

FINAL REPORT

VOLUME I

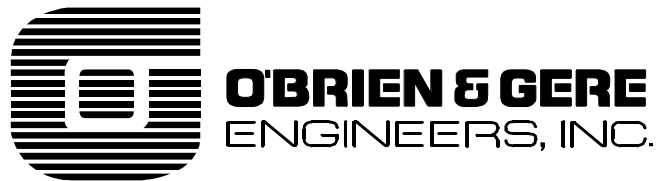
Remedial Investigation Report

**Old Erie Canal Site
Clyde, New York**

**Parker Hannifin Corporation
Cleveland, Ohio**

**General Electric Co.
Albany, New York**

November 24, 2003



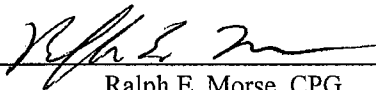
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Ralph E. Morse, CPG
Managing Scientist

November 24, 2003



O'BRIEN & GERE
ENGINEERS, INC.

435 New Karner Road
Albany, New York 12205

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1. Introduction

1.1. General

This Remedial Investigation (RI) Report has been developed by O'Brien & Gere Engineers, Inc. on behalf of the Parker Hannifin Corporation (Parker-Hannifin) and the General Electric Company (GE) for the Old Erie Canal Site (Site). The RI was conducted pursuant to Order on Consent # B8-0533-98-06 between the New York State Department of Environmental Conservation (NYSDEC), Parker-Hannifin and GE. The Site is currently listed in the Registry of Inactive Hazardous Waste Disposal Sites (Site No. 859015) as a Class 2 site. This RI was conducted in accordance with the NYSDEC-approved Remedial Investigation/Feasibility Study (RI/FS) Work Plan prepared by O'Brien & Gere and dated December 2001 and attached to the Order on Consent.

As part of the RI/FS Work Plan, a site specific Health and Safety Plan (HASp), a Sampling and Analysis Plan (SAP) which includes both the Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), and a Citizen Participation Plan (CPP), were developed by O'Brien & Gere and approved by the NYSDEC.

1.2. Project objectives

The objective of the RI is to define the nature and extent of Site-related contamination, assess potential risks to human health and the environment, and to develop the data necessary for the development and evaluation of remedial alternatives during the Feasibility Study for media of concern. To meet this objective, the historical information and the RI field investigation data collected at the Site has been integrated into this RI Report.

1.3. Project scope

The original scope of the RI as presented in the NYSDEC-approved RI/FS Work Plan was modified and expanded several times during the course of the investigation. The first expansion was performed in response to the results of the preliminary screening program. The second expansion was performed in response to VOC detections in storm water and surface water at the Site. A third expansion was performed in response to elevated concentrations of volatile organic compounds (VOCs) in monitoring wells MW-4S and MW-4B and temporary well point GP-16. The fourth and final expansion of the RI scope of work consisted of a hydraulic monitoring program to evaluate the ground

water/surface water relationship near the Clyde River and two additional ground water sampling events. Additional details of this expanded scope of work are presented in Sections 1.3.2. through 1.3.6. A complete description of the field investigation methodology is included as Section 3.

1.3.2. Expanded preliminary screening program (First Expansion)

In response to the elevated concentrations of VOCs detected in the temporary monitoring points located between the manufacturing building and the residential property to the west, five additional direct push borings (GP-40 to GP-44) were installed to define the extent of the dissolved phase VOC contamination along the western and northwestern portions of the Site.

1.3.3. Refinement of the final locations of the monitoring wells

The results of the preliminary screening program were used to adjust the final locations of the additional monitoring wells proposed in the RI/FS Work Plan. During a May 17, 2002 conference call between NYSDEC, the New York State Department of Health (NYSDOH), Parker-Hannifin, GE, and O'Brien & Gere, the results of the preliminary screening program were reviewed. As a result, the final location of monitoring wells MW-2S, MW-2B, MW-3S, MW-4S, MW-4B, MW-7S, MW-7B and MW-8S were modified as follows.

Monitoring well pair MW-2 was moved approximately 100 feet south of the original location proposed in the RI/FS Work Plan due to dry overburden conditions observed during the drilling of test boring GP-7. Due to the elevated concentrations of the VOCs at temporary well point GP-36, which also coincided with a glaciofluvial channel deposit observed along the western boundary of the Site, monitoring wells MW-3S and MW-4S were shifted approximately 100 feet west of the original location proposed in the RI/FS Work Plan. In addition, the proposed bedrock well that was originally to be coupled with MW-3S was moved to coincide with MW-4S to further evaluate conditions downgradient of the barge turnaround where elevated concentrations of VOCs were detected during the preliminary screening program. Monitoring well pair MW-7 was moved approximately 100 feet south of the original location proposed in the RI/FS Work Plan to better monitor the area down gradient of the barge turnaround. Monitoring well MW-8S was moved approximately 400 feet west of the original location proposed in the RI/FS Work Plan. MW-8S was moved due to relatively dry conditions encountered during drilling of test boring GP-1 and to monitor the upgradient portion of the glaciofluvial channel deposit observed along the western portion of the Site. Also as a result of the preliminary screening program, one additional shallow unconsolidated-unit monitoring well (MW-9S) was proposed.

1.3.4. Additional surface water and storm water investigations (Second Expansion)

In response to the detection of VOCs in surface water within the former Barge Canal and along the storm drain line leading to catch basin CB-3, a surface water confirmation sampling program and an enhanced storm sewer system evaluation was recommended. The scope of work for these additional investigations is described in an August 13, 2002 letter and is summarized below.

1.3.4.1. Surface water confirmation sampling program

To confirm prior analytical results, additional surface water samples were collected from locations SW-5, SW-9, and from two additional down-stream locations (SW-10 and Outfall) for laboratory analysis of VOCs via USEPA SW-846 Method 8260B. SW-10 is located within the former Barge Canal prior to where the surface water flow combines with the storm water discharge from the Village of Clyde, and the Outfall sample was collected from the combined flow just prior to its discharge to the Clyde River.

1.3.4.2. Expanded storm sewer evaluation

The scope of the original RI included a review of available underground utility maps to locate existing and historical storm sewer system components at the Site. In addition, an inspection of on-site sewers, manholes and catch basins was conducted to assess the condition of these storm sewer system components and the potential for the sewers to serve as conduits for ground water migration. To evaluate the source of the VOCs identified within the storm sewer system, an expanded storm sewer evaluation was performed. The expanded storm sewer evaluation focused on evaluating the relationship between the current and historical storm sewer lines and changes that were made to the system during building expansions. An investigation into the integrity of the storm sewer piping was also performed to evaluate the source of the VOCs identified within the storm sewer system. The structural integrity and the overall condition of the sewers were evaluated through the use of internal closed circuit television (CCTV) inspection techniques, smoke testing and dye testing. As a result of this evaluation, an IRM was proposed to address the VOCs in the storm sewer system and is discussed in Section 3.11.3, and more fully in the Storm Water Interim Remedial Measures Work Plan prepared by O'Brien & Gere dated June 2003.

1.3.5. Additional RI investigation activities (Third Expansion)

Based on the results of the original RI field investigation activities, additional RI activities were proposed. These activities were discussed during an October 9, 2002 project review meeting between the NYSDEC, NYSDOH, Parker-Hannifin, GE and O'Brien and Gere and summarized in a November 1, 2002 letter. In general the additional RI investigation activities involved subsurface investigation in the areas of temporary well locations GP-15, GP-16, monitoring well MW-4S, and in an area south of the Clyde River as described below.

1.3.5.1. Soil boring and temporary monitoring well installation program

In response to elevated concentrations of VOCs in ground water samples collected from temporary monitoring well GP-16, and to a lesser extent temporary monitoring well GP-15, additional soil and ground water sampling was proposed. The objective of the additional sampling was to evaluate whether the abandoned sanitary sewer bedding material has any impact on contaminant migration in the vicinity of locations GP-15 and GP-16 and MH-3A or MH-3B.

Fourteen additional test borings were advanced in the area south of the manufacturing building. In addition, to further delineate the geometry of the glaciofluvial channel deposit located along the western boundary of the Site two additional borings and temporary monitoring wells were installed in the area south of the Old Erie Canal in the vicinity of monitoring well MW-4S.

1.3.5.2. Overburden and bedrock monitoring wells and sampling

The results of the ground water sampling indicated that elevated concentrations of VOCs were detected in overburden and shallow bedrock ground water in the vicinity of monitoring wells MW-4S and MW-4B. Therefore, Parker-Hannifin and GE proposed to install additional overburden and shallow bedrock monitoring wells south of the Clyde River to delineate the extent of the VOC impacts. Two new monitoring well pairs, each consisting of an overburden well and a shallow bedrock well (designated MW-11S/MW-11B and MW-12S/MW-12B), and a single new shallow bedrock well (designated MW-10B) were installed south of the Clyde River.

Since the primary ground water constituents detected during the RI were VOCs, and to evaluate whether natural attenuation is occurring, ground water samples collected from the newly installed wells were analyzed for VOCs and natural attenuation parameters only.

1.3.6. Expanded hydrogeologic study and groundwater investigation (Fourth Expansion)

The expanded hydrogeologic study consisted of a ground water elevation monitoring program to further evaluate ground water flow directions at the Site and to evaluate surface water and ground water interaction near the Old Erie Canal and the existing Barge Canal (i.e., Clyde River). Data loggers were installed in select monitoring wells and the Clyde River to facilitate data collection.

To confirm the results of the initial ground water sampling event performed in June 2002, two additional sampling events were conducted. However, since the primary constituents detected during the initial sampling round were VOCs, and to confirm that natural attenuation is occurring at the Site, samples were analyzed for VOCs and natural attenuation parameters only.

1.4. Property access

Several activities associated with the RI were performed on properties adjacent to the Site. These activities included the completion of direct push soil borings, collection of surface water/sediment samples, installation of monitoring wells, and subsequent access to the monitoring wells to collect water level information, ground water samples and to complete hydraulic conductivity testing. Inspection of select sanitary and storm sewer manholes was also conducted.

The majority of the off-site activities occurred on the Village of Clyde's properties located north, south and west of the Site. Off-site field activities also occurred on the Cole property located west of the Site, and the Bricco property located on the south side of the Clyde River.

Formal access agreements were executed between Parker-Hannifin and the adjacent property owners prior to conducting fieldwork.

1.5. Report organization

Section 1 outlines the initiation, objectives, scope of the project, and the access to adjacent properties. Section 2 discusses the facility background, including a summary of previous investigations.

Field methodologies associated with implementation of the RI field activities are described in Section 3. In addition to field methodologies and protocols, Section 3 briefly summarizes the raw data, analytical techniques, and results of various analyses upon which later sections are based.

Section 4 presents regional and site-specific geologic information and provides the framework for Section 5, which details hydrogeologic conditions. Sections 6, 7, 8, and 9 discuss the nature and extent of VOCs, SVOCs, Pesticides, PCBs and Metals in ground water, surface water, sediment and surface soil, and subsurface soil respectively. Section 10 discusses the VOCs in the storm water. Section 11 presents a fish and wildlife impact analysis and a human health risk assessment. Section 12 presents the conclusions of the RI.

2. Background

2.1. General

The Old Erie Canal Site includes the southern and southwestern portions of property owned by Parker-Hannifin at 124 Columbia Street in the Village of Clyde, Town of Galen, Wayne County, New York (Figure 2-1) (hereafter referred to as “Parker-Hannifin’s Property”). The Site as shown on Figure 2-1, includes portions of Parker-Hannifin’s Property as well as portions of the abandoned Erie Canal, which is currently owned by the Village of Clyde. The Site is approximately 10.5 acres in size and is bounded to the north by Columbia Street, to the east by the P&C Grocery Store property, and to the west by private residential properties. An active rail line and the New York State Barge Canal (Barge Canal) border the Site to the south.

2.2. Site background

2.2.1. General

Information related to historical manufacturing operations on the Property was summarized in the Final Preliminary Site Assessment (PSA) Report dated September 1995 prepared by URS Consultants, Inc. (URS) for the NYSDEC, and the Working Copy of the PSA Report (Preliminary PSA Report) dated January 1991 prepared by URS for NYSDEC. To further evaluate historical manufacturing operations and to obtain additional information related to the Old Erie Canal and the existing Barge Canal, O’Brien & Gere reviewed historical facility maps and other information obtained from the following: Parker-Hannifin; New York State Thruway Authority; New York State Canal Corporation; the Sanborn Library, LLC; Environmental Data Resources, Inc.; and National Aerial Resources.

The Site has been used for manufacturing operations since the early 1800’s. The first known manufacturing operations at the Site have founding dates that correspond to the completion of the construction of the original Erie Canal. Based on information obtained from the Office of Canals, the first canal construction in New York State began around July 4, 1817. The canals became operational following an inauguration by Governor DeWitt Clinton on October 26, 1825. The original Erie Canal (i.e., Clinton’s Ditch) was 40 feet wide and four feet deep. Historical maps obtained from the Office of Canals, which depict the results of the Holmes Hutchinson Survey dated 1834, indicate that glass manufacturing operations had already been established on the Property.

The Erie Canal was subsequently enlarged to a width of seventy feet and a depth of seven feet between 1836 and 1862. Based on survey maps dated 1862 obtained from the Office of Canals, the enlarged Erie Canal now included the barge turnaround located in the southwestern portion of the Site.

As early as 1884, public opinion was developing for enlargement and improvement of existing canals in New York State. In 1903, a Barge Canal Referendum Bill was passed by the New York State Senate and Assembly, which called for the construction of the existing Barge Canal System (Office of Canals). The section of the canal which runs through the Village of Clyde was constructed as part of Contract No's. 47 and 47A. Maps dated July 1, 1908 and prepared as part of Contract No. 47 show the plan and profile of the proposed Barge Canal. The Barge Canal utilized a portion of the Clyde River and occupied a channel 100 feet wide at the bottom of its prism and approximately twelve feet in depth. At the conclusion of the navigation season, the Old Erie Canal was formally abandoned in November 1917. Work on the Barge Canal in Wayne County was formally completed in August 1918 (Canal Society of New York State, 1991).

Subsequent to the abandonment of the Old Erie Canal, through out New York State, many sections of the abandoned canal have been filled in and/or used as historical disposal locations. In the Village of Clyde, portions of the former barge turnaround and the Old Erie Canal were used by local contractors for the disposal of construction and demolition debris. In addition, based on a review of available data, the portion of the Old Erie Canal located along the southern section of Parker-Hannifin's property was filled in by Parker sometime between 1968 and 1979.

Additional information associated with the history of manufacturing operations on the Property is presented in the Final PSA Report (URS, 1995). As presented in the Final PSA Report, glass manufacturing dominated Site operations until circa 1932. Based on a field survey conducted in 1932 for the preparation of Sanborn Fire Insurance maps, the Clyde Glass Works were abandoned and all but one building had been removed.

