500	ND(1,000)	ND(1,000)	ND(1,000)

Source	***MW3R-89***	***MW3R-89 dup***	***MW3R-89***	***MW-4***	***MW-4***	***MW-5***	***MW-5***
Sample ID	***W-2428-DT-033***	***W-2428-DT-034***	***W-2428-DT-049***	***W-2428-DT-015***	***W-2428-DT-058***	***W-2428-DT-019***	***W-2428-DT-053***
Date	***10/18/89***	***10/18/89***	***12/13/89***	***10/11/89***	***12/15/89***	***10/12/89***	***12/13/89***
Units	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***	***μg/L***
Cyanide	120B	160B	ND(10)	60	30	40	44
Hexavalent Chromium	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)
Oil and Grease	4,800	3,900	ND(1,000)	ND(1,000)	ND(1,000)	ND(1,000)	ND(1,000)

TABLE 10.6

GROUNDWATER ANALYTICAL RESULTS - OTHER COMPOUNDS
TONAWANDA COKE CORPORATION

Source	*MW-6*	*MW-6*	*MW-7*	*MW-7 dup*	*MW-7*	*MW-7 dup*	*MW8-89*
Sample ID	*W-2428-DT-014*	*W-2428-DT-055*	*W-2428-DT-012*	*W-2428-DT-013*	*W-2428-DT-051*	*W-2428-DT-052*	*W-2428-DT-009*
Date	*10/10/89*	*12/13/89*	*10/9/89*	*10/9/89*	*12/13/89*	*12/13/89*	*6/30/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Cyanide	320AB	300AB	90	70	167B	170B	3,730AB
Hexavalent Chromium	NA	ND(10)	ND(10)	ND(10)	ND(10)	50	ND(10)
Oil and Grease	7,100	ND(1,000)	3,700	ND(1,000)	ND(1,000)	ND(1,000)	7,400

Source	*MW9-89*	*MW9-89*	*MW10-89*	*MW11-89*	*MW11-89*	*MW12-89*	*MW12-89*
Sample ID	*W-2428-DT-001*	*W-2428-DT-061*	*W-2428-DT-060*	*W-2428-DT-026*	*W-2428-DT-059*	*W-2428-DT-030*	*W-2428-DT-048*
Date	*6/26/89*	*12/19/89*	*12/19/89*	*10/17/89*	*12/19/89*	*10/18/89*	*12/12/89*
Units	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
Cyanide	ND(10.0)	30	19	10	12	30	24
Hexavalent Chromium	20X	ND(10)	10	ND(10)	ND(10)	ND(10)	ND(10)
Oil and Grease	ND(1,000)	ND(1,000)	6,300	ND(1,000)	ND(1,000)	ND(1,000)	ND(1,000)

TABLE 10.6

GROUNDWATER ANALYTICAL RESULTS - OTHER COMPOUNDS
TONAWANDA COKE CORPORATION

Source ***Sample ID*** ***Date*** ***Units***	***MW13-89*** ***W-2428-DT-016*** ***10/17/89*** ***µg/L***	***MW13-89*** ***W-2428-DT-046*** ***12/12/89*** ***µg/L***	***MW13-89 dup*** ***W-2428-DT-047*** ***12/12/89*** ***µg/L***	***MW14-89*** ***W-2428-DT-010*** ***7/5/89*** ***µg/L***	***MW14-89*** ***W-2428-DT-063*** ***12/20/89*** ***µg/L***	***MW15-89*** ***W-2428-DT-025*** ***10/17/89*** ***µg/L***	***MW15-89*** ***W-2428-DT-054*** ***12/14/89*** ***µg/L***
Cyanide	2,750AB	1,690AB	1,720AB	48.4	21	250AB	147B
Hexavalent Chromium	ND(10)	ND(10)	ND(10)	20X	ND(10)	ND(10)	ND(10)
Oil and Grease	ND(1,000)	ND(1,000)	ND(1,000)	ND(1,000)	NS	2,200	ND(1,000)

Source ***Sample ID*** ***Date*** ***Units***	***MW16-89*** ***W-2428-DT-020*** ***10/17/89*** ***µg/L***	***MW16-89*** ***W-2428-DT-062*** ***12/19/89*** ***µg/L***	***MW17-89*** ***W-2428-DT-002*** ***6/27/89*** ***µg/L***	***MW17-89*** ***W-2428-DT-057*** ***12/15/89*** ***µg/L***	***Most*** ***Stringent*** ***MCL*** ***µg/L***
Cyanide	10	15	13.8	270AB	100
Hexavalent Chromium	ND(10)	10	20X	ND(10)	50
Oil and Grease	5,500	ND(1,000)	ND	ND(1,000)	

Notes:

ND	- Not detected above quantifiable limit stated in parentheses
NS	- No sample due to laboratory accident
NA	- Not analyzed
X	- The associated data is estimated due to holding time exceedance.
B	- The associated value exceeded NYSDOH Raw Water Supply Standards (10NYCRR Part 170).
A	- The associated value exceeded NYSDEC Class GA groundwater Standards (6NYCRR Part 703.5).

limit of 10 µg/L. Therefore, no problem areas exist at the Site with regard to Cr+6.