By 1941 the Property was reportedly purchased by Acme Electric and a new building was constructed. Acme Electric reportedly occupied the Property from 1941 to 1945 and produced transformers for the United States Navy. GE reportedly purchased the Property in 1945 and manufactured electrical equipment, including ballast for fluorescent lights, rectifiers, transistors, and diodes. In 1965 Parker-Hannifin reportedly purchased the Property from GE. Following purchase of the facility in 1965, Parker-Hannifin initially manufactured components for automobile air conditioning systems. Historical manufacturing processes included the use of one stationary, closed-loop vapor degreaser and several small portable, closed-loop vapor degreasers as well as other

miscellaneous metal fabricating activities. Reportedly, usage of the vapor degreaser was discontinued prior to 1985. Parker-Hannifin's current operations include the manufacture, testing, and overhaul of fuel injection nozzles used in industrial and military operations.

2.3. Plant structures

2.3.1. Plant structures

As discussed above, the existing manufacturing building was originally constructed in 1941. As shown on Figure 2-2, the original manufacturing building occupied only a small portion of the Property located near the northern border of the Site near Columbia Street. In addition, a small concrete block building was located south of the western end of the manufacturing building. Additional information taken from available plant diagrams indicates that by the early 1950's a number of utilities, including storm and sanitary sewers, had been installed at the Property.

The original sanitary sewer system at the Site was serviced by the Village of Clyde's sanitary system. The infrastructure of the Site's original sanitary sewer system is shown on Figure 2-2, and included a 6-inch main sanitary sewer pipe and a 4-inch lateral pipe tying into the 6-inch main pipe. The 6-inch sanitary sewer pipe extended from the eastern portion of the manufacturing building to the west where it tied into the Village of Clyde's sanitary system piping which was located within a 16.5-foot wide right-of-way along the western boundary of the Site. The Village's sanitary sewer system discharged into a septic tank, located at the confluence of the former barge turnaround and the Old Erie Canal. The waste was then discharged from the septic tank into a catch basin (CB-3) located in the unfilled portion of the Old Erie Canal, and ultimately into the Clyde River.

The original infrastructure of the Site's storm sewer system is also shown on Figure 2-2 and included three 6-inch vitreous clay pipes (VCPs) that extended south from the western end of the manufacturing building and converged into a 500-gallon equalization basin. Two of these storm drain lines are relatively shallow and were responsible for roof drainage. The third line received flow from a building floor drain system. One additional 6-inch VCP extended along the south side of the building and received flow from a series of roof drains along the eastern portion of the manufacturing building. One catch basin located south of the manufacturing building also discharged into this storm drain line.

The equalization basin subsequently discharged into catch basin CB-3 via a 6-inch VCP, and ultimately into the Clyde River. The Village of Clyde also maintained a storm sewer system that is located just north of the manufacturing building along Columbia Street. The Villages storm sewer system discharges to the Old Erie Canal approximately 530 feet west of catch basin CB-3.

In addition to the sanitary sewer and storm sewer systems discussed above, an abandoned waste sewer pipe was identified on historic plant diagrams. This pipe is shown leading from the manufacturing building to a former outfall structure located adjacent to the Old Erie Canal. Based on available facility mapping, the waste sewer line was abandoned prior to September 1954.

Further improvements were made to the storm sewer system between 1968 and 1972. These improvements coincided with improvements to the Village of Clyde's sanitary sewer system. As part of the Village's sanitary sewer system upgrades, the Village of Clyde abandoned and subsequently demolished the septic tank located in the area of the former barge turnaround. This project included plugging the 10-inch outlet pipe discharging from the septic tank to catch basin CB-3. The piping from the canal water intake structure located in the Barge Canal leading to the main building was also abandoned during this time period.

After the demolition of the Village of Clyde's septic tank, Parker-Hannifin's sanitary sewer system was upgraded to connect to the Village of Clyde's new sanitary sewer system. The Village of Clyde's main sanitary sewer pipe is located north of the building along Columbia Street. The Site is serviced by the Village of Clyde's sanitary sewer system through a lateral pipe located along the northwestern portion of the Site. The Site's improved sanitary system includes sanitary sewer pipes located both north and south of the building with several laterals feeding into them from the building.

In 1971, Parker-Hannifin attempted to install a 12-inch corrugated metal pipe (CMP) to direct surface water from the eastern unfilled portion of the former canal through the filled in portion of the former canal bed to catch basin CB-3. However, installation of this pipe was not completed. During installation of the pipe, the trench collapsed following which, Parker-Hannifin abandoned the project. During this time frame, Parker-Hannifin also installed a storm drain west of the facility, draining from the present shipping and receiving dock. This line discharges to the surface approximately 100 feet west of the loading dock.

In 1971 the Village of Clyde installed a 48-inch CMP traversing the southern portion of the property. The 48-inch CMP directs surface water from the eastern unfilled portion of the former canal through the filled in portion of the former canal bed and discharges into the unfilled portion of the former canal in the western portion of the Site. In association with an expansion to the southeastern portion of the building in 1971, Parker-Hannifin installed two PVC storm sewer pipes. The storm sewer pipes discharge south into the 48-inch CMP.

The present structures at the Site are shown on Figure 2-3. As shown on Figure 2-3, the present structures consist of several buildings, a loading dock, and several fenced storage tank areas located on the western end of the main manufacturing building, and parking areas. The largest building is the main manufacturing building which as discussed above,

has been expanded several times since its original construction. Three additional buildings, which are all located in close proximity to each other along the western side of the Property, include a concrete block building, a pole barn, and a small metal building. In addition, the limits of the Property have been expanded since Parker-Hannifin's purchase from GE in 1965, the Property now includes portions of the Old Erie Canal and former barge turnaround located along the southern and southwestern portions of the Site, respectively.

2.4. Historical environmental data

2.4.1. Past waste disposal practices

Based on information reported in the Preliminary PSA Report (URS, 1991), the Old Erie Canal was reportedly used as a historical disposal location for spent solvents, acids, polychlorinated biphenyls (PCBs), and manufacturing wastes. According to the NYSDEC, wastes including trichloroethene (TCE), acetone, PCBs, phenol, arsenic, and cyanide were disposed of at the Site. Additionally, a shallow pit was reportedly utilized to dispose of solvents by either evaporation or burning. However, based on subsequent interviews of former Parker-Hannifin employees conducted by O'Brien & Gere during the RI, a shallow pit was never present in the southern portion of the Site. It was reported that there was a single occurrence when Parker-Hannifin employees burned used calibrating fluid on the ground in an area south of the southern parking lot. The burning of calibration fluid was discontinued on the same day following complaints from a local doctor and was never performed again.

Acids were reportedly treated to neutralize the pH of solutions and then disposed of in the former canal bed. Additional information suggests that a pH neutralization pit was located under the existing pole barn (Figure 2-3) and that the pit was later filled in with sand and covered with concrete (URS, 1995). Spent solvents and paint residues were also reportedly disposed of in a landfill area located on the adjacent Village of Clyde's property which was reportedly located west of the manufacturing building (URS, 1995). The referenced landfill area coincides with the location of the Village of Clyde's septic tank that was demolished prior to 1972. The landfill area was reportedly used by local contractors for the disposal of construction and demolition debris. Concrete blocks and debris are still visible at the land surface in this portion of the Site. As shown on Figure 2-3, portions of the former barge turnaround and the Old Erie Canal were used for landfilling.

2.4.2. Previous investigations

Environmental investigation of the Site was initiated in 1989 by NYSDEC and NYSDOH. Since those initial investigations, several data collection efforts have been conducted to characterize the nature and

extent of potential contamination at the Site. These investigations have included collection and laboratory analysis of ground water, subsurface soil, surface soil, sediment, surface water, storm sewer water, basement sump water, and indoor air.

As discussed below, surface water, surface soil/sediment, subsurface soil, and ground water samples were collected from the Site between July 1989 and December 1994 by NYSDEC as part of a PSA. These samples were submitted for Target Compound List (TCL) VOC, semi-volatile organic compound (SVOC), pesticide, PCB, target analyte list (TAL) total metal and/or cyanide analyses. The approximate locations of these previous sampling points are illustrated in Figures 1-8 and 1-9 of the RI/FS Work Plan. A detailed summary of the analytical results of these investigations are provided in Exhibits B, C, D, and E of the RI/FS Work Plan, as well as the Preliminary PSA Report (URS, 1991) and Final PSA Report (URS, 1995). The results of these analyses are summarized briefly as follows:

- No PCBs were detected in any of the surface water, subsurface soil, or ground water samples collected from the Site;
- PCBs were detected in the three surface soil/sediment samples collected from the Site in August 1994. The maximum reported total PCB concentration was 3.4 milligram/kilogram (mg/kg). No PCBs were detected in the two surface soil/sediment samples collected from the Site in July 1989;
- VOCs, SVOCs, and pesticides were detected in all surface water, surface soil/sediment, and subsurface soil samples collected from the Site, with the exception that no VOCs, SVOCs, and pesticides were detected in the two surface water samples collected from the Barge Canal (i.e., SW-4 and SW-5) and no VOCs were detected in the upgradient surface soil/sediment sample (i.e., SED-1);
- No VOCs, SVOCs, or pesticides were detected in the ground water samples collected from wells EMW-3 and EMW-5 located within the fill in the Old Erie Canal. VOCs were detected in ground water samples collected from monitoring wells EMW-1, EMW-2 and EMW-4;
- Total metals were detected in each of the surface water, surface soil/sediment, subsurface soil, and ground water samples collected from the Site and submitted for total metals analyses;
- No cyanide was detected in the surface water, surface soil/sediment, subsurface soil, and ground water samples collected from the Site, with the exception of a trace detection in one surface water sample (SW-2) collected in August 1994;

In April 1989, the NYSDOH collected samples for laboratory analysis from a residential well at 30 Sibley Street located approximately 0.5 miles west of the Site, and from the basement sump of 170 Columbia Street located directly west of the manufacturing building (URS, 1991). Results of the NYSDOH's analyses indicate that no VOCs, SVOCs, pesticides or PCBs were detected in these samples. Total metals were detected in both the residential well and basement sump samples. A detailed summary of the analytical results is provided in Exhibit A of the RI/FS Work Plan.

Investigation of environmental conditions at the Site began in July 1989 when NYSDEC collected surface water and surface soil/sediment samples from the bottom of the Old Erie Canal east and west of the filled portion of the canal for full TCL analyses. A copy of the analytical results is provided in Exhibit B of the RI/FS Work Plan. The surface soil/sediment samples were not analyzed for total metals or cyanide. No PCBs were detected in the surface soil/sediment or surface water samples. The results of the laboratory analyses indicated the presence of VOCs, SVOCs [predominantly polycyclic aromatic hydrocarbons (PAHs)], and a few pesticides. It should be noted that two VOCs (methylene chloride and acetone) identified in these surface soil/sediment samples are considered common laboratory contaminants and the quantitations are questionable because these constituents were also detected in associated laboratory blank(s). The Final PSA Report concluded that the VOCs, SVOCs, and pesticides in the surface soil/sediments were likely a result of off-site migration into the old Erie Canal east and west of the Site. However, PAHs and pesticides were not reported to have been utilized in former manufacturing processes or disposed of at the Site. PAHs are ubiquitous in soils and are relatively persistent in the environment. PAHs are a product of incomplete combustion of organic materials, such as coal and oil. In addition, PAHs may also be found in substances such as coal tar, creosote and used fuels/oils. Organic constituents [total 1,2-dichloroethene (1,2-DCE) and phenolic compounds] were detected in the surface water collected west of the Site. Low concentrations of SVOCs were also detected in the surface water sample collected to the east (i.e., upstream) of the Site. Total metals were detected in both surface water samples.

The following year, in 1990, the NYSDEC conducted a PSA, which included file reviews and a Site visit. The results of the analyses performed on the samples collected by NYSDEC and NYSDOH, as well as the results of the PSA, are reported in the Preliminary PSA Report (URS, 1991).

Based on the recommendations presented in the Preliminary PSA Report (URS, 1991), the NYSDEC conducted an expanded environmental investigation at the Site in 1994. This investigation included the collection of surface water, surface soil/sediment, subsurface soils, and ground water samples, as well as soil gas and geophysical surveys. The approximate locations of these previous sampling points as well as a summary of the analytical results were summarized in the RI/FS Work

Plan. A summary of the results of this investigation are presented in the Final PSA Report (URS, 1995).

In August and September 1994, four surface water samples (SW-2, SW-3, SW-4 and SW-5) and three surface soil/sediment samples (SED-1, SED-2, and SED-3) were collected from the Site and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. Multiple VOCs, SVOCs, pesticides, and total metals were detected in the surface water samples collected from locations SW-2 and SW-3. With respect to the surface water samples collected from locations SW-2 and SW-3, the primary VOCs are TCE and its biodegradation products total 1,2- DCE and vinyl chloride. Only one VOC (2-butanone), which is unrelated to the Site, was detected in the surface water sample collected from location SW-4 in the current Barge Canal. Otherwise no VOCs, SVOCs, pesticides, or cyanide was detected in surface water samples collected from the Barge Canal at locations SW-4 or SW-5. In addition, no PCBs were detected in any of the four surface water samples. Concentrations of total metals were detected in each of the surface water samples collected from Site. Concentrations of a number of total metals were comparatively higher in the surface water samples collected from locations SW-2 and SW-3. Cyanide was only detected in the surface water sample collected from location SW-2.

No VOCs were detected in the upgradient surface soil/sediment sample collected at location SED-1. Consistent with surface water results, chlorinated VOCs, primarily TCE, total 1,2-DCE, and vinyl chloride, were detected in the surface soil/sediment samples collected from SED-2 and SED-3. SVOCs, pesticides, PCBs, and total metals were also detected in each of the surface soil/sediment samples (SED-1, SED-2, and SED-3). Consistent with surface water results, comparatively higher concentrations of total metals were detected in the surface soil/sediment samples collected from locations SED-2 and SED-3. No cyanide was detected in the surface soil/sediment samples.

In October 1994, subsurface soils were collected from the soil borings advanced for the installation of monitoring wells EMW-1 through EMW-5 and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. Subsurface soils were collected from approximately 1 to 3 feet below ground surface (bgs) in EMW-1 and 9 to 12 feet bgs in EMW-2 through EMW-4. VOCs, SVOCs, pesticides, and total metals were detected in all of the subsurface soil samples. No PCBs or cyanide were detected in any of the subsurface soil samples. With the exception of location EMW-2, trace concentrations of chlorinated VOCs were detected in subsurface soil samples collected from EMW-1, EMW-3, and EMW-5. Comparatively higher concentrations of VOCs (total 1,2-DCE and acetone) were detected in the subsurface soil sample collected from EMW-2. Comparatively higher concentrations of SVOCs and total metals were detected in subsurface soils collected from EMW-3 and EMW-5 located in the filled portion of the Old Erie Canal on the south central and southeast boundaries of the Property. Comparatively higher

concentrations of aluminum and arsenic were detected in the subsurface soil sample collected from EMW-1.

In December 1994, ground water samples were collected from each of the five monitoring wells EMW-1 through EMW-5 and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. VOCs, were detected in ground water samples collected from monitoring wells EMW-1, EMW-2, and EMW-4. The highest concentrations were detected in EMW-1, and the lowest concentrations were found in EMW-4. No VOCs were detected in the ground water samples collected from monitoring wells EMW-3 and EMW-5 located in the filled portion of the Old Erie Canal on the south central and southeast boundaries of the Property. Natural attenuation is occurring as strongly evidenced by the detection of biodegradation compounds (total 1,2-DCE and/or vinyl chloride) at higher concentrations than the parent compounds [TCE and/or tetrachloroethene (PCE)]. Total metals were detected in each of the ground water samples. No SVOCs, pesticides, PCBs, or cyanide were detected in the ground water samples collected from any of the five monitoring wells.