Oil and grease is a parameter which is also monitored as part of TCC's SPDES permit. The allowable daily average discharge is 23.0 pounds per day, which converts to a concentration of 1058 µg/L, and the allowable daily maximum discharge is 67.0 pounds per day, which converts to 3082 µg/L. Oil and grease was detected in ten samples collected from eight different wells. The range of the detected concentrations of oil and grease was 1500 to 7400 µg/L. However, in all instances in which at least two sets of data are available, the other samples indicated oil and grease to be non-detect at 1000 µg/L. The exceptions, MW8-89 and MW10-89, only have one data set as there was insufficient sample volume available during the other sampling visits.

10.2.5 Summary

From the SSI VOC and BNA data, it appears that two isolated areas of chemical presence exist at wells MW3R-89 and MW8-89. Total VOC and BNA concentrations at MW3R-89 are approximately 22.5 µg/L and 404 µg/L, respectively, and at MW8-89 the concentrations are approximately 104 µg/L and 1944 µg/L, respectively.

The metals data from the first round of groundwater samples did not indicate any elevated concentrations and therefore metals were not included on the SSI list for the second and third sampling rounds.

Cyanide concentrations were elevated at MW8-89 (Site 108) and MW13-89 (Site 110). The other well in the Site 110 area is MW-2 which contained cyanide as well, but at somewhat lower concentrations. Cr+6 concentrations did not exceed the most stringent MCL standards. Oil and grease was present at many well locations, however, in many instances additional data from the same well location indicated non-detectable oil and grease concentrations.

10.3 SURFACE WATER SAMPLES

Following the establishment of the SSIs, surface water samples were collected from nine locations around the TCC facility. Five of the locations were analyzed for the full TCL/TAL list, while the other four were analyzed for only the SSI parameter list. It should be noted that the detectable concentrations of non-SSI parameters was infrequent and either low level or attributable to potential field or laboratory contamination. Table 10.7 presents the surface water analytical results.

10.3.1 VOCs

Benzene and toluene were present above the most stringent groundwater MCL in the surface water sample collected from the SW-6 location (see Figure 6.1). However, the surface water sample collected upgradient from SW-6 at SW-8, reported no detectable benzene or toluene

TABLE 10.7

SURFACE WATER ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source *Sample ID* *Date* *Units*	*SW-5* *SW-2428-DT-036* *10/19/89* *μg/L*	*SW-5* *SW-2428-DT-075* *12/20/89* *μg/L*	*SW-5 dup* *SW-2428-DT-076* *12/20/89* *μg/L*	*SW-6* *SW-2428-DT-037* *10/19/89* *μg/L*	*SW-6 dup* *SW-2428-DT-038* *10/19/89* *μg/L*	*SW-6* *SW-2428-DT-079* *12/20/89* *μg/L*	*SW-8* *SW-2428-DT-039* *10/19/89* *μg/L*
VOCs							
Methylene Chloride	ND(10)			ND(10)	ND(10)		ND(10)
Acetone	170*			160*	180*		200
Benzene	ND(5)			6.9AD	7.0AD		ND(5)
Toluene	ND(5)			13D	14D		ND(5)
BNAs							
Fluoranthene	ND(10)			ND(10)	ND(10)		ND(10)
Pyrene	ND(10)			ND(10)	ND(10)		ND(10)
Phenol	ND(10)			ND(10)	ND(10)		10AB
2-Methylphenol	ND(10)			ND(10)	ND(10)		10
Metals							
Aluminum		157	149			198	
Antimony		ND(20)	ND(20)			ND(20)	
Arsenic		ND(5)	ND(5)			ND(5)	
Barium		26	24			45	
Beryllium		ND(1,000)	1			ND(1,000)	
Cadmium		ND(0.5)	ND(0.5)			ND(1,000)	
Calcium		87,000	100,000			146,000	
Chromium		ND(5)	ND(5)			108D	
Cobalt		ND(5)	ND(5)			ND(5)	
Copper		9	ND(5)			30	
Iron		820AD	830AD			1,640AD	
Lead		ND(5)	ND(5)			23	
Magnesium		20,500	22,300			27,300	
Manganese		960AD	800AD			5,000AD	
Nickel		160	47			520	
Potassium		7,700	8,550			10,700	
Sodium		212,000	240,000			614,000	
Zinc		21	41			7	
Other Compounds							
Cyanide	20	51	42	10	20	1,680	10
Oil and Grease	1,300			ND(1,000)	ND(1,000)		1,000
Hexavalent Chromium	ND(10)			ND(10)	ND(10)		ND(10)