VOCs and total metals are evident in each matrix (i.e., surface water, surface soil/sediment, subsurface soil and ground water) sampled throughout the Site. However, metals are naturally occurring in these matrices. In addition, arsenic is the only metal reportedly disposed of on-site (URS, 1995) and listed in NYSDEC's Inactive Hazardous Waste Disposal Report. Therefore, the total metals results from the PSA and the RI/FS program will be compared against Site-specific and/or relevant reference background concentrations to evaluate the significance of the data. and whether or not the total metals are Site-related.

Although PCBs were reportedly disposed of on-site and listed in NYSDEC's Inactive Hazardous Waste Disposal Report, PCBs were not detected in the subsurface soil, surface water and ground water samples collected from the Site. PCBs were, however, detected in three of the sediment samples collected from the Site, with a maximum reported total concentration of 3.4 mg/kg. Similarly, although cyanide was reportedly disposed of on-site and listed in NYSDEC's Inactive Hazardous Waste Disposal Report, cyanide was not detected in the subsurface soil, surface soil/sediment and ground water samples collected from the Site. However, cyanide was detected in one of the surface water samples collected from the Site. Various SVOCs, the majority of which were PAHs, and pesticides were detected in subsurface soils, surface soil/sediment, and surface water samples collected from the Site. However, SVOCs and pesticides were not detected in the ground water samples. Other than phenol and paint residues (e.g., phthalates), the PSA reports (URS, 1991 and 1995) did not identify pesticides or specific SVOCs which had been utilized during historical operations or disposed of at the Site. Therefore, the PCB, cyanide, SVOC and pesticide results from the PSA and the RI/FS program will be evaluated to determine the significance of the data and whether or not they are Site-related.

In addition to the samples collected by the NYSDOH in 1989, the NYSDOH collected water samples for VOC analysis from the basement sump of 170 Columbia Street located directly west of the manufacturing building on seven additional occasions between April 1989 and June 2002 (i.e., July 12, 1995, March 25, 1996, October 1, 1996, November 4, 1996, September 23, 1997, March 27, 2000 and June 2, 2002). In total, chlorinated VOCs were not detected in six of the eight water samples. Vinyl chloride and cis-1,2-dichloroethene were detected during the March 1996 sampling event at a concentration of 0.5 µg/L, each, well below ground water standards. Based on these results, NYSDOH collected a water sample from the basement sump again in October 1996. The detected concentration of vinyl chloride (1.9 µg/L) and cis-1,2-dichloroethene (1.1 µg/L) prompted the agency to collect indoor air samples from the residence in November 1996. VOCs were not detected in the water sump samples collected in November 1996 in conjunction with the air samples. Various VOCs were detected in the indoor air samples, however, NYSDOH concluded that the low concentrations of VOCs detected in the air samples were consistent with background conditions and were not attributable to the Site.

Water samples were collected from the basement sump in September 1997, March 2000 and June 2002. No VOCs were detected in any of these samples.

In June 2002, NYSDOH collected a water sample from the basement sump of 176 Columbia Street located west of the manufacturing building, no VOCs were detected in this sample. The results of the analyses performed on the water and air samples collected by NYSDOH are provided in Exhibit A.

3. Field investigation methodology

3.1. General

This section describes the procedures followed while performing the tasks associated with the RI scope of work presented in the RI/FS Work Plan and the supplemental scopes of work presented in Section 1.3.

3.2. Public water connection verification program

The public water connection verification program was conducted during the late Spring and early Summer of 2002. The objective of the public water connection verification program was to identify residences and/or businesses located within a one half-mile radius of the Site that may not be serviced by the Village of Clyde's public water distribution system.

3.2.1. Public records review

The initial phase of the Public Water Connection Program consisted of identifying and locating residences in the vicinity of the Site that were not connected to the public water system and relied on ground water wells as potable water supplies.

Based on discussions with Village of Clyde Water Department personnel, public water is available to all residences and businesses within the Village of Clyde boundary and therefore within a one-half mile radius of the Site. However, outside of the Village boundary, public water is not available.

3.2.2. Base map preparation

Tax maps obtained from the Wayne County Real Property Tax office were used to prepare a base map of the Village of Clyde and the rural areas immediately surrounding the Village (hereafter referred to as the "study area") (Figure 3-1). The base map was prepared by compiling sections of digitized tax maps using computer assisted drafting software.

3.2.3. Results of residential well identification

As a result of the records search and field verification performed by the Water Department personnel, it was determined by the Village of Clyde

Water Department that although public water is available within the Village of Clyde, not all residences are hooked up.

Based on a list provided by the Village, a total of 25 twenty-five residences located within the Village Boundary were identified as having a residential water supply well on their property. Seven of the twenty-five residences are located within a half-mile radius of the Site. Of the seven residences located within a half-mile radius of the Site, three rely solely on their residential well as a water supply source. The remaining four properties have both a residential well and public water supply servicing their property.

Table 3-1 presents a summary of the residences within the study area that have a well on their property. Figure 3-1 presents a pictorial summary of the study area and the public water connection status.

According to the Village of Clyde Zoning department, if a property has a residential well they are not required to connect to the public water distribution system. However, if a property has a residential well and a public water connection, the residential well must be decommissioned. All properties within the Village are required to connect to the Village Sewer system.

3.3. Electromagnetic field survey

On April 16 and 17, 2002, O'Brien & Gere performed a variable frequency electromagnetic (VFEM) survey using a GEM-300. The VFEM survey was conducted to evaluate whether the septic tank associated with the Village of Clyde's former sanitary sewer system was still present, so its location could be avoided during the subsequent soil boring program. VFEM is a non-invasive surface geophysical technique used to characterize subsurface conditions without disturbing the soil. A VFEM survey indirectly measures the electrical conductive properties of underlying objects in units of parts per million (ppm). Since all objects have electrical conductive properties, materials with contrasting properties can be distinguished. The VFEM survey permits a rapid evaluation of underlying material at discrete depth intervals.

The initial VFEM survey involved establishing four survey grids with the geophysical survey lines generally oriented in an east-west direction along transects located approximately five feet apart. The VFEM measurements were obtained at a rate ranging between about one data point per 2.5 feet to one data point per 5 feet. The data collection rate is a function of how fast the portable unit is transported along the survey line. Data was digitally recorded by the instrument.

Once the data was collected on the GEM-300, the geophysical data was downloaded to a portable field computer and reviewed for completeness and quality. The results from each survey area were merged to form one

comprehensive data set that was then contoured. Contour maps representing the results of the VFEM survey are presented in Appendix A, and are discussed in further detail below.

The contour maps are divided into two categories, the Quadrature component of the secondary electromagnetic field and the In-Phase component of the secondary electromagnetic field. The Quadrature component is generally indicative of soil characteristics of the survey area, while the In-Phase component is more sensitive to metallic conductors.

The color coding of the maps shown in Appendix A differentiate between positive (yellow to red) and negative (blue to purple) anomalies. Large positive anomalies are indicative of metallic, conductive materials such as iron and steel. Negative anomalies are commonly indicative of low or non-conductive materials or non-conductive void areas within construction and demolition debris (e.g., concrete, fiberglass and roofing debris).

Due to the large amounts of surface debris (i.e., concrete block and construction demolition debris) found overlying the reported location of the septic tank, the results of the survey are inconclusive as to whether or not the septic tank has been removed from the Site. However, other items that can be observed on the figures presented in Appendix A include several large positive anomalies that are attributed to surficial metallic objects and structures encountered during the survey. For example, the positive anomalies found in the areas surrounding the chain link fences and adjacent to the buildings are associated with the conductive properties of the metal fence and the building materials. The maps also identify the 48-inch corrugated metal pipe that conveys surface water beneath the southern portion of the Site. The remaining positive and negative anomalies shown on the maps are likely associated with surficial debris.

3.4. Preliminary screening program

The objective of the preliminary screening program was to rapidly characterize conditions in the shallow unconsolidated unit, particularly with respect to the nature and distribution of fill materials at the Site, and to further evaluate the extent of the dissolved phase plume in the shallow unconsolidated unit along the southern and western portions of the Site.

The Preliminary Screening Program involved the installation of soil borings using direct push sampling methods and the installation of temporary monitoring wells.

3.4.1. Direct push boring program

As shown on Figure 3-2, a total of 61 direct push soil borings were installed at the Site. In accordance with the RI/FS Work Plan, 39 direct push soil borings were advanced at or near the Site during the first phase of fieldwork. Based on the results of the initial screening program, five additional soil borings were advanced along the eastern and northeastern portions of the Site. The initial 44 soil borings were installed between April 22 and May 3, 2002.

Based on the soil and ground water data obtained at geoprobe location GP-16, and to further evaluate the hydrogeology in the area south of the Old Erie Canal, 17 additional direct push soil borings were installed at the Site on November 19 and 20, 2002. Fourteen additional direct push soil borings (GP-45 through GP-58) were performed along the south side of the manufacturing building and three direct push soil borings (GP-59 through GP-61) were performed south of the Old Erie Canal. Drilling and well installation activities were performed by Parratt-Wolff, Inc. of East Syracuse, New York using a truck mounted Geoprobe®. An O'Brien & Gere geologist supervised the soil boring and temporary monitoring well installation activities.

The direct push sampling technique utilizes a 1½ inch inner diameter (ID) stainless steel Macrocore sampler lined with a polyethylene sleeve to collect soil samples with minimal disturbance. Macrocore samples were obtained continuously at four foot intervals from ground surface down to the top of the glacial till unit or until refusal was encountered. Upon recovery, a representative sample from each macrocore was transferred to a glass jar, immediately covered with aluminum foil and a screw-on cap, and allowed to equilibrate to the ambient air temperature. The headspace was then analyzed for total VOCs using a calibrated photoionization detector (PID).

Soil samples were logged in the field by the supervising geologist using the Modified Burmister and Unified Soil Classification Systems. In addition to logging the geologic descriptions, observations including soil sample texture, composition, color, consistency, moisture content, sample recovery, PID readings and any noticeable odors or stains were recorded by the geologist. A summary of the direct push boring and temporary monitoring well installation program, including ground surface and measuring point elevations, depth to glacial till and/or bedrock and screened intervals are summarized on Table 3-2. The soil boring logs are included in Appendix B.

3.4.2. Subsurface soil sampling program

In conjunction with the direct push boring program eight subsurface soil samples were obtained and submitted to the laboratory for TCL analysis. The soil samples were collected from a combination of background locations and suspected source areas. For the purposes of this sampling activity, suspected source areas are defined as being locations where soil

samples exhibited visual contamination (e.g., oils and/or sheens) or elevated concentrations of VOCs as indicated by field screening observations (e.g., PID measurements greater than 50 ppm). Refer to Figure 3-2 for the soil sample locations.

The subsurface soil samples collected during the direct push field investigation were analyzed for:

- VOCs by USEPA SW-846 Method 8260B;
- SVOCs by USEPA SW-846 Method 8270C;
- PCBs by USEPA SW-846 Method 8082;
- Pesticides by USEPA SW-846 Method 8081A;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A; and
- pH by Method 9045C.

Each soil sample was placed in a cooler containing wet ice immediately after sampling. New nitrile gloves were donned prior to collection of each soil sample. Sampling notes, including weather conditions, sampling time and depth and sample identification details were recorded in a project dedicated field notebook. Chain-of-custody documentation was maintained daily in accordance with the NYSDEC-approved SAP. The results of the subsurface soil sample analyses are described in Section 9.

3.4.3. Ground water sampling

At the completion of each soil boring, a temporary monitoring well was installed at each boring location. Temporary monitoring wells were constructed of 1-inch ID, flush joint, schedule 40 polyvinyl chloride (PVC) riser pipe with a five foot length of 0.010-inch slot well screen placed at the bottom of the borehole. The annular space at the ground surface was sealed using bentonite paste to prevent surface water from entering the borehole.

Following placement of the PVC well screen and riser pipe, a ground water sample was obtained. Ground water samples were collected using either a new disposable PVC bailer or by using high-density polyethylene (HPDE) tubing equipped with a foot valve. Ground water samples collected from the direct push temporary monitoring well locations were submitted to the laboratory for VOC analysis using a modified USEPA SW-846 Method 8260B. Ground water samples GP-1 to GP-44 were submitted to the laboratory for quick turnaround analysis

(i.e., 24 to 72 hours), while the remaining ground water samples were analyzed with a five to seven day turnaround time. Ground water samples were not collected at locations GP-3, 7, 21, 44, 48, 52, 55 and 61 due to a lack of ground water.

Field quality assurance/quality control (QA/QC) procedures included the collection of blind field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples at a rate of one per twenty environmental samples. Trip blanks were included with each cooler that contained samples for VOC analysis. The sample containers were labeled with the sample identification, date, time, project identification, and required laboratory analysis. The same information was recorded on the corresponding field data sheets. Each ground water sample was placed in a cooler containing wet ice immediately following collection.

New nitrile gloves were donned prior to collection of each ground water sample. Sampling notes, including weather conditions and well purging and sampling details, were recorded in the field notebook. Chain-of-custody documentation was maintained daily following procedures provided in the NYSDEC-approved SAP. Section 6 presents the results of the ground water sample analyses.

3.5. Drilling and well installation program

To further evaluate the hydrogeologic setting at the Site, a monitoring well installation program was implemented. Between May 20 and May 30, 2002 a total of nine shallow unconsolidated unit monitoring wells and three shallow bedrock monitoring wells were installed at the Site. To delineate the extent of the VOC impacts detected along the southern portion of the Site (south of the Barge Canal) two additional shallow unconsolidated unit monitoring wells and three additional shallow bedrock monitoring wells were installed between November 18 and November 25, 2002. The monitoring well locations are shown on Figure 3-3. Parratt-Wolff, Inc. of Syracuse, New York preformed the drilling and well installation activities under the supervision of an O'Brien & Gere geologist.

3.5.1. Shallow unconsolidated unit drilling procedures

Soil borings were advanced through the unconsolidated deposits to the top of the glacial till unit using 4¼-inch ID hollow stem auger drilling techniques. Continuous split-barrel soil samples were collected at two foot intervals in accordance with American Society for Testing and Materials (ASTM) Method D-1586 during the installation of wells MW-1S and MW-3S. Soil samples were not collected at soil boring locations MW-2S, MW-3S, MW-4S, MW-5S, MW-6S, MW-7S, MW-9S, MW-11S and MW-12S because soil sampling was completed at each location during previously completed phases of the site investigation.

Following advancement of the hollow-stem auger to the appropriate sampling depth, the split barrel sampler was lowered to the bottom of the boring and driven into the undisturbed soil using a 140-pound hammer with a 30-in drop. A representative sample of the split-spoon was then transferred to a clear glass container, sealed with aluminum foil, and capped for later headspace analysis with a PID for total VOCs.