TABLE 10.7

SURFACE WATER ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source	SW-8	SW-9	SW-10	SW-10	SW-11	SW-12	SW-14
Sample ID	SW-2428-DT-074	SW-2428-DT-024	SW-2428-DT-023	SW-2428-DT-069	SW-2428-DT-042	SW-2428-DT-043	SW-2428-DT-040
Date	12/20/89	10/16/89	10/16/89	12/20/89	10/19/89	10/19/89	10/19/89
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
VOCs							
Methylene Chloride		NA	ND(10)		NA	NA	ND(10)
Acetone		NA	80*		NA	NA	55*
Benzene		ND(10)	ND(5)		ND(1,000)	ND(1,000)	ND(5)
Toluene		ND(10)	ND(5)		ND(1,000)	ND(1,000)	ND(5)
BNAs							
Fluoranthene		42.5	ND(10)		ND(3)	ND(3)	ND(10)
Pyrene		23.9	ND(10)		4.83	6.58	ND(10)
Phenol		NA	ND(10)		NA	NA	ND(10)
2-Methylphenol		NA	ND(10)		NA	NA	ND(10)
Metals							
Aluminum	203			106			
Antimony	ND(20)			ND(20)			
Arsenic	ND(5)			5			
Barium	ND(10)			18			
Beryllium	ND(1,000)			ND(1,000)			
Cadmium	ND(0.5)			ND(0.5)			
Calcium	212,000			224,000			
Chromium	42			ND(5)			
Cobalt	ND(5)			ND(5)			
Copper	13			92			
Iron	810AD			220			
Lead	14			23			
Magnesium	22,100			17,100			
Manganese	1,200AD			460AD			
Nickel	280			320			
Potassium	12,900			12,500			
Sodium	1,210,000			1,390,000			
Zinc	48			16			
Other Compounds							
Cyanide	33	90	10	40	ND(10)	ND(10)	10
Oil and Grease		15,400	ND(1,000)		1,900	ND(1,000)	ND(1,000)
Hexavalent Chromium		ND(10)	ND(10)		ND(10)	ND(10)	ND(10)

TABLE 10.7

SURFACE WATER ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source **Sample ID** **Date** **Units**	**SW-14** **SW-2428-DT-082** **3/15/90** **µg/L**	**SW-15** **SW-2428-DT-041** **10/19/89** **µg/L**	**SW-16** **SW-2428-DT-064** **12/19/89** **µg/L**	**SW-17** **SW-2428-DT-066** **12/19/89** **µg/L**	**SW-17 dup** **SW-2428-DT-067** **12/19/89** **µg/L**	**SW-18** **SW-2428-DT-068** **12/19/89** **µg/L**	**Most Stringent MCL** **µg/L**
VOCs							
Methylene Chloride		NA	ND(10)	ND(10)	ND(10)	52	5
Acetone		NA	ND(50)	ND(50)	ND(50)	ND(50)	50
Benzene		ND(1,000)	6.4AD	ND(5)	ND(5)	ND(5)	ND
Toluene		ND(1,000)	ND(5)	ND(5)	ND(5)	ND(5)	5
BNAs							
Fluoranthene		ND(3)	ND(10)	ND(10)	ND(10)	ND(10)	50
Pyrene		9.13	ND(10)	ND(10)	• ND(10)	ND(10)	50
Phenol		NA	ND(10)	ND(10)	ND(10)	ND(10)	1
2-Methylphenol		NA	ND(10)	ND(10)	ND(10)	ND(10)	50
Metals							
Aluminum			159	197	196	203	
Antimony			ND(20)	22	ND(20)	ND(20)	
Arsenic			ND(5)	ND(5)	ND(5)	5	25
Barium			45	27	28	35	1,000
Beryllium			1	ND(1)	1	ND(1)	
Cadmium			0.7	ND(0.5)	0.5	0.7	
Calcium			86,800	88,000	93,500	111,000	
Chromium			9	8	11	6	50
Cobalt			ND(5)	ND(5)	ND(5)	16	
Copper			9	5	7	49	200
Iron			920AD	980AD	920AD	100	300
Lead			18	19	20	44	25
Magnesium			29,700	31,000	29,900	13,000	
Manganese			3,520AD	220	720AD	880AD	300
Nickel			38	41	46	45	
Potassium			5,900	6,190	6,610	2,060	
Sodium			141,000	142,000	206,000	32,800	20,000
Zinc			2.8	22	29	9.3	300
Other Compounds							
Cyanide		60	155	230	212	ND(10)	100
Oil and Grease		1,200	ND(1,000)	ND(1,000)	ND(1,000)	ND(1,000)	
Hexavalent Chromium		ND(10)	ND(10)	10	ND(10)	ND(10)	50

Notes:

	All other TCL/TAL parameters were not detected.
•	The associated value is estimated due to potential field contamination.
ND	Not detected above quantifiable limits stated in parentheses.
NA	Not analyzed for this particular parameter as it was not included in the SSIs.
A	The associated value exceeded NYSDEC Class GA Groundwater Standards (6NYCRR Part 703.5).
D	The associated value exceeded NYSDOH Drinking Water Standards (Sanitary Code Part 5).
B	The associated value exceeded NYSDOH Raw Water Supply Standards (10NYCRR Part 170).

concentrations. All other surface water samples collected in October 1989 reported no detectable SSI VOCs.