Upon recovery, soil samples were classified in the field by a supervising geologist using the Modified Burmister and Unified Classification Systems. In addition to logging the geologic descriptions, observations including soil sample texture, composition, color, consistency, moisture content, sample recovery, and the observance of noticeable odors or stains were recorded by the geologist. Information for these soil borings is presented on the soil boring logs in Appendix C.

3.5.2. Shallow bedrock drilling procedures

Shallow bedrock monitoring wells were installed by initially advancing the soil boring to the top of the bedrock unit using 6¼-inch ID hollow stem augers. Split-barrel soil samples were collected at two-foot intervals continuously throughout the total depth of the borehole in accordance with ASTM Method D-1586. Soil sample collection and logging procedures were completed as described above for the unconsolidated unit. The borehole was further advanced approximately 1 foot into the bedrock unit, creating a socket, by advancing the augers into the top of the weathered zone or by utilizing rotary drilling techniques. The top of bedrock was identified by split-barrel sampler refusal and/or hollow stem auger refusal.

A five-inch ID casing was lowered into the borehole and tapped into place to seat the casing into the bedrock socket. A cement-bentonite grout was tremied into the annulus between the outside of the casing and the borehole, as the hollow-stem augers were removed. As the grout was pumped into the annulus, the tremie pipe was kept within the grout as it was placed so that a continuous annular seal was achieved. The cement grout was allowed to cure overnight. The shallow bedrock wells were drilled within the five-inch ID casing using a four-inch outside diameter (OD) diamond core bit (HX).

Test boring and rock coring logs that describe the subsurface materials encountered in each boring were prepared by the supervising geologist for each of the bedrock wells. Information for these soil borings is presented on the soil boring logs in Appendix C.

3.5.3. Well installation

Monitoring wells were constructed of 2-inch ID, flush joint, schedule 40 PVC riser pipe with either a five or ten-foot length of 0.010-in slot PVC well screen. Each shallow unconsolidated unit monitoring well was constructed such that the base of the well screen was set just above the

top of the glacial till unit. Each shallow bedrock monitoring well has ten feet of well screen set from approximately three to thirteen feet below the top of the bedrock surface. A threaded PVC bottom plug was installed at the base of each ground water monitoring well. A vented, non-threaded, locking J-Plug was installed at the completion of drilling activities. A designated measuring point was notched into the top of the PVC riser pipe in each well to provide a permanent reference point for subsequent total depth and depth to water measurements.

After installing the PVC well materials, sand was gradually introduced inside the augers to fill the annular space between the well screen and the borehole. The sand pack extended from the bottom of the boring to approximately one-foot above the top of the screen. The sand pack consists of a clean, well-graded, silica sand with grain size distribution matched to the slot size of the screen. A Morie Grade 0 sand was used.

A bentonite seal was placed above the sand pack to form a seal at least two feet thick. A cement-bentonite grout extended from the top of the bentonite seal to the ground surface. The grout material consisted of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture was prepared in accordance with ASTM D 5092-90. The grout was placed via a tremie pipe that was kept within the grout as it was placed so that a continuous annular seal was achieved.

In most areas, it was necessary to provide flush mounted casings on the monitoring wells. Monitoring wells MW-7S and MW-7B have a steel casing equipped with a locking cap placed over the monitoring well. The protective casing extended at least two feet bgs and was cemented in place. The shallow bedrock monitoring wells have a lockable cap installed on top of the five-inch casing grouted into place initially. Table 3-3 is a summary of the monitoring well construction and survey data, including ground surface and measuring point elevations, screened intervals, and sand pack intervals. For detailed information, refer to the well completion logs provided in Appendix D.

3.5.4. Well abandonment

Monitoring well EMW-1 was permanently decommissioned on May 30, 2002 by overdrilling the existing monitoring well and advancing the augers to the original borehole's total depth of 32 ft bgs. Once the overdrilling was complete, the borehole was grouted. The grout material consisted of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture was prepared in accordance with ASTM D 5092-90, such that approximately three to five pounds of bentonite was mixed with 6½ to 7 gallons of water per 94-pounds of cement. The grout was introduced via a tremie pipe that was kept within the grout as it was placed so that a continuous annular seal was achieved.

3.5.5. Decontamination procedures

During the drilling program, decontamination procedures as described in the SAP were followed so that potential contaminants were not introduced into the borehole or transferred across the Site. A temporary decontamination pad was constructed at a location approved by Parker-Hannifin. Prior to drilling the first boring, the equipment used for drilling and well installation was steam cleaned to remove possible contaminants that may have been encountered during mobilization of drilling equipment to the Site. Equipment which came into contact with Site soil, as well as drilling tools, augers, drilling rod, hoses, and the rear of the drill rig underwent the initial steam cleaning process. While working at the Site, all drilling equipment coming in contact with soil was decontaminated between drilling locations. At the conclusion of the drilling program, the drilling equipment was decontaminated a final time prior to leaving the Site.

All well construction materials were transported to the Site in factory-sealed plastic. If well construction materials were not sealed, they were decontaminated and maintained in plastic sheeting on-site.

The cleaning process involved the use of a high-pressure steam cleaner. Potable water was used for decontamination and drilling procedures. Decontamination water was collected and stored for subsequent characterization and off-site disposal in accordance with the SAP.

3.5.6. Well development

Following the completion of the monitoring well installation program, each monitoring well was developed prior to ground water sampling. Each newly-constructed monitoring well was developed to:

- Remove fine-grained materials from the sand pack and formation;
- Reduce the turbidity of ground water samples; and
- Increase the yield of the well to ensure a sufficient volume of water was available during ground water sampling.

The monitoring wells were developed as soon as possible, but not less than 24 hours after installation. All ground water and solids produced during well development were managed as described in the SAP. The wells were developed using the procedures presented in the SAP.

Well development included the removal of ground water from the well to remove residual drilling materials and establish an effective hydraulic connection between the screened interval and the formation. The goals for development was to obtain ground water in which the pH, temperature and specific conductivity had stabilized and exhibited a turbidity of less than or equal to 50 Nephelometric Turbidity Units (NTUs). Independent of the field parameters, a minimum of five well

volumes was removed during well development. Due to the required management of Site ground water, if the aforementioned field parameters could not be obtained, well development continued until an amount of ground water equivalent to ten well volumes was removed.

In addition, each of the existing monitoring wells was inspected and total depths were measured and compared to the well construction logs. If significant siltation occurred in these wells (i.e., greater than 10% of the well screen is blocked), then the existing monitoring wells were redeveloped prior to the start of ground water sampling activities.

3.6. Ground water sampling program

Ground water samples were collected on June 24 to 26, 2002 from each of the accessible monitoring wells in accordance with the NYSDEC-approved RI/FS Work Plan. Ground water samples were collected from newly installed wells MW-1S, MW-2S, MW-2B, MW-3S, MW-4S, MW-4B, MW-5S, MW-6S, MW-7S, MW-7B, MW-8S and MW-9S and existing monitoring wells MW-1, EMW-2, EMW-3, EMW-4 and EMW-5 for laboratory analysis. In accordance with the additional scope of RI activities (O'Brien & Gere letter dated November 1, 2002), ground water samples were also collected on December 16 to 19, 2002 from each of the additional monitoring wells installed south of the Clyde River (i.e., MW-10B, MW-11S, MW-11B, MW-12S, MW-12B) and from select on-Site monitoring wells (MW-4S, MW-4B, MW-7S, MW-9S, EMW-2 and EMW-4).

Prior to the collection of ground water samples, static water levels were measured to the nearest 0.01-ft in each monitoring well. Care was taken to disturb only the upper portion of the water column to avoid resuspending settled solids in the wells. Water level measurements were performed as described in Section 3.7.

To collect representative ground water samples, each monitoring well was adequately purged prior to sampling. In rapidly recharging wells, thorough purging was accomplished by the removal of a minimum of three well volumes. In slowly recharging wells, the wells were purged to dryness for a minimum of one well volume. The monitoring wells were purged using the procedures described in the NYSDEC-approved SAP. The purge water was transferred into 55-gallon steel drums, secured, and staged at the Site.

The ground water samples were collected using a suction pump and dedicated HDPE tubing, and transferred into the appropriate sample containers. The sample containers were labeled with the sample identification, date, time, project identification, and required laboratory analysis. The same information was recorded on the field data sheets. Each ground water sample was then placed in a cooler containing wet ice immediately after sampling.

In addition, field parameters, including pH, temperature, specific conductivity, and dissolved oxygen, were measured at the time of sample collection and recorded on the field data sheets. New nitrile gloves were donned prior to collection of each ground water sample. Chain-of-custody documentation was maintained daily following procedures outlined in the NYSDEC-approved SAP.

In accordance with the NYSDEC-approved RI/FS Work Plan, 16 ground water samples, one blind duplicate sample, one set of MS/MSD samples, and three trip blank samples (one trip blank was included in each shipment) were collected between June 24 and June 26, 2002 and submitted to STL for the following analyses:

- TCL VOCs by USEPA SW-846 Method 8260B;
- TCL SVOCs by USEPA SW-846 Method 8270C;
- TCL PCBs by USEPA SW-846 Method 8082;
- TCL pesticides by USEPA SW-846 Method 8081A;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A; and
- pH by Method 9045C.

In accordance with the additional scope of RI activities (O'Brien & Gere letter dated November 1, 2002), 11 ground water samples, one blind duplicate sample, one set of MS/MSD samples, and three trip blank samples (one trip blank was included in each shipment) were collected between December 16 and December 19 2002 and submitted to STL for analysis of TCL VOCs via USEPA SW-846 Method 8260B. Refer to Section 6 for discussion of the nature and extent of constituents in the ground water.

In addition to the full TCL analysis of the ground water, each permanent monitoring well was analyzed for natural attenuation parameters. As noted in the NYSDEC-approved SAP, low flow sampling techniques were utilized to collect the ground water samples obtained for analysis of the natural attenuation parameters. The ground water samples were analyzed for the following natural attenuation parameters:

Natural Attenuation	
Parameter	USEPA SW-846 ¹ Analytical Method
methane	modified 8015/Kampbell <i>et al.</i> , 1989
ethane	modified 8015/Kampbell <i>et al.</i> , 1989
ethene	modified 8015/Kampbell <i>et al.</i> , 1989
DOC	9060
alkalinity	MCAWW 310 ²
chloride	9212, 9250, 9251, 9253 or 9056
nitrate	9210 or 9056
sulfate	9038, 9036, 9035 or 9056
sulfide	9215
iron II (Fe ⁺²)	field
redox potential	field
specific conductivity	9050A or field
temperature	field
turbidity	MCAWW 180.1 ² or field
dissolved O ₂	field
pH	9045C or field
DOC: dissolved organic carbon O ₂ : Oxygen	
¹ SW-846: USEPA's <i>Test Methods for Evaluating Solid Waste, 3rd Edition</i> , December 1996, with all current revisions.	
² MCAWW: <i>Methods for Chemical Analysis of Water and Wastes</i> , USEPA, 1983.	

In addition to the ground water sampling discussed above, to obtain additional ground water quality data at the Site in 2003, ground water samples were collected from 22 monitoring wells (i.e., MW-1, MW-1S, MW-2S, MW-2B, MW-3S, MW-4S, MW-4B, MW-5S, MW-6S, MW-7S, MW-7B, MW-8S, MW-9S, MW-10B, MW-11S, MW-11B, MW-12S, MW-12B, EMW-2, EMW-3, EMW-4 and EMW-5) on May 27 and 28, 2003 for VOC analysis. Ground water samples were also obtained for VOC analysis from monitoring well MW-4S on April 24 and July 2, 2003. Monitoring wells that historically exhibited elevated VOC concentrations (i.e., MW-1S, MW-4S, MW-4B, MW-6S, MW-7S, and EMW-2) were also sampled for natural attenuation parameters.

During the 2003 sampling events, water level measurements were obtained in advance of the ground water sampling activities. Ground water samples for VOC analysis were obtained using the passive bag sampling technique. The passive bag samplers were placed at or near the midpoint of the saturated portion of the screened interval, with the exception of wells MW-4S and MW-6S. In wells MW-4S and MW-6S, passive bag samplers were placed near the top and bottom of the saturated interval to evaluate the potential for contaminant stratification in these wells. The passive bags, pre-filled with laboratory-grade deionized water, were obtained from Columbia Analytical Services, Inc. (CAS) of Rochester, New York.

Ground water samples obtained for natural attenuation parameters were collected using low-flow sampling techniques in accordance with the NYSDEC-approved RI/FS Work Plan. The ground water samples were analyzed for the following natural attenuation parameters: methane, ethane, ethene, dissolved organic carbon, alkalinity, chloride, nitrate, sulfate, sulfide, iron II (Fe+2), redox potential, specific conductivity, temperature, turbidity, dissolved oxygen and pH.

Quality control (QC) consisted of two field duplicates, two MS/MSD samples, and a trip blank for each shipment of VOC samples. Analytical services were provided by CAS.

3.7. Water level monitoring

3.7.1. Spot measurements of water levels

A total of 12 synoptic water level rounds were collected from each of the Site's monitoring wells and staff gauges during the course of the RI. Water level measurements were obtained from the new wells after well development activities were completed. Prior to purging and sampling activities associated with the ground water sampling event, water level measurements were also obtained by O'Brien & Gere personnel. The water level elevation data are presented in Table 3-4.

Water level measurements were obtained with an electronic water level indicator. The electronic water level measurement method involves lowering a probe into a well, which, upon contact with the water, completes an electric circuit. At the instant the circuit is closed, the water level indicator provides an audible and/or visual alarm, which indicates that the water has been contacted. The depth to water was measured to the nearest 0.01foot, using the marked measuring point on the monitoring well riser pipe or casing as a reference. Depth to water measurements were recorded on the field form. Nitrile gloves were worn during water level measurement activities.

3.7.2. Hydraulic monitoring program

In addition to the synoptic water level monitoring events discussed above, a hydraulic monitoring program was performed at the Site between April 10 and November 5, 2003. The hydraulic monitoring program included the use of data loggers and pressure transducers to obtain nearly continuous water level measurements in the Barge Canal, the Old Erie Canal, and monitoring wells MW-3S, MW-4S, MW-4B, MW-5S, MW-12S and background monitoring well MW-9S.

The near continuous water level monitoring program was performed using In-Situ, Inc. Troll two-channel data loggers and associated pressure transducers. Each of these data loggers is capable of collecting and storing

up to 53,248 data points from each of the two channels for subsequent transfer to a portable computer. Water level elevation measurements were obtained using a 15-minute recording interval. The pressure transducers used in this test had a range of 15 and 30 pounds per square inch (psi) or approximately 34.5 and 69 feet of water, respectively. The reported accuracy is within 0.05 percent (%) or the full range, or approximately 0.017 and 0.034 feet of water, respectively.

The data loggers were installed as a dedicated installation, whereby all the components of the data logger are installed within the borehole and the extra extension cable, if any, was coiled within the protective casing. In this manner wells with protective casings could be locked during the monitoring period.

At the beginning of the hydraulic monitoring program, water level measurements were obtained from each of the wells being monitored using data loggers and used to reference instrumentation. Water level measurements were also obtained during the monitoring period in order to provide a check on the results and allow calibration, if necessary.