In order to better understand the surface water pathways, a visit was made to the Site to confirm sample locations and surface water directions. It was discovered that two different flows contributed to the flow through the culvert crossing under River Road to the west and discharging in the area of SW-6. The sample location SW-8 represented the flow coming from the north along the east side of River Road, but there was also a flow component from the east. Following this swale upgradient, it was found that two separate flows contributed to this swale. One flow originated from the coal storage area of the TCC facility to the east. A second flow came from the southeast in the form of two long culverts under the group of buildings just east of River Road. South of the TCC Site these culverts collected all of the surface waters from the large marshy area including much of the petrochemical facilities south of the Site.

Subsequent sampling of this component of the surface water drainage pattern was conducted as follows:

SW-18 - sample collected from ditch originating just west of the coal piles, at the southeast corner of Site 109, prior to flow down the slope towards River Road.

SW-16 - sample collected from the flow of the combined culverts from the south prior to the flow joining the swale with the flow from SW-18.

SW-17 - sample collected prior to the combined SW-18/SW-16 flow joining with the northerly SW-8 flow and heading by culvert under River Road.

The results of the samples collected from these three additional locations showed only SW-16 had a detectable level of benzene (6.4 μg/L) above the most stringent MCL. All other SSI VOC parameters were reported as non-detect for the three additional surface water locations. This benzene presence in the surface water sample collected at location SW-16 indicates the contamination is originating south of the Site and entering the TCC surface water pathway via the two culverts. It should be noted, however, that the sample (SW-17) of the combined TCC flow (SW-18) and off-Site flow (SW-16) had no detectable concentration of benzene due to probable dilution. As the flows SW-17 and SW-8 combine prior to heading west through the culvert under River Road to SW-6, and SW-17 and SW-8 have no detectable concentrations. The presence of benzene and toluene in the SW-6 sample is inexplicable, but does not appear to originate from the TCC plant facility on the east side of River Road.

10.3.2 BNAs

Two PAH compounds, fluoranthene and pyrene, were detected in the surface water sample collected at SW-9, however, neither compound exceeded the most stringent groundwater MCL (50 μg/L). The surface water at location SW-9 represents the drainage originating from New York Wire site to the north. As the surface water flow proceeds south along

River Road, surface water along the TCC access road (SW-10) joins the flow prior to discharging at SW-8. No BNA compounds were detected at either of these locations.

Three other samples; SW-12, SW-14 and SW-15; reported low-level concentrations of pyrene. These locations are all located southeast of the Site in the low marshy area. An aerial survey was completed in order to determine the topographic features of the Site. From this survey, the direction of surface water flow in this low marshy area can be determined. It appears that the surface waters at SW-12, SW-14 and SW-15 all flow towards a central location in the area of SW-13 and that the general direction of surface water flow from the low marshy area is to the west. This is confirmed by the physical barriers and railroad tracks to the east and south which prevent any off-Site flow in these directions.

Although pyrene was detected in the SW-12, SW-14 and SW-15 surface water samples, no pyrene (or any other PAH compound) was detected in the SW-13 and SW-11 samples representing surface water flow downgradient of the three other samples.

The three additional samples (SW-16, SW-17 and SW-18) which were collected to attempt to isolate the reported VOC presence at SW-6, did not report any BNA compounds whatsoever. This indicates that there is no BNA surface water contamination originating from the coal storage area and the southern off-Site areas including the previously mentioned low marshy area.

10.3.3 Metals

Samples were analyzed for TAL metals from five specific locations; SW-5, SW-8, SW-9, SW-10 and SW-14, and also from the three additional locations; SW-16, SW-17 and SW-18. Only two metals, iron and manganese, were found to exceed the most stringent groundwater MCL (300 µg/L). Manganese concentrations were reported for all samples with the highest concentration (5000 µg/L) being detected in the SW-6 sample. Several surface water flows contribute to the surface water located in the area of SW-6, and of these flows, the highest reported concentration (3520 µg/L) was from the SW-16 sample representing the southerly off-Site flow directed through the two long culverts. Although some levels of manganese were detected in SW-18 from the TCC coal storage area and SW-10 from the TCC access road area, it appears that the off-Site areas are the major contributor to the elevated manganese levels reported for SW-6 and the downgradient SW-5 surface waters.

Iron concentrations exceeding the most stringent groundwater MCL were reported in all but two of the surface water samples, SW-10 and SW-18. As with manganese, the highest concentration was reported for the SW-6 sample. Since the SW-18 and the SW-10 samples, representing TCC surface water flow, contained iron below the most stringent MCL, and the SW-16 sample, representing the southerly off-Site flow, contained elevated iron concentrations, it appears that the iron contamination, like the manganese contamination, originates off Site and is not due to TCC.

10.3.4 Other Compounds

Cyanide was only found to exceed the most stringent groundwater MCL (100 µg/L) on three occasions. The highest reported concentration was 1680 µg/L from the SW-6 sample. This level was detected in the revisit sample collected on December 20, 1989 for TAL metals. The initial SW-6 sample (and duplicate) reported cyanide to be at or just above the detection limit (10 µg/L).