At the end of the monitoring period, the water level elevation data was transferred from the data logger to a portable computer for processing. In addition, the water levels obtained manually were converted to water level elevations with respect to mean sea level using the surveyed elevations of the measuring points.

Climatic data (i.e., precipitation and temperature) were obtained from the Syracuse Airport weather monitoring station from a web-based data retrieval system through the Northeast Regional Climate Center located at Cornell University, Ithica, New York. These data were obtained in order to evaluate water level fluctuations potentially related to recharge. The daily precipitation data is presented graphically in the attached figures. The results of this monitoring program are discussed in Section 5.

3.8. Hydraulic conductivity testing

In-situ hydraulic conductivity tests were performed on the new and existing monitoring wells to estimate the hydraulic conductivity of the geologic materials immediately surrounding each well. These tests, commonly referred to as slug tests, involved monitoring the recovery of water levels toward an equilibrium level after an initial perturbation. The perturbation was either a sudden rise or fall in the water level that corresponded to either the addition or removal of a physical slug respectively. During the slug test, either a five foot inert rod or a volume of deionized water was rapidly introduced into the well causing the water level to rise (falling head test). During a rising head test, a five foot inert rod was rapidly removed from the well causing the water level to drop.

Prior to conducting the tests, background water levels were collected manually and digitally using an In-Situ, Inc. Troll 4000 down-hole pressure transducer equipped with a data logger. The instruments were lowered into the well five to ten feet below the ground water surface and secured by attaching the transducer cable to the well casing using a stainless steel clamp. Since the addition of the data logger displaced water in the 2-in diameter monitoring wells, the water level in each well was allowed to re-equilibrate to static conditions prior to starting the test. Once the ground water recovered to the pre-disturbed level, the data logger was programmed to record the water levels on a logarithmic scale. The hydraulic conductivity tests were not considered complete until a minimum of 90% recovery was achieved. Equipment lowered into the monitoring wells was decontaminated prior to each test using a phosphate-free detergent, distilled water wash and a distilled water rinse.

Interpretation of the slug test data was performed using the Bouwer and Rice (1976) method. The principle behind the Bouwer and Rice method is that a plot of recovery data (S_o-S_t) versus time (t) theoretically follows a straight line on a semi-log plot. Horizontal hydraulic conductivity (K) is then calculated as follows:

$$K = [\ln(s_o)-\ln(s_t)]r_{ce}^2\ln(r_e/r_w)/2Lt$$

where:

K = hydraulic conductivity;
 L = length of well screen/sand pack (intake);
 t = time since initial displacement;
 s_o = initial displacement in well;
 s_t = displacement at time t ;
 r_e = equivalent radius over which head loss occurs;
 r_c = well casing radius;
 r_w = well radius (borehole);and,

$$r_{ce} = [r_c^2 + n(r_w^2 - r_c^2)]^{1/2}$$

The Bouwer and Rice method assumes that the aquifer being evaluated is unconfined, homogeneous and isotropic. This method is most appropriate for shallow wells screened in well sorted sand below the water table, but it is also applicable to aquifers that are not in strict accordance with the assumptions stated above. Additionally, application of the above equations to bedrock wells assumes that sufficient joints and bedding planes intersect the screened interval so as to behave like a porous medium with Darcian flow. Bouwer and Rice recommend computing an equivalent casing radius (r_{ce}) to correct for the porosity of the gravel pack when the height of the static water column in the well is less than the screen length.

Table 3-5 summarizes the results of the hydraulic conductivity testing program. Additional details on data acquisition and analysis are presented in Appendix E.

3.9. Surface water sampling

As discussed in Section 2.4.2, surface water samples were collected during the PSA from the Old Erie Canal and the current Barge Canal. Those results indicated that multiple VOCs, SVOCs, pesticides and total metals were detected in the surface water samples collected from the western end of the backfilled portion of the Old Erie Canal. Based on these results, a surface water sampling program was performed to confirm prior analytical results, and to help delineate the extent of the constituents which may be Site related.

Surface water samples were collected on May 21, 2002 from eight locations (SW-01 through SW-05 and SW-07 through SW-09). One additional surface water sample, designated SW-06, was proposed to be collected from the wetland area located along the western side of the Site; however, the location was dry at the time of the sampling event. The surface water samples were submitted to STL for the following analyses:

- VOCs by USEPA SW-846 Method 8260B;
- SVOCs by USEPA SW-846 Method 8270C;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A;
- Pesticides by USEPA SW-846 Method 8081A;
- PCBs by USEPA SW-846 Method 8082; and
- pH by USEPA SW-846 Method 9045C.

Based on the analytical results from the May 2002 sampling event, surface water samples were collected from locations SW-5, SW-9, and from two additional downgradient surface water locations (SW-10 and outfall) on November 21, 2002 for laboratory analysis of VOCs. This supplemental sampling event was to confirm prior analytical results, and to help delineate the extent of VOCs in surface water that may be site-related. The supplemental surface water samples were submitted to STL for analysis of TCL VOCs only via EPA SW-846 Method 8260B.

During each surface water sampling event, the surface water samples were collected from the most downgradient location first, followed by subsequent upgradient locations. New nitrile gloves were donned prior to the collection of each surface water sample. The surface water samples were collected directly into the appropriate sample containers. Each sample container was labeled with the sample locations, sampling date and time, project identification, and required analysis. The same information was recorded on the field data sheets. Upon collection, the samples were immediately placed in an insulated cooler containing wet

ice. Chain-of-custody documentation was maintained following procedures provided in the NYSDEC-approved SAP. Surface water sample locations are shown on Figure 3-4. Section 7 presents the results of the surface water sample analysis.

3.10. Surface soil/sediment sampling

Sediment samples were collected on May 21, 2002 from nine locations (SED-1 through SED-9). One surface soil (SS-1) sample was also collected from the adjacent property to the west of the Site on May 21, 2002. On November 21, 2002 one additional sediment sample (SED-10) was collected from the Site to help delineate the extent of constituents in the sediment that may be Site related. The sediment and surface soil sample locations are presented on Figure 3-4.

The sediment samples were collected from the most downgradient location first, followed by subsequent upgradient locations. New nitrile disposable gloves were donned prior to the collection of each surface soil/sediment sample. The surface soil/sediment samples were collected with a stainless-steel spoon and composite bowl, and transferred into the appropriate laboratory-provided sample containers.

The sample containers were labeled with the sample locations, sampling date and time, project identification and required analysis. The same information was recorded on the field sheets. Upon collection, the samples were immediately placed in an insulated cooler containing wet ice.

Surface soil/sediment samples were submitted to STL for the following analyses:

- VOCs by USEPA SW-846 Method 8260B;
- SVOCs by USEPA SW-846 Method 8270C;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A;
- Pesticides by USEPA SW-846 Method 8081A;
- PCBs by USEPA SW-846 Method 8082; and
- pH by USEPA SW-846 Method 9045C.

Chain-of-custody documentation was maintained following procedures provided in the NYSDEC-approved SAP. Section 8 presents the results of the sediment and surface soil sample analysis.

3.11. Storm sewer evaluation

As discussed in Section 2, herein, several storm sewer lines run through the impacted portions of the Site and discharge into catch basin CB-3, which is located within the unfilled portion of the Old Erie Canal. Based on the results of the Final PSA Report, the potential for VOCs in the storm sewer system exists. Therefore, to evaluate the relationship between the storm sewer lines and potentially contaminated ground water in the shallow fill unit, a storm sewer evaluation was performed.

3.11.1. Inspection of storm sewers, manholes and catch basins

The initial step in the storm sewer evaluation was to perform a detailed review of the available underground utility maps to locate existing and historical storm sewer system components at Parker-Hannifin's Property. Following the completion of the map review, an inspection of the on-site sewers, manholes and catch basins was conducted to assess the condition of these storm sewer components and the potential for the sewers to serve as conduits for the preferential flow of impacted ground water.

Manholes and catch basins were opened and visually inspected from the surface. The visual inspections consisted of observing the interior of manholes or catch basins and noting its construction and condition. The number, size, and elevation of inlet and outlet piping as well as the type and condition of construction materials were also identified. Evidence of ground water infiltration, and indications that the sewer lines have become plugged or abandoned was also noted. Field observations made during the inspections of the manholes and catch basins were recorded on field inspection forms.

To maximize the visibility of manhole components during the inspection and to facilitate the collection of storm water samples from the influent and effluent pipes of catch basin CB-3, it was necessary to remove accumulated sediment and debris from inside of the catch basin CB-3 structure.

The catch basin clean out activities were conducted between May 22 to 24, 2002. O'Brien & Gere contracted O'Brien & Gere, Inc. of North America (OGINA) to conduct catch basin CB-3 clean out activities. Sediment and debris were removed from catch basin CB-3 by using a combination of manual excavation and vacuum extraction to remove the smaller pieces of debris and sediment while at the same time dewatering the structure. The excavated material was placed into 55-gallon drums and staged on-site. To minimize the amount of water flowing into catch basin CB-3 from the storm sewer system, the influent pipes to CB-3 were temporarily plugged. Once the sediment, debris and water were removed from CB-3, the block walls of the catch basin were cleaned using a steam cleaner.

The accumulated sediment, debris and the wastewater generated during the catch basin clean out program were transferred to 55-gallon steel drums and two polyethylene storage tanks provided by OGINA and staged on-site pending characterization and off-site disposal in accordance with the SAP.

3.11.2. Storm water sampling

In accordance with the NYSDEC-approved RI/FS Work Plan, storm water samples were collected from the Site during a period of relatively high ground water level conditions. The purpose of the storm water sampling program was to evaluate the extent of VOCs in the Site storm sewers.

Storm water samples were collected from each of the two influent lines to catch basin CB-3 and the two upgradient manholes (i.e., MH-3A and MH-3B) located in the parking lot near the pole barn. The four storm water sample locations are shown on Figure 3-4.

The storm water samples were collected as grab samples directly into the appropriate sample containers using either a peristaltic pump equipped with dedicated Tygon[®] tubing or directly into 40-ml glass vials. New nitrile gloves were donned prior to the collection of each water sample. The sample containers were labeled with the sample locations, date, time, project identification, and required analyses. The same information was recorded on the field sheets. The sample containers were immediately placed in an insulated cooler containing wet ice.

The four storm sewer samples, plus one trip blank sample, were submitted to STL for analysis of TCL VOCs via USEPA SW-846 Method 8260B. The analytical results are further discussed in Section 10.

3.11.3. Expanded storm sewer evaluation

In response to the detection of VOCs in surface water within the former Barge Canal and along the storm drain line leading to catch basin CB-3, an expanded storm sewer evaluation was performed to evaluate the source of the VOCs identified within the storm sewer system. The expanded storm sewer evaluation focused on evaluating the relationship between the current and historical storm sewer lines and changes that were made to the system during building expansions.

Between August 26 and 28, 2002, a storm and sanitary sewer inspection and assessment was performed at the Site. In addition, on August 26, 2002, the status of the roof drain connections to the storm sewer lines and modifications that may have been made were evaluated.

The structural integrity and the overall condition of the sewers were evaluated through the use of internal closed circuit television (CCTV)

inspection techniques. As part of the pipeline television inspection, cleaning of several pipelines was required to allow passage of the camera unit through the sewers and enable satisfactory visual assessment of the pipes during the television inspection. The pipeline cleaning and CCTV inspection was performed by Severn Trent Pipeline Services, Inc. of Saratoga Springs, New York.

The CCTV inspection consisted of robotic video taping which provided continuous visual inspection of the accessible pipes, and was capable of noting pipe deficiencies, ground water infiltration, and locations of laterals. For the sewer lines which are 6-inch diameter or smaller, a color push-rod, straight view CCTV system was used. For the sewer lines greater than 6-inch diameter, a color, self-propelled, pan-and-rotate CCTV system was used. For areas of the sewer that were submerged, the pipelines were dewatered prior to television inspection.

To minimize the migration of contaminants during television inspection, decontamination of equipment and personnel was conducted in accordance with the SAP.

Results of the television inspection were recorded on video tapes, and inspection logs were generated to document areas of observed infiltration, integrity loss, cracks, off-set joints and other malformations.

An additional focused evaluation of the storm sewers was performed on May 20, 2003 to further evaluate the sources of storm water to MH-3B. The objective of the additional evaluation was to determine if there is a potential for storm water to reach MH-3B via any of the three storm drain lines located north of MH-3B. In addition, several of the roof drains located on the eastern side to the manufacturing building were evaluated to verify their discharge location. This evaluation involved the use of smoke testing, water and dye testing.

Based on the results of the storm sewer evaluations, an Interim Remedial Measure (IRM) was proposed. The IRM Work Plan, dated June 2003 was approved by the NYSDEC on August 18, 2003. The IRM consists of the in-place decommissioning of catch basins CB-3 and CB-3E, manholes MH-3A and MH-3B, storm sewer line 3 and storm sewer line 4. In addition to the in-place decommissioning of the catch basins and storm sewer lines, water stops will be installed on Line 3 and Line 4 to minimize the potential for migration of VOC-impacted ground water along the original storm sewer pipe or within the associated bedding material. Implementation of the IRM is anticipated to take place in November 2003.

3.12. Surveying

Following the completion of field activities, the newly-installed monitoring wells, soil boring locations, surface water sample locations, surface soil/sediment sample locations and staff gauges were surveyed

for horizontal and vertical control and were incorporated into the existing Site base map. For each of the monitoring wells, the top of the riser pipe (reference point) and the top of protective steel casing were surveyed vertically to the nearest 0.01 feet. The ground surface at each monitoring well and sampling location were also surveyed to the nearest 0.01 feet. Richard M. Rybinski, L.S. of Manlius, New York performed the survey.

3.13. Handling of investigation derived waste

The RI activities produced Investigation Derived Materials (IDM) that required appropriate management procedures. The various IDM included drill cuttings, ground water, drill rig decontamination fluids, sediments, and personnel protective equipment (PPE). The handling procedures for the IDM are discussed below.

3.13.1. Drill cuttings

Drill cuttings derived from the overburden and bedrock drilling were placed in 55-gallons steel drums. Each drum was labeled with the appropriate borehole identification(s), the dates on which the cuttings were generated, and a description of the type of waste (i.e., drill cuttings). In accordance with the NYSDEC-approved RI/FS Work Plan, Parker-Hannifin arranged for the off-site disposal of the drill cuttings at a permitted facility.

3.13.2. Ground water and surface water

Ground water produced during development and sampling activities was containerized in 55-gallon steel drums. Each drum was labeled with the appropriate monitoring well identification(s), the dates on which the ground water were generated, and a description of the type of waste (i.e., development or purge water).

Based on the analytical results from the investigation, Parker-Hannifin arranged for the final disposal of the ground water in accordance with the NYSDEC-approved RI/FS Work Plan.

The accumulated wastewater generated during the catch basin clean out and storm water verification programs was transferred to two polyethylene storage tanks and staged on-site. Characterization and subsequent off-site disposal of wastewater generated during the RI was performed by Parker-Hannifin in accordance with the NYSDEC-approved RI/FS Work Plan.

3.13.3. Decontamination fluids, sediment, PPE and associated debris

Liquid/solid mixtures generated during equipment decontamination and catch basin clean out activities were temporarily stored in 55-gallon drums until solids had settled. The water was then transferred into drums

containing similar fluids, appropriately labeled and temporarily stored on site. The settled solids were also transferred into drums containing similar materials, labeled and temporarily stored on site. Characterization and subsequent off-site disposal of this IDM was performed by Parker-Hannifin in accordance with NYSDEC-approved RI/FS Work Plan.

Used PPE and other associated debris (polyethylene sheeting, sample tubing, etc.) were containerized in 55-gallon steel drums, labeled and temporarily stored on site. In accordance with NYSDEC-approved RI/FS Work Plan, Parker-Hannifin performed characterization and subsequent off-site disposal of these materials.

4. Geologic conditions

4.1. Regional geology

4.1.1. Physiographic setting

The Old Erie Canal Site is located on the lake Ontario plain within the Finger Lakes physiographic region of New York State. This broad flat plain at the northern end of the Ontario basin is the result of the flat underlying sedimentary rocks and the deposition of glacial deposits as the remnants of the Laurentide ice sheet retreated out of New York State about 10,000 years ago. Glacial retreat left the bedrock mantled with glacial till, glaciolacustrine sediments, and glaciofluvial deposits. Unique glacial features called drumlins were also formed during this intense period of glaciation. Drumlins are elongated, oval shaped features that formed by the reworking of glacial till in a sub-glacial environment (Fairchild, 1929). The maximum elevation of the drumlins in western New York State range from approximately 400 to 600 feet above mean sea level (amsl). The lower elevations within the drumlin fields predominantly represent drainage patterns that developed during deglaciation with some features having been developed more recently. A large number of the drainage features have been abandoned, as they were only active during the waning stages of glaciation.

As the Laurentide ice sheet receded north, a series of glacial lakes started to form. Drainage from these proglacial lakes was primarily to the east into Lake Ontario at the City of Oswego, New York. The gradual draining of the glacial lakes formed the eastward flowing Ganargua Creek, which borders the western boundary of Wayne County, New York. In the City of Lyons, New York, Ganargua Creek converges with an outlet stream of Lake Canandaigua. The confluence of these streams formed the eastward flowing Clyde River that ultimately empties into the Seneca River at the Village of Montezuma, New York.

4.1.2. Glacial history

During the Pleistocene Epoch (i.e., 1.8 million years ago to 10,000 years ago), New York State and the rest of the northeast seem to have experienced four major long-term glacial and deglacial events. However, each glacial readvance destroyed, to a large degree, the geologic evidence of the previous glaciation. The ice cap that affected New York and the rest of the northeast, the Laurentide, originated in the Laurentian Mountain area of Quebec and in the uplands of eastern Quebec and Labrador. In western New York State, there is evidence remaining of at

least two glacial advances from north to south. The first advance is believed to have been initiated about one million years ago (Von Engeln, 1961; Bloom, 1986). The final retreat of the Laurentide ice sheet from the region did not occur until about 10,000 years ago (e.g., during the Late Wisconsin Stage of the Pleistocene Epoch). During the height of the Late Wisconsin glaciation (approximately 20,000 years ago), a continental ice sheet covered the majority of New York State. The glacial margin extended across northern Pennsylvania and northern New Jersey to its southern limit along the length of Long Island, New York.

The drumlin field currently occupying the northern Lake Ontario plain was formed when the Wisconsin stage of the Laurentide ice sheet reached its maximum advancement, approximately 20,000 years ago, and reworked the underlying lodgment till into a series of drumlins. Regionally, the axes of nearly all the drumlins trend north to south reflecting the direction of glacial advance.

By 10,000 years ago, the Wisconsin Stage of the Laurentide ice sheet had receded, leaving a complex assemblage of glacial deposits above the middle Paleozoic bedrock. The glacial retreat produced a series of proglacial lakes and outwash deposits from glacial melt water throughout the region. Glaciation also drastically changed the drainage pattern in central New York State. Prior to the Pleistocene glacial events, drainage patterns within central New York State were thought to flow north into the Lake Ontario basin from eastward and westward trending tributary streams. These tributaries fed the northward flowing pre-glacial Seneca River from the valleys of Lake Cayuga, Lake Owasco, Lake Skaneateles and Lake Otisco. The present Finger Lakes are a byproduct of glaciation with the valleys scoured by the repeated glacial advances and retreats and southerly drainage prevented by the deposition of the Valley Heads moraine.

During formation of the Finger Lakes, the Seneca River was redirected eastward due to glacial scouring. As ice continued to recede northward, proglacial lakes at the ice margin continued to discharge water first to the south into the Susquehanna River then alternating east and west to the Mohawk-Hudson and Mississippi Rivers (Fairchild 1909).

Further melting of the Laurentide ice sheet formed proglacial Lake Montezuma (Fairchild, 1919) that formerly occupied the Cayuga Valley and Montezuma Marsh when the ice margin was in the northern part of Wayne County, New York. During this time period, proglacial Lake Montezuma drained into the Seneca River, which emptied into the early Lake Iroquois, located near the City of Syracuse, New York. Simultaneously, in the western portion of the Lake Ontario basin proglacial Lake Dawson (elevation 460 feet amsl) occupied an area that spanned from the present City of Rochester, New York to the present City of Hamilton, Ontario, Canada. Proglacial Lake Dawson discharged water to the east through an anastomosing set of branches called the Fairport channels. This slow moving outflow system drained eastward from Fairport through the City of Lyons, New York to the Village of

Clyde, New York and formed the current corridor of the Old Erie Canal system.

Meltwater from the receding ice-front continued to replenish proglacial Lake Dawson, Lake Ontario, proglacial Lake Montezuma, and proglacial Lake Iroquois until they completely occupied the area from Rome, New York to Ontario, Canada. Proglacial Lake Dawson eventually merged into proglacial Lake Iroquois and proglacial Lake Montezuma. These lakes may have collectively existed as a large southern bay known as Glacial Lake Iroquois (Elevation 440 feet). Gillette (1940) identified Clyde Bay as one of the many bays along the southern margin of Glacial Lake Iroquois. Clyde Bay was identified as a triangular shaped feature formerly located west of Clyde, New York in the Town of Galen, New York. The triangular shape of the former Clyde Bay was similar to existing Sodus Bay presently located north of Clyde, New York on Lake Ontario.

As the ice-front continued to retreat, the volume of meltwater draining into Glacial Lake Iroquois began to diminish. This caused the shoreline to recede to the present size of Lake Ontario. The receding water left much of the lowlands as marsh and muck lands forming the present Montezuma Marsh and surrounding swamplands that represent the final evidence of Clyde Bay.

4.1.3. Bedrock stratigraphy

Bedrock underlying Wayne County is Early to Late Silurian age (approximately 438 to 408 million years ago). The Early Silurian age rocks in the region are represented by the Medina Group and are exposed in the northern part of Wayne County, New York. This group represents the oldest group found in Wayne County, New York. The Medina Group is composed of Red Medina Sandstone or Grimsby Sandstone and overlies Middle Silurian age rocks of the Clinton and Lockport Groups in east-west trending exposures located south of the Late Silurian age rocks. The Clinton Group is composed of a mixture of shale, sandstone, and limestone. Conformably overlying the Clinton Group is the Lockport Group that consists of limestone and dolomitic limestone, and is commonly found as building material in the area.

The upper most bedrock unit in the southern half of Wayne County, New York and within the vicinity of the Old Erie Canal Site is the Salina Group. The Salina Group is comprised of three formations. In ascending order they are the Vernon, Syracuse and Camillus Formations. In Wayne County, New York, the Syracuse and Camillus Formations are difficult to distinguish and surface exposures are rare. Therefore, they have commonly been mapped together as a single unit. The bedrock underlying the Site is mapped as the Syracuse-Camillus Formation and is predominantly comprised of gray shale with some red shale and thin limestone (Canal Society of New York State, 1991).

4.2. Site geology

With the exception of fill, unconsolidated deposits of glacial origin overlie the bedrock throughout most of the Old Erie Canal Site. The glacial deposits are associated with the Finger Lakes Lobe of the late Wisconsin Laurentide ice sheet (Fairchild, 1929).

Three types of unconsolidated deposits have been identified at the Site. These include artificial fill material, glaciofluvial deposits, and glacial till. The unconsolidated deposits are underlain by detrital and clastic sedimentary rocks of the Syracuse-Camillus Formation.

Three geologic cross-sections have been prepared to illustrate the relationship between the unconsolidated glacial deposits and the underlying bedrock. The location and orientation of the cross-sections are shown on Figure 4-1. Figure 4-2 illustrates cross-section (A-A') starting at well pair MW-12, located on the south side of the Clyde River, extending north to monitoring well MW-8S located northwest of the manufacturing building. Figure 4-3 shows cross-section (B-B') starting at soil boring GP-42/monitoring well MW-9S, located in the northwestern portion of the Site, running eastward to monitoring well MW-2S/2B located just east of the manufacturing building. Cross-section (C-C') starting at soil boring GP-35/monitoring well MW-5S, located in the southwestern portion of the Site, continuing eastward along the southern property line to soil boring GP-39 is illustrated on Figure 4-4.

4.2.1. Unconsolidated deposits

The Site's unconsolidated deposits overlying the bedrock consist of, fill material, glaciofluvial deposits and glacial till. Based on the soil borings, the combined maximum thickness of the unconsolidated deposits is approximately 31 feet. The overburden is thickest in the southwestern portion of the Site and is thinnest near the northeastern portion of the site. The overburden is contiguous across the Site with no bedrock exposures.

4.2.1.1. Fill

The fill material observed throughout the majority of the Site is associated with the following: historical landfilling activities conducted on the Village of Clyde's property west of the manufacturing building; filling of the former barge turnaround area, filling of the Old Erie Canal along the southern portion of Parker-Hannifin's property; and, the demolition of historical structures at the Site. The fill material predominantly consists of black to brown sand, gravel, and silt mixed with varying amounts of cinders, ash, slag, brick, and glass. The fill material was encountered across the majority of the Site and ranged in thickness from 0.5 to 9-feet. The majority of fill exists in the abandoned section of the Old Erie Canal located along the southern portion of Parker-Hannifin's Property, along the eastern portion of the former barge

turn-around area, located southwest of the manufacturing building, and in the area surrounding the manufacturing building. The fill material appears to be absent in the area located along the western boundary of the Site, specifically at boring locations GP-10, GP-13, GP-18, GP-19, GP-24, GP-40, GP-41, GP-61, MW-7S and MW-7B.

4.2.1.2. Glaciofluvial deposits

Glaciofluvial deposits of varying composition were generally observed directly beneath the fill material. The maximum thickness of the glaciofluvial deposits is 23.0 feet at location GP-36 which is located near the southern portion of the Site and appears to pinch-out in the area surrounding the manufacturing building and in the southeastern parking lot.

Along the western portion of the Site, generally coinciding with the former barge turnaround area, a remnant glaciofluvial channel has been scoured into the glacial till unit resulting in the deposition of a greater thickness of sand and gravel. The decreasing trend in bedrock elevation from the northeast to the southwest combined with the increasing thickness of glaciofluvial deposition in the southern extent of the channel indicates channel scouring in a southern direction. In the course of the scouring process, sand and gravel were deposited followed by channel abandonment and subsequent deposition of silt and clay layers (i.e., backswamp deposits) due to periodic flooding of the Clyde River. This in turn formed the wetland conditions that are now present along the western Site border.

As seen on Figure 4-2, the north-south trending glaciofluvial channel deposit, located along the western side of the Site, extends from the north of well MW-8S to the Clyde River. It is not known if this channel was an active tributary to the modern Clyde River. As shown on Figures 4-3 and 4-4, the remnant glaciofluvial channel deposit ranges in width from approximately 150 to 200-feet.

The various types of sand and gravel deposits observed at the Site include channel gravel; channel sands; and channel silts, sands and gravel. The channel gravel deposits can be best described as gray to dark gray poorly sorted coarse to fine grained gravel with sand and silt. As shown on the geologic cross-sections, the channel gravel deposits commonly overlay glacial till or bedrock. The channel sand deposit consists of yellowish brown to gray medium to fine grained sand. The channel sand deposits generally overlay the channel gravel deposits. However, as shown in Figure 4-5, alternating layers of gravel and sand were observed in the southern extent of the glaciofluvial channel. The channel silt, sand and gravel deposit is described as poorly sorted gray clayey silt with coarse to fine sand and medium to fine gravel. This deposit does not appear to be laterally contiguous beneath the Site, but does overlie the channel gravel located within the northern portion of the channel.

The backswamp deposits are best described as a gray to yellowish gray to olive, interbedded silt and clay. The backswamp deposits are generally observed overlying the glaciofluvial channel deposits in the western portion of the Site. These deposits also appear to overlie the glacial till along the eastern bank of the remnant glaciofluvial channel.

4.2.1.3. Glacial till unit

The glacial till unit encountered across the majority of the Site consists of a poorly sorted mixture of a reddish brown clayey silt matrix with some coarse to fine sand and little gravel. The glacial till characteristics (e.g., hard, dry, dense, and friable) are indicative of Lodgment Till. Lodgment Till was deposited during the advancement of the glacial ice sheet, and compacted by the weight of the glacial ice mass.

The dense glacial till unit acts as an aquitard, or an underlying confining unit that hydraulically separates the fill and glaciofluvial units from the shallow bedrock unit. The thickness of the glacial till deposit ranges from 6 to 15 feet across the majority of the Site. The glacial till unit appears to be absent beneath the glaciofluvial channel located along the western portion of the Site, but is observed again along the westernmost property boundary. As noted in Section 4.2.1.2, the former glaciofluvial environment apparently scoured a channel into the glacial till unit and subsequently deposited channel sands and gravel as drainage conditions changed, thus forming the remnant glaciofluvial channel.

4.2.2. Confining unit structure

In order to gain a better understanding of the distribution of contaminants in the subsurface, geologic information collected at the Site has been used to develop a top of low permeability unit contour map. In general, the glacial till unit represents the underlying confining layer at the Site, however, as discussed previously, the glacial till unit is not continuous beneath the Site. In the vicinity of the remnant glaciofluvial channel the glacial till unit is absent and the low permeability bedrock unit serves as the underlying confining unit.

As shown in Figure 4-5, the top of the low permeability unit slopes toward the remnant glaciofluvial channel from both the east and west. In the eastern portion of the Site, the top of the low permeability unit slopes fairly uniformly to the west/southwest from a maximum elevation of 394.5 feet above mean sea level (amsl) at location GP-7 to a low of 366.0 feet amsl at location GP-34, located near the confluence of the former barge turnaround and the Old Erie Canal. In the western portion of the Site, the top of the low permeability unit slopes under a uniform gradient to the east from a high of 396.4 feet amsl at location MW-7B to a low of 368.2 feet amsl at location GP-25, which is also located in the remnant glaciofluvial channel. Within the glaciofluvial channel, where the glacial till is absent and the bedrock serves as the underlying confining unit, the

top of the low permeability unit slopes north to south from MW-8S toward the Clyde River respectively.

The top of the low permeability unit from the eastern and western margins of the Site converges toward the remnant glaciofluvial channel. As previously noted, the glacial till is absent from this portion of the Site, and the bedrock is considered the underlying confining layer.