The other samples with elevated cyanide concentrations are SW-16 (155 µg/L), representing the off-Site southerly area, and SW-17 (230 µg/L), representing the combination of the surface water flow from the TCC coal storage area (SW-18) and the southerly off-Site area (SW-16). It appears that this cyanide contamination is originating off Site as cyanide was not detected at SW-18. The SW-16, SW-17 and SW-18 samples were collected on the day previous to the collection of the SW-6 sample with the elevated cyanide concentration.

Cr+6 was only detected in one sample (SW-17 and its duplicate) and the reported concentration was equivalent to the detection limit (10 µg/L) and well below the most stringent groundwater MCL (50 µg/L).

Oil and grease was detected in five surface water samples. However, the concentrations in four of the samples was between 1000 and

1900 μg/L. These levels are not of concern. The sample with an elevated oil and grease concentration (15400 μg/L) was collected at SW-9. This location represents the surface water flow contributed by the New York Wire site north of the TCC access road.

10.3.5 Summary

The major area of concern is the surface water in the swale of Site 108 on the west side of River Road. There was benzene, toluene, iron, manganese and cyanide present in the SW-6 surface water samples. However, it appears that this chemical presence is being contributed to by the southerly off-Site areas for which the surface water is directed by two long culverts towards the southwest corner of Site 109. SW-16 samples represent this off-Site surface water flow and the analytical results indicate the detection of similar parameters.

Oil and grease, fluoranthene and pyrene were detected in the SW-9 sample representing the northerly off-Site surface water flow from the New York Wire site. Coincident sampling of SW-8 and SW-6, downgradient of SW-9, did not reveal detectable concentrations of these compounds and, therefore, there is no further concern with the surface water source.

Pyrene was detected at low-level concentrations at the extremities of the low marshy area, however, the flows from these sampling locations do not proceed off Site. In fact, the flow of surface water from these locations is directed towards a central marshy area which had no detectable levels of pyrene.

10.4 SEDIMENT SAMPLES

Following the initial collection of surface water samples, the Work Plan specified the collection of sediment samples at the locations where the surface water analyses indicated chemical presence related to TCC operations. This sediment sampling program centered around the SW-6 location. Sediment samples were collected at SW-6, downgradient at SW-5 and upgradient at SW-9 due to the PAH presence noted there. Two sediment samples were also collected in the low marshy area, SW-11 and SW-14, in order to assess the apparent pyrene presence. Table 10.8 presents the sediment sample analytical results.

Sediment samples of the off-Site surface water pathway from the southerly area were not collected as the three additional surface water samples were collected as part of the third sampling visit.

10.4.1 VOCs

Benzene and toluene were detected in the SW-6 sediments. These compounds were also found, at lower concentrations, both downstream at SW-5 and upstream at SW-9. The presence of these compounds in the SW-9 sediments indicates that there is some off-Site

TABLE 10.8

SEDIMENT ANALYTICAL RESULTS
TONAWANDA COKE CORPORATION

Source ***Sample ID*** ***Date***	***SW-5*** ***S-2428-DT-077*** ***12/20/89***	***SW-6*** ***S-2428-DT-080*** ***12/20/89***	***SW-9*** ***S-2428-DT-072*** ***12/20/89***	***SW-9 (dup)*** ***S-2428-DT-073*** ***12/20/89***	***Field Blank*** ***S-2428-DT-081*** ***12/20/89***
VOCs (μg/kg)					
Methylene Chloride	2,500	2,090	2,010	1,300	4,840
1,2-Dichloroethene (total)	2,690	90	ND(20)	ND(20)	ND(20)
Benzene	40	190	160	60	240
Toluene	200	420	120	100	240
Total Xylenes	ND (20)	280	ND (20)	ND (20)	ND (20)
Ethylbenzene	ND(20)	110	ND(20)	ND(20)	ND(20)
BNAs (μg/kg)					
Acenaphthylene	ND(7,500)*	ND(6,000)*	2,120	1,960	ND(600)
Phenanthrene	8,350	125,000	ND(600)	ND(600)	ND(600)
Pyrene	9,620	ND(6,000)*	ND(600)	ND(600)	ND(600)
Anthracene	ND(7,500)*	36,600	ND(600)	ND(600)	ND(600)
Benzo(a) Anthracene	ND(7,500)*	20,800	ND(600)	ND(600)	ND(600)
Benzo(b) Fluoranthene (1)	ND(7,500)*	39,900	ND(600)	ND(600)	ND(600)
Benzo(k) Fluoranthene (1)	ND(7,500)*	39,900	ND(600)	ND(600)	ND(600)
Chrysene	ND(7,500)*	32,000	ND(600)	ND(600)	ND(600)
Fluoranthene	ND(7,500)*	106,000	ND(600)	ND(600)	ND(600)
Fluorene	ND(7,500)*	194,000	ND(600)	ND(600)	ND(600)
Other Compounds (mg/kg)					
Oil and Grease	4,060	31.7	17.6	606	618

Notes:

All other SSI parameters, cyanide and Cr+6 were not detected.