4.2.3. Bedrock

The bedrock immediately underlying the unconsolidated deposits in the vicinity of the Site consists of shale and dolomitic limestone of the Late Silurian Syracuse-Camillus Formation. Bedrock cores were collected during the RI activities from well locations MW-2B, MW-4B, MW-7B, MW-10B, MW-11B and MW-12B.

The Syracuse-Camillus Formation is the uppermost and youngest formation encountered at the Site. Based on an evaluation of the bedrock core samples, the bedrock consists of gray to dark greenish gray, fine grained, moderately fractured shale and thinly bedded gray dolomitic limestone. The shale is smooth textured, horizontally bedded, with frequent gypsum strings. The dolomitic limestone also has frequent gypsum strings, as well as occasional gypsum nodules. The rock quality designation is typically very poor to moderately fractured, ranging from 0 to 68%. In the cores examined, no fossils were observed.

Table 4-1 summarizes depths to bedrock in feet bgs and bedrock elevations in feet above mean sea level determined at the bedrock drilling locations. The depths to bedrock observed during the drilling program ranged from 16.5 to 31 feet bgs. Generally, the bedrock surface dips gently, with a fairly uniform gradient, from the northeast to the southwest. Figure 4-6 presents a generalized contour map of the bedrock surface at the Site. The elevation ranges from a high of 381.9 feet amsl at MW-2B to a low of 359.0 feet amsl at MW-11B.

5. Hydrogeologic conditions

5.1. Climate and water budget

Daily precipitation data was obtained for the 2002 calendar year from New York State Canal Lock #26 located approximately 2.6 miles southeast of the Old Erie Canal Site. Since temperature data is not recorded at New York State Canal Lock #26, temperature data for the Greater Rochester International Airport located approximately 40 miles east of the Site was obtained from the Northeast Regional Climate Center located in Cornell, New York.

The total precipitation for the 2002 calendar year was 37.27 inches and the average temperature was 50.1 degrees Fahrenheit (°F). Based on data collected over a 30-year period (i.e., 1972 to 2002) the normal annual precipitation and temperature from these monitoring locations are 38.19 inches and 48.2 °F, respectively. Therefore, the total precipitation for 2002 was approximately one inch less than normal and temperature was approximately 2 °F above normal. Figure 5-1 graphically compares the 2002 temperature and precipitation data to the 30-year averages.

The available climatic data have been used to perform a water budget for the 2002 calendar year. In a water budget, mean monthly potential evapotranspiration (PET) and overland runoff are subtracted from mean monthly precipitation to obtain water surplus or deficit values. Ultimately, an estimate of ground water recharge can be developed. Normally, a water surplus exists from January through April and from September through December. During such times, ground water recharge can occur. The high PET during late spring and summer months creates water deficit conditions, which normally prevent significant ground water recharge. During periods of high PET, the moisture content of the soil can drop well below field capacity. The soil moisture deficit must be overcome before ground water recharge can resume.

As stated above, the average annual precipitation is 38.19 inches in the vicinity of the facility. The average annual PET is estimated to be 26.30 inches using Hamon's (1961) methodology. Thus, an average of 11.89 inches is available for runoff and recharge and to overcome soil moisture deficits. Figure 5-2 shows the average annual calculated water budget on a monthly basis.

Water budget conditions change from year to year as actual climatic conditions deviate from normal. The total annual precipitation at the Clyde Lock #26 was 37.27 inches in 2002. The estimated total annual PET for 2002 was 27.81 inches. The estimated annual surplus for 2002 was 9.46 inches. Figure 5-2 shows the calculated actual water budget on a monthly basis for the 2002 calendar year.

5.2. Hydrogeologic system

Based on data collected as part of the remedial investigation, a conceptual hydrogeologic model has been developed for the Site. The conceptual model includes two hydrogeologic units: the shallow unconsolidated unit and the shallow bedrock unit. The majority of the shallow unconsolidated unit is hydraulically separated from the shallow bedrock unit by a low permeability, dense glacial till unit. These units differ in their physical properties, ground water flow patterns, and their responses to stresses (e.g., seasonal climatic changes, precipitation events, and navigation conditions in the Clyde River).

The shallow unconsolidated unit is composed of fill material and glaciofluvial deposits and has a thickness ranging from 1.0 to 29.2 feet. The water table generally occurs in this hydrogeologic unit under unconfined conditions and is free to rise and fall in response to ground water recharge and discharge. With the exception of less permeable surface areas (e.g., parking lots, roads, and buildings), precipitation appears to result in uniformly distributed recharge to the shallow unconsolidated unit.

Ground water flow in the western and central portions of the Site is generally to the west toward the remnant glaciofluvial channel and to the south toward the Clyde River. The remnant glaciofluvial channel located in the western portion of the Site appears to represent a local ground water drainage point where ground water flow paths converge from the east, north, and west. In the area north of the Clyde River, once the ground water converges within the permeable channel deposits it generally flows south. South of the Clyde River, ground water flow is generally to the northeast.

The shallow bedrock hydrogeologic unit at the Site is part of the Syracuse-Camillus formation and consists of interbedded shale and limestone. In the portions of the Site where the glacial till unit is present, ground water in the shallow bedrock unit is observed under semi-confined conditions. Along the western portion of the Site where the glacial till unit is absent in the vicinity of the channel deposit, the shallow bedrock unit is observed under unconfined conditions.

North of the Clyde River, ground water flow within the shallow bedrock unit is generally to the southwest. South of the Clyde River, ground water flow within the shallow bedrock unit is generally to the Northeast. Bedrock ground water flow at the Site occurs principally through

secondary porosity features such as fractures, joints and bedding planes. The water levels in the shallow bedrock unit are generally above the bedrock surface indicating that the ground water in these wells is under pressures higher than atmospheric pressure.

5.3. Response of the hydrogeologic system

Water levels fluctuate seasonally in both the shallow unconsolidated and the shallow bedrock hydrogeologic units. Figure 5-3 illustrates the water level fluctuations in well pairs MW-2 and MW-4 from June 2002 to November 2003. As shown on Figure 5-3, water level trends observed in the unconsolidated unit are similar to the trends observed in the shallow bedrock unit. The range in water levels at well pair MW-2 was approximately 1.0 and 1.3 feet in the unconsolidated and the shallow bedrock units, respectively. The range in water levels at well pair MW-4 was approximately 2.3 feet in both the unconsolidated and the shallow bedrock units. The highest water levels occurred in the late fall/early winter months and the late spring/early summer months. Water levels began to decline during the summer months when water deficit conditions begin due to higher evapotranspiration rates and precipitation rates are typically low. In addition, as shown in Figure 5-3, the water level elevations at well pair MW-2 are significantly higher than the water level elevations at well pair MW-4. These data demonstrate that well pair MW-2 represents the hydraulically upgradient location at the Site.

Water level fluctuations in the shallow unconsolidated hydrogeologic unit are variable across the Site. Three hydrographs have been prepared to illustrate the water levels in the shallow unconsolidated unit from June 2002 to November 2003. Figure 5-4 shows the water level fluctuations in the northern portion of the Site. The range during this time period in water levels is between one foot at MW-2S and 3.5 feet at MW-9S. Figure 5-5 illustrates water level fluctuations in the vicinity of the remnant glaciofluvial channel. Within the channel deposits, the range in water levels from June 2002 to November 2003 were between 1.4 feet in MW-7S to 3.5 feet in MW-9S.

Figure 5-6 is an assemblage of ground water hydrographs for wells MW-3S, MW-4S, MW-5S, EMW-3, and EMW-4 and surface water levels from the Clyde River. These hydrographs show water level fluctuations that were observed in wells adjacent to and in close proximity to the Clyde River. The range in water levels in this portion of the Site between June 2002 and November 2003 was between approximately 2.0 feet at EMW-4 and 4.2 feet at MW-5S.

Figure 5-7 shows the water level fluctuation in bedrock wells MW-2B, MW-4B and MW-7B from June 2002 to November 2003. These wells are located along the eastern, western and southern boundaries of the Site respectively. In the shallow bedrock ground water system, water levels fluctuated over a range of 1.3 feet to 2.3 feet during this monitoring

period. As previously mentioned, the water level trends observed in each of the bedrock monitoring wells were similar to trends observed in the respective paired wells screened in the unconsolidated unit. Figure 5-7 also illustrates the ground water elevations collected from bedrock monitoring wells MW-10B, MW-11B and MW-12B located along the south side of the Clyde River between December 2002 and November 2003. Since these monitoring wells were installed in November 2002, ground water level measurements were not collected from these wells prior to the December monitoring event.

As shown in Figure 5-3, in the area north of the Clyde River, a downward vertical hydraulic gradient is observed between the unconsolidated and shallow bedrock hydrogeologic units. Based on the water level data from well pairs MW-2 and MW-4, on average, the hydraulic head in the shallow bedrock unit is approximately 0.7 and 1.3 feet lower than the hydraulic head in the shallow unconsolidated unit, respectively. At well pair MW-2, the downward vertical gradient between the unconsolidated and shallow bedrock ranged from approximately 0.03 to 0.06 feet per foot (feet/foot) during these periods. At well pair MW-4, the downward vertical hydraulic gradient between the unconsolidated and shallow bedrock units ranged from approximately 0.03 to 0.15 feet/feet.

As shown in Figure 5-8, south of the Clyde River, an upward vertical hydraulic gradient is observed between the unconsolidated and shallow bedrock hydrogeologic units. Based on the water level data from well pairs MW-11 and MW-12, on average, the hydraulic head in the shallow bedrock unit is approximately 3.7 and 4.6 feet higher than the hydraulic head in the shallow unconsolidated unit, respectively. At well pair MW-11, the upward vertical gradient between the unconsolidated and shallow bedrock ranged from approximately 0.10 to 0.14 feet per foot (feet/foot) during these periods. At well pair MW-12, the upward vertical hydraulic gradient between the unconsolidated and shallow bedrock units ranged from approximately 0.08 to 0.24 feet/feet.

As shown in Figures 5-9 through 5-11, water levels at the site also fluctuate in response to precipitation events. Three hydrographs have been prepared to illustrate the water level data obtained during the near continuous hydraulic monitoring program which was conducted between April and November 2003. Figure 5-9 shows the water level fluctuations in the Old Erie Canal and at well pair MW-4. Figure 5-10 illustrates water level fluctuations for wells located along cross-section A-A', and Figure 5-11 illustrates water level fluctuations for wells located along the southern boundary of the between the Old Erie Canal and the rail road tracks. Based on the data presented in Figures 5-9 through 5-11, the response to precipitation events is variable across the site. Unconsolidated unit well MW-9S responds very strongly to precipitation, but water levels in this well quickly subside once the event is over. The water level data obtained at well pair MW-4 indicates that the water level response to precipitation events does not appear to be as strong in the unconsolidated unit as it is in the shallow bedrock unit. The

surface water level in the Old Erie Canal clearly shows a response to precipitation events. As discussed in Section 2, the Old Erie Canal receives storm water flow from both the Parker-Hannifin Property and the Village of Clyde storm sewer systems.

5.4. Hydraulic properties

The results of the hydraulic conductivity testing for the unconsolidated unit ranged from 1.15×10^{-04} cm/sec (0.33 ft/day) in well MW-9S to 6.93×10^{-03} cm/sec (19.65 ft/day) in MW-5S. The average hydraulic conductivity estimate for the unconsolidated hydrogeologic unit is 2.40×10^{-03} cm/sec (6.81 ft/day).

The horizontal hydraulic conductivity for the shallow bedrock wells installed during the RI ranged from 3.00×10^{-04} cm/sec (0.85 ft/day) in well MW-4B to a low of 3.79×10^{-06} cm/sec (0.01 ft/day) in well MW-2B. The average hydraulic conductivity estimate for the shallow bedrock unit is 1.13×10^{-04} cm/sec (0.320 ft/day). Table 3-5 summarizes the hydraulic conductivity estimates based on the falling and rising head slug testing. Additional details on data acquisition and analysis are presented in Appendix E.

5.5. Ground water flow

Ground water flow at the Site is discussed below in terms of two hydrogeologic units, the overburden (unconsolidated) and the shallow bedrock units. The two units appear to be hydraulically connected, but are discussed separately due to inherent differences in the geologic material and nature of ground water flow.

In addition to naturally occurring variations in ground water elevations, the Site ground water system appears to be influenced by the operation of the New York State Canal system (Clyde River). In particular, during the navigation season, which commonly occurs from early May to early November, the gates at each of the Canal Locks are activated to allow for navigation of the Clyde River. During the navigation season, the water level upstream of Canal Lock 26 is maintained at an elevation of approximately 386 feet above mean sea level. During these periods of high surface water in the Clyde River, the hydraulic head in the Clyde River and the channel deposits is similar resulting in a low ground water flow velocities in the channel deposits towards the river.

During the non-navigation season from November to early May, the gates are kept open at each of the locks and the surface water elevations are lowered. Surface water elevations during non-navigation season are variable due to seasonal variations in surface water flow in the Clyde River. During the periods of low surface water in the Clyde River, the hydraulic head in the Clyde River is lower than that in the channel deposits, resulting in a higher ground water flow velocities within the

channel deposits towards the river. During the non-navigation season the average ground water velocity across the Site is nearly four times greater than during navigation season.

Based on the operation of the Barge Canal system, ground water levels measured on July 17, 2002 are considered representative of navigation season conditions and ground water levels measured on December 16, 2002 are considered representative of non-navigation conditions. The navigation and non-navigation seasons generally correspond to periods of high and low ground water elevations at the Site respectively. Therefore, contour maps of the potentiometric surface in the overburden and shallow bedrock units have been prepared for July 17, 2002 and December 16, 2002 (Figures 5-12, 5-13, 5-15 and 5-16).

5.5.1. Ground water flow within the unconsolidated unit

As shown on Figures 5-12 and 5-13, ground water flow within the shallow unconsolidated unit is generally to the southwest and appears to be influenced by the permeable channel deposits located within the north-south trending remnant glaciofluvial channel. The permeable channel deposits locally cause ground water to flow towards the channel from the east, north, and west. However, ground water in the southeastern margin of the Site flows to the south-southwest toward the Clyde River and does not appear to be influenced by the channel.

The remnant glaciofluvial channel appears to represent a local drainage feature where ground water flow paths converge from the east, north, and west. Ground water within the channel flows south, under a shallow hydraulic gradient, from the area between MW-9S toward the MW-4 series.

Based on the July 17, 2002 water level measurements, the rate of ground water flow or average linear velocity, within the unconsolidated unit ranged from 0.49 to 0.35 feet/day in the eastern and central portions of the Site (i.e., approaching the remnant glaciofluvial channel and the Clyde River). The ground water flow velocity decreases within the remnant glaciofluvial channel and ranges from 0.043 to 0.031 feet/day.

These velocities are based on Darcy's Law, modified to account for porosity as follows:

$$v=Ki/n$$

where v is velocity (feet/day), K is hydraulic conductivity of the unconsolidated unit wells presented previously (6.81 feet/day), i is the average hydraulic gradient [0.018 and 0.0016 feet/feet in the eastern and central portions of the Site, and within the glaciofluvial channel, respectively], and n is effective porosity (25 to 35% assumed). The order of magnitude lower hydraulic gradient observed in the remnant glaciofluvial channel is a function of the channel deposits' ability to readily transmit ground water with less loss of hydraulic head.