* High quantifiable limits due to dilution.

(1) Indistinguishable isomers, reported value is total concentration.

ND Not detected above quantifiable limits stated in parentheses.

chemical contribution from the New York Wire site. It is expected that the sediments at SW-16 would most likely indicate benzene and toluene presence as this was postulated to be the major surface water chemical contamination source.

Total xylenes and ethylbenzene were detected in the SW-6 sediment sample as well, however, no other samples contained this compound. This may also originate from the off-Site source (SW-16) but xylenes and ethylbenzene were not detected in any of the surface water samples.

Total 1,2-dichloroethylene was detected at elevated levels in the sediment at SW-5, but at much lower levels upgradient at SW-6. This chemical presence would appear to be originating from the Site 108 area. 1,2-Dichloroethylene was not detected in any of the surface water samples.

10.4.2 BNAs

Phenanthrene and pyrene were detected in the sediments of SW-5. At SW-6, phenanthrene was detected at higher concentrations, but pyrene was not detected in the sediment. These compounds were not detected in the surface water at these two locations, however, pyrene was detected in the surface water at SW-9, but not the sediment. The source of the phenanthrene at SW-6 and SW-5 is unknown, as this compound was not detected in any of the surface water samples.

There are several other PAH compounds; anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene and fluorene, which were detected in the SW-6 sediment sample. These did not occur in the sediment downgradient at SW-5 or in any of the surface water samples. The presence of these PAH compounds could possibly be due to historic surface water drainage from the TCC Site, but the surface water samples did not contain these compounds as they are readily adsorbed to the soil particles. The soil description of the SW-6 sediment sample indicated an iridescent sheen and the PAH concentrations indicate a hot-spot of compounds directly related to coke/coal. It appears that the PAHs have adsorbed to the sediments in the SW-6 area, however, due to their low solubility these compounds are not expected and apparently have not migrated via the surface water towards the Niagara River.

Acenaphthylene was detected in the SW-9 sediment samples but not in any downgradient (SW-6 and SW-5) locations, and this compound was not detected in any of the surface water samples. SW-9 is an off-Site location and therefore the acenaphthylene presence is not likely due to TCC operations.

10.4.3 Other Compounds

Cyanide and Cr+6 were not detected in any of the collected sediment samples. Oil and grease was present in all the sediment samples, but the only higher concentration was found in the SW-5 sample. This coincides with a low-level oil and grease concentration detected in the corresponding surface water sample. There is presently no further contribution of oil and grease from upgradient sources as evidenced by the SW-6 surface water and sediment samples.

10.4.4 Summary

The sediment samples indicated evidence of past PAH presence which was no longer present in the surface waters from the TCC Site or off-Site areas. The presence of benzene and toluene was to be expected, but total xylenes and 1,2-dichloroethene were also present. The source of these chemicals is unknown as they are not present in the surface waters either.

11.0 ENVIRONMENTAL ASSESSMENT

11.1 INTRODUCTION

This assessment reviews the data presented in the previous sections of this report, makes comparisons with background concentrations of chemicals present in the soil at the site, and compares the concentrations reported in surface water and groundwater with Federal and New York State regulatory standards and guidelines for water quality. From these comparisons, conclusions will be drawn regarding the potential impact of the Site on public health and the environment.

The following data sets were evaluated:

- Borehole and test pit soil samples;
- Sediment samples;
- Surface water samples; and
- Groundwater samples.

This section will define the chemicals of concern, the potential exposure pathways and estimated exposure point concentrations, and discuss the potential risk and hazard presented by the Site.

11.2 SITE RELATED CHEMICALS OF CONCERN

The Section 5.2, SSI Parameters Section, evaluation selected a specific list of chemicals for further groundwater analyses. Since this list indicates the primary chemicals at the Site with the greatest potential for mobility in the water media, these chemicals were also selected as the chemicals for the environmental assessment. This list was as follows:

VOCs
- 1,2-Dichloroethene (total)
- 1,1,1-Trichloroethane
- Benzene
- Toluene
- Ethylbenzene
- Total Xylenes

PAHs

Cyanide

Cr+6

Oil and grease

Table 11.1 presents this list of chemicals and the State and Federal water quality standards and guidance limits which will be used in this evaluation.

11.3 POTENTIAL EXPOSURE PATHWAYS

Their are four potential media of concern at the Site, air, surface water, surface and subsurface soil and groundwater.

TABLE 11.1

WATER QUALITY STANDARDS, CRITERIA AND HEALTH ADVISORIES (μg/L)

	New York (2)				USEPA					
					Health Advisories (5)					
Chemical(1)	Surface	Groundwater	MCL(3)	WQC(4)	1 Day	10 Day	Longer 10 kg	Longer 70 kg	Life	Risk (6) 1×10^{-6}
Benzene *	1.0 (G)	ND	5	0.66	235	235	--	--	--	1.0
1,2-Dichloroethylene (Total)	50 (7)	50 (7)	70 (8)	--	2720	1000	1000	3500	350	NC
Ethylbenzene	50 (G)	50 (G)								
Toluene	50 (G)	50 (G)								
1,1,1-Trichloroethane	50 (G)	50 (G)								
Xylenes (Total)	50 (G)	50 (G)								
PAHs										
Fluoranthene (non-carc)	50 (G)	50 (G)								
Benzo (a) pyrene (Carc)	.002 (G)	-- --	--	0.028	--	--	--	--	--	--
Cyanide	100 (STD)	200 (STD)	--	200	220	220	220	750	750	
Chromium (+6)	50 (STD)	50 (STD)	--	50	1400	1400	240	840	170	
Oil & Grease										

All units are ug/liter

Notes:

(1) * Indicates chemicals with an IRIS file.

(2) New York Surface Water and Groundwater (GW) Standards (STD) and Guidance (G).

(3) EPA Maximum Contaminant Level.

(4) EPA Water Quality Criteria (Federal Register 1980) - Fish and Water Consumption. Carcinogens - 1×10^{-6} incremental risk of cancer.

(5) Health Advisors

1-day	-	Limit for a 10 kg child, single 1 liter exposure.
10-day	-	Limit for 10 kg child drinking 1 liter/day for 10 days.
Longer 10-kg	-	Limit for 10 kg child drinking 1 liter/day for months to years.
Longer 70-kg	-	Limit for 70 kg adult drinking 2 liters/day for months to years.
Lifetime:		Limit for lifetime of consumption at levels noted for age groups.

(6)

Risk	-	1×10^{-6}: Concentration producing 1×10^{-6} incremental risk of cancer in a lifetime (IRIS)
NC	-	Non-Carcinogen
NA	-	Not available for these carcinogens. Use WQC value.

(7) Limit for trans-ISOMER.

(8) Proposed MCLG.

Air samples were not collected at the Site during this investigation as the previous studies did not reveal this media to be of concern.

Surface soil and sediment concentrations are a concern for on-Site workers and trespassers, however trespassers would not be expected to enter the fenced main plant area to the east of River Road, but could attempt to enter the more secluded fenced area west of River Road. Concern for the non-worker contact would relate to the area between the main plant area and the Niagara River. Surface soil including sediment chemical presence will be evaluated and sub-surface soils will be addressed as it relates to groundwater. Potential human contact with subsurface soil chemicals at this Site would occur by leaching of the subsurface soils by percolating surface water which subsequently reached the groundwater. This potential exposure will be discussed in the evaluation of groundwater exposure.

Surface water can provide a potential exposure pathway. The stream which courses through the Site is small and intermittent, and there is no potential for direct contact of more than an incidental and infrequent nature. The stream does discharge to the Niagara River which is a source of drinking water, food fish, and recreation (swimming). This potential exposure will be discussed. In addition, concerns have been raised in a previous report regarding the potential impact on the marshy areas to the southeast of the Site. This potential concern will also be discussed.

Groundwater is a primary concern at waste disposal sites, in general. At this Site, groundwater was sampled from the upper most waterbearing unit which was in fill material. Below the fill material was a thick layer of clay which forms an effective aquitard. There are two areas where groundwater showed chemcial presence, the eastern area of the main plant fenced area and the area between River Road and the Niagara River. Because of the topography of the Site, these two areas are not hydraulically connected due to surface topography and the existence of the clay strata which forms an effective aquitard between the two areas. It is also apparent that the well showing chemical presence in the area between River Road and the River (MW8-89) is not effectively connected hydraulically to the Niagara River since it did not contain enough water for sampling during the last two sampling rounds. MW-7 was non-detect for SSI parameters and this is added confirmation that water is not moving from MW8-89 to the River. This indicates that the groundwater which was sampled is confined to very small areas and since the fill area is neither a suitable location for a production well nor is there a productive aquifer, there is no potential exposure to groundwater at the Site. To further put the groundwater concentrations into perspective, the reported concentrations can be compared to standards and criteria or guidelines for drinking water as published by the State of New York and the USEPA. Only concentrations in the single sample from MW8-89 exceed any of the standards and guidance values noted on Table 1. Since subsequent samples were not obtainable from this well because of the limited water in-flow, these minimal exceedences do not cause any concern.

11.4 EVALUATION OF CHEMICAL CONCENTRATIONS

Soil concentrations are reported on Table 10.1 (Test Pits) and Table 10.2 (Boreholes). Sediment sample concentrations are reported in Table 10.8. The SSI VOCs were present at low ppb concentrations, if detected at all. The VOCs were present in one sediment sample (SW6) at higher concentrations than reported in the soil. The upgradient (SW5) and downgradient (SW9) did not contain these higher concentrations. SW6 is located to receive the drainage from River Road. Automobile exhaust and oily emissions would be a source for the VOCs and PAHs reported at the SW6 location. This indicates a very limited distribution of chemicals in the sediment. The concentrations observed would not be a health concern because of the limited potential contact. The concentrations observed in the sediments in an industrial site are likely to be present due to the adsorption from surface water drainage to the sediments. These concentrations, and even higher, could be expected in soil in a urban area. None of the VOC concentrations would be a health concern, even in an area of unrestricted access.

PAHs were reported generally across the Site in part-per-billion to low part-per-billion concentrations. Considering the location of the Site in an industrial area and the general practice of applying flyash on industrial sites, these levels of PAHs would be anticipated. PAHs are comparatively insoluble in water and have a strong tendency to adsorb to soil particles, therefore, there is little potential for migration off-Site. Direct contact exposure to the PAHs in on-site soil and sediment would be minimal and would not present a concern for worker or trespasser health.

Concentrations of metals reported in soil were generally within the range of concentrations which occur in soil naturally. Considering the location, one could expect elevated concentrations of chemicals related to industrial air pollution such as arsenic, lead, and mercury. Magnesium was reported at elevated concentrations in only one location (River section locations Q & S), but this concentration in this limited area would not be health concern for soil exposure.

Surface water concentrations were low for the SSI chemicals. Benzene and toluene were the only VOCs noted reported in surface water at detectable concentrations. Acetone was reported but is considered a laboratory contaminant. Benzene is reported at concentrations which only slightly exceed the EPA MCL value of 5 µg/l. The toluene concentrations are well below any State of Federal limits noted on Table 11.1. Toluene and benzene were noted at location SW-6, adjacent to River Road which carries a heavy traffic load. VOCs and PAHs would be expected as surface contamination from vehicle exhausts. Benzene was also noted at SW-16, but again at a concentration that is slightly greater than the EPA MCL and could be expected in surface water in an urban/industrial area.

PAHs were noted in surface water but were limited to the lower molecular weight and more soluble pyrene and fluoranthene which are non-carcinogens. Concentrations similar to those found at the Site are ubiquitous in an urban industrial setting. Since some of the surface water locations indicating chemical presence are located in the east portion of the Site, there is a potential for this contaminated surface water to migrate to the marshy areas adjacent to the Site. The benzene and toluene would not be a concern because they would dissipate rapidly due to volatilization from shallow surface water. The high adsorption factor for PAHs would prevent these chemicals from migrating off-Site, or any distance into the marshy area. None of the concentrations of the chemicals reported on-site would be a concern if present in a marsh ecosystem. The VOCs present are not highly toxic and would have a short residence time in the marshy areas due to biodegradation and volatilization. The PAHs have low toxicity and are rapidly metabolied by vertebrates including birds, mammals and fish.

Groundwater monitoring revealed detectable concentrations in two wells, MW8-89 and MW-3 (and its replacement MW3R-89). As discussed earlier, there are no complete pathways for exposure of man or the environment from these wells. Any minor movement of groundwater from the area around MW7-89 to the River would be inconsequential since no VOCs or BNA were detected in the groundwater above the detection levels of 1.0 μg/L and 3.0 μg/L, respectively. For cyanide, and oil and grease, average groundwater concentrations were 123 μg/L and 1,300 μg/L, respectively at well MW7. Using a gradient of 0.006, a flow path width of 640 feet and a saturated depth of 6 feet and the geometric mean hydraulic conductivity of 3.6×10^{-4} cm/sec, the estimated chemcial mass flux to the River is 0.00018 lbs/day for cyanide and 0.0019 lbs/day for oil and grease.

12.0 CONCLUSIONS AND RECOMMENDATIONS

Following completion of the Supplemental Site Investigation at the TCC Site, CRA has formulated the following conclusions:

- there is widespread PAH presence in surface fill materials at Site as expected due to coal/coke presence,
- the underlying clay is acting as an aquitard and prevents both vertical and horizontal groundwater movement. The clay does not contain TCC chemicals,
- groundwater chemical presence at wells MW3R-89 and MW8-89 by SSI VOCs and PAHs is localized and not exiting the Site,
- the estimated mass flux to the River via the groundwater is 0.00018 lbs/day for cyanide and 0.0019 lbs/day for oil and grease,
- cyanide is present in the groundwater beneath the Site but does not appear above MCLs at the Site boundaries except in the northeast corner,
- no chemicals are currently leaving the TCC Site via the surface water pathways, and
- chemical presence in TCC surface waters appears to be due to off-Site migration from south.

Based on the findings of this Supplemental Site Investigation and the previous studies, CRA concludes that an intensive Remedial Investigation/Feasibility Study (RI/FS) is not warranted for the TCC Site at this time. However, in order to address the cyanide situation in the northeast corner of the Site, CRA recommends that two additional monitoring wells should be drilled off Site. These wells will be monitored for groundwater elevation to determine if there is an off-Site gradient, and sampled for the SSIs, in particular cyanide, to further evaluate the groundwater situation north and east of MW13-89 and MW-2. At the same time, it is recommended that groundwater sampling of all the on-Site wells be completed on a yearly basis for five years in order to continue to update the TCC data base and ensure the situation remains unchanged.