As shown on Figure 5-13, the water levels are much higher in December than in July. Based on the December 16, 2002 water level measurements, ground water flow within the overburden unit ranged from 1.36 to 1.91 feet/day in the eastern and central portions of the Site. The rate of ground water flow decreases within the glaciofluvial channel and ranges from 0.16 to 0.11 feet/day due to lower gradients. These velocities are based on a hydraulic conductivity of 6.81 feet/day, an estimated effective porosity of 25 to 35%, and average hydraulic gradients of 0.07 and 0.0058 for the eastern and central portions of the Site and within the channel respectively.

In addition to the July and December 2002 ground water contour maps, Figure 5-14 presents a contour map of the potentiometric surface in the overburden unit on November 4, 2003. As shown on Figure 5-14, the general ground water flow patterns discussed above remain consistent.

Based on a review of the ground water contour maps and the ground water velocity estimates, ground water flow in the unconsolidated unit appears to be influenced by the operation of the Barge Canal. In particular, two distinct ground water flow conditions develop within the glaciofluvial channel due to the seasonal operation of the Barge Canal. During the navigation season from early May to early November, the Clyde River is at an approximate elevation of 385 to 387 feet amsl. In response to maintaining the Clyde River at an elevation of 385 to 387 feet amsl, ground water in the glaciofluvial channel flows at an average velocity of 0.037 feet per day with an average hydraulic gradient of 0.0016. During the non-navigation season (i.e., early November to early May) the Clyde River is approximately 5 feet lower at an elevation of approximately 382 feet amsl, the average ground water velocity in the glaciofluvial channel is approximately 0.135 feet/day with an average hydraulic gradient of 0.0058. During the non-navigation season the average ground water velocity across the glaciofluvial channel is nearly four times greater than during navigation season.

Unlike ground water elevations outside of the glaciofluvial channel, a uniform head distribution is commonly observed during the navigation and non-navigation season in the glaciofluvial channel. The uniform head distribution suggests a zone of moderate to high permeability that allows ground water within the channel deposits to readily adjust to recharge and discharge fluxes with minimal head loss.

The ground water contour maps also suggest that the Clyde River is predominantly an effluent stream (i.e. gaining stream). That is, under most conditions, the Clyde River appears to receive some component of its flow from the shallow ground water system. The hydraulic head in the ground water beneath the Site is generally greater than the hydraulic head in the Clyde River. This hydraulic relationship is based on ground water elevations observed in monitoring wells MW-3S, MW-4S, and MW-5S and surface water elevations measured from Staff Gauge SG-3 in the Clyde River. The three ground water monitoring wells are located approximately 140 feet from the Clyde River.

5.5.2. Ground water flow within the shallow bedrock

As shown on Figures 5-15 and 5-16, north of the Clyde River, ground water flow within the shallow bedrock unit is generally to the southwest. As shown on Figure 5-16, south of the Clyde River, ground water flow within the shallow bedrock unit is generally to the northeast. An estimate of the rate of ground water flow within the shallow bedrock unit north of the Clyde River has been estimated using the modified form of Darcy's Law presented previously. Based on the July 17, 2002 water level elevations, the ground water velocity in the shallow bedrock is estimated to range from 0.032 to 0.0097 feet/day. These velocities are based on the geometric mean horizontal hydraulic conductivity of the shallow bedrock 0.32 feet/day, an assumed effective porosity of 5 to 10%, and a hydraulic gradient of 0.015 feet/feet.

Based on the December 16, 2002 water level elevations, the rate of flow within the shallow bedrock unit north of the Clyde River is estimated to range from 0.036 to 0.011 feet/day. These velocities are based on the geometric mean horizontal hydraulic conductivity of the shallow bedrock 0.32 feet/day, an assumed effective porosity of 5 to 10% and a hydraulic gradient of 0.017 feet/feet.

In addition to the July and December 2002 ground water contour maps, Figure 5-17 presents a contour map of the potentiometric surface in the shallow bedrock unit on November 4, 2003. As shown on Figure 5-17, the general ground water flow patterns discussed above remain consistent.

6. Nature and extent of constituents in ground water

6.1. General

The analytical results for ground water samples collected during the Old Erie Canal Site RI are presented in the following sections. Discussions of the analytical data are based on samples obtained during the preliminary screening program, as well as the subsequent ground water sampling events. As described in Sections 3.4.3 and 3.6, ground water samples were obtained from temporary overburden well points, overburden monitoring wells, and bedrock monitoring wells.

The ground water samples obtained from the temporary overburden well points were collected from 44 points installed as part of the preliminary screening program between April 22 and May 2, 2002 as well as 17 points installed during a supplemental sampling program on November 21, 2002. All ground water samples obtained from the temporary overburden well points were analyzed for VOCs using USEPA SW-846 Method 8260B. In addition, ground water samples were collected during an initial sampling event from 14 overburden monitoring wells and three bedrock monitoring wells between June 24 and 26, 2002 and analyzed for the full TCL/TAL list of parameters, which includes VOCs using USEPA SW-846 8260B, SVOCs using USEPA SW-846 8270C, PCBs using SW-846 8082, Pesticides using USEPA SW-846 8081A, Metals using USEPA SW-846 6010B and 7470A, Cyanide using USEPA SW-846 9012A, and pH with method 9045C. Subsequently, ground water samples were obtained during two supplemental sampling events. Seven overburden monitoring wells and four bedrock monitoring wells were sampled between December 17, and 19, 2002 and analyzed for VOCs using USEPA SW-846 Method 8260B. Sixteen overburden monitoring wells and six bedrock monitoring wells were sampled on May 27, and 28, 2003 and analyzed for VOCs using USEPA SW-846 Method 8260B.

Ground water samples were also collected and analyzed for natural attenuation parameters (see Section 3.6 for a list of the natural attenuation parameters) during the initial sampling event from 13 overburden monitoring wells and three bedrock monitoring wells between June 24 and 26, 2002. Subsequently, samples for analysis of natural attenuation parameters were obtained during two supplemental sampling events. Two overburden monitoring wells and three bedrock monitoring wells were sampled on December 17, and 18, 2002. Five overburden monitoring wells and one bedrock monitoring well were sampled on May 29, and 29, 2003.

In total, ground water samples were collected from 52 of the 61 temporary well points, 16 overburden monitoring wells, and six bedrock monitoring wells as part of the Old Erie Canal Site RI. The results of the ground water quality analyses are presented in tabular form in Appendices F and G. Laboratory reporting forms from the ground water quality analyses are provided in Appendices H and I for the temporary well points and the monitoring wells, respectively.

The remainder of this section presents the distribution of the constituent concentrations in ground water at the Site as well as a comparison of detected concentrations to NYSDEC Class GA ground water standards (hereafter referred to as “ground water standards”). The discussion presented below regarding VOCs in ground water focuses on the five primary VOC constituents detected at the Site. These VOCs include the following: cis-1,2-DCE, toluene, TCE, vinyl chloride, and total xylenes. For the purposes of this report, these parameters are identified as the primary ground water COCs. Other VOCs detected in ground water were generally at the same locations and at lower concentrations. The purpose of identifying these parameters as COCs is to focus on the parameters which would ultimately drive the remedial strategy, while acknowledging the existence of other constituents (which are identified on the data tables).

The ground water standards for the COCs are as follows:

cis-1,2 DCE	5 µg/L
Toluene	5 µg/L
TCE	5 µg/L
Vinyl chloride	2 µg/L
Total xylenes	5 µg/L

To facilitate the following discussions, the Site has been organized into separate areas based on the distribution of COCs, historical Site use, geologic and hydrogeologic setting. As illustrated in Figure 6-1, the Site was organized according to the following areas:

Area A (background locations – east of the manufacturing building)

Area A represents background conditions and is located northeast and east of the manufacturing building. This area is located hydraulically up gradient of the manufacturing building and the abandoned portions of the Old Erie Canal. As shown on Figure 6-1, one temporary monitoring point (GP-7) and two monitoring wells (MW-2S and MW-2B) were installed in this area.

Area B (southeastern portion of the Site)

Area B represents the areas located in the southeastern portion of the Site and generally consists of the eastern (i.e., up stream) section of the filled

in portion of the Old Erie Canal. As shown on Figure 6-1, two temporary well points (GP-38 and GP-39) and three monitoring wells (MW-3S, EMW-3 and EMW-5) are included in this area.

Area C (northern portion of Site near Columbia Street and generally north of the manufacturing building)

Area C represents the area north of the manufacturing building along Columbia Street and includes the adjacent residential property located to the west of the Site. This portion of the Site is hydraulically up gradient of the Barge Turnaround and represents the northern extent of the glacio-deltaic channel deposit. In addition, the shallow unconsolidated unit (i.e., above the glacial till unit) in the area north of Columbia Street and east of the channel deposit is often unsaturated as evidenced by dry wells at the time of the ground water sampling at temporary well points GP-3 and GP-44. As shown on Figure 6-1, this portion of the Site consists of seven temporary well points (GP-1, GP-2, GP-3, GP-4, GP-42, GP-43 and GP-44) and two permanent overburden monitoring well locations (MW-8S and MW-9S).

Area D (area west of the manufacturing building)

Area D represents the area west of the manufacturing building and is hydraulically up gradient of the Barge Turnaround and represents the northern portion of the glacio-deltaic channel deposit. As shown on Figure 6-1, this portion of the Site consists of nine temporary overburden well points (GP-5, GP-6, GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, and GP-14) and one permanent overburden monitoring well location (MW-1S).

Area E (Barge Turnaround)

Area E represents the former barge turnaround area, which includes portions of the remnant glaciofluvial channel deposit. The channel deposit consists of fluvial and overbank deposits having a maximum thickness of 20.5 feet bgs in the barge turnaround area. In general, the overbank deposits were found to overlay the channel deposits in this area. Also noted within the barge turnaround area was the absence of the glacial till unit found otherwise across the Site.

As shown on Figure 6-1, this portion of the Site consists of 13 temporary well points (GP-19, GP-20, GP-24, GP-25, GP-26, GP-28, GP-31, GP-32, GP-33, GP-34, GP-36, GP-37 and GP-60), five permanent overburden monitoring well locations (EMW-2, EMW-4, MW-4S, MW-6S and MW-7S) and one permanent bedrock monitoring well (MW-4B).

Area F (area west of the barge turnaround)

Area F represents the area west of the barge turnaround and is hydraulically up gradient of the barge turnaround. As shown on Figure 6-1, this portion of the Site consists of six temporary overburden well

points (GP-18, GP-35, GP-40, GP-41, GP-59, and GP61), one permanent overburden monitoring well location (MW-5S) and one permanent bedrock monitoring well location (MW-7B).

Area G (area between barge turnaround and manufacturing building)

Area G represents the area between the barge turnaround and the manufacturing building and is hydraulically the up gradient portion of the Site. As shown on Figure 6-1, this portion of the Site consists of 23 temporary overburden well points (GP-15, GP-16, GP-17, GP-21, GP-22, GP-23, GP-27, GP-29, GP-30, GP-45, GP-46, GP-47, GP-48, GP-49, GP-50, GP-51, GP-52, GP-53, GP-54, GP-55, GP-56, GP-57 and GP-58) and one permanent overburden monitoring well location (MW-1). This portion of the Site includes an abundance of active and abandoned sanitary and storm sewer lines and is characterized as having a relatively limited saturated thickness. As such, six of the temporary overburden well points were dry at the time of sampling (GP-21, GP-48, GP-52, GP-55, GP-57 and GP-58).

Area H (area south of the Barge Canal/Clyde River)

Area H represents the areas south of the Barge Canal/Clyde River. As shown on Figure 6-1, two overburden monitoring wells (MW-11S, and MW-12S) and three bedrock monitoring wells (MW-10B, MW-11B and MW-12B) are included in this area.

Table 6-1 details which monitoring wells are located within each of the eight primary ground water monitoring areas.

6.2. Distribution of constituents in ground water

6.2.1. Volatile organic compounds

A detailed summary of the VOC analytical results can be found in Appendices F and G, while the subsequent discussion will focus primarily on the COCs detected at concentrations above the ground water standards. The analytical results of the five select VOC parameters identified as ground water COCs are also shown for each of the monitoring wells on Figure 6-2.

Areas A and B

A total of 13 ground water samples were obtained from the eight ground water sample locations within these areas for VOC analysis. One sample location (GP-7) was dry at the time of sampling. As shown on Tables 6-2 and 6-3, no VOCs were detected above ground water standards within these areas.

Area C

A total of 12 ground water samples were obtained from seven of the ground water sample locations in this area for VOC analysis. These samples included one blind duplicate sample and a confirmation sample that was collected from well MW-9S. Two sample locations (GP-3 and GP-44) were dry at the time of sampling.

As shown on Table 6-4, low concentrations of VOCs were detected in seven of the nine ground water sample locations in this area. With the exception of one detection of cis-1,2-DCE (8.7 µg/L at temporary well point GP-4) and two detections of vinyl chloride, (2.4 and 3.9 µg/L in the samples collected from GP-4 and GP-2 respectively), all other VOCs detected were at concentrations below ground water standards.

Area D

A total of ten ground water samples were obtained from the ten ground water sample locations in this area for VOC analysis. As shown on Table 6-5, 11 compounds were detected at concentrations above the ground water standards. Of the 11 compounds, six were detected only once above the ground water standard and three of those six were from the same location.

TCE was detected above the ground water standard in four samples from this area, at concentrations ranging from 73J µg/L at GP-14 to 1900B µg/L at GP-13. Cis-1,2-DCE was detected above the ground water standard in all samples obtained from this area with concentrations ranging from 14 µg/L at GP-9 to 9100 µg/L at GP-13. Vinyl chloride was detected above the ground water standard in nine samples, at concentrations ranging from 5.7J µg/L at GP-6 to 2700 µg/L at GP-14. Toluene was detected above the ground water standard in three samples from this area, at concentrations ranging from 9BJ µg/L at GP-11 to 660 µg/L at GP-6. In addition, m&p xylenes and o xylene were detected at concentrations of 1600 and 520 µg/L, respectively.

Area E

A total of 36 ground water samples were obtained from the 19 ground water sample locations in this area for VOC analysis. These samples included initial and confirmation sampling at EMW-2, EMW-4, MW-4B, MW-4S and MW-7S, as well as blind duplicate samples. A blind duplicate was collected from MW-4B during the initial and confirmation sampling events. As shown on Table 6-6, of the 23 VOC compounds detected in this area, 15 were found at levels exceeding the ground water standards.

With the exception of the detection of 71,000 µg/L of TCE at GP-25, TCE was detected above the ground water standard in 14 of the samples

obtained from this area with concentrations ranging from 43BJ µg/L at GP-19 to 4,600DJ µg/L at GP-34. Cis-1,2-DCE was detected above the ground water standard in 25 samples obtained from this area with concentrations ranging from 5.2 µg/L at GP-37 to 200,000 µg/L in the blind duplicate sample collected from GP-34. Vinyl chloride was detected above the ground water standard in 27 of the samples obtained from this area with concentrations ranging from 6.8 µg/L at GP-37 to 44,000 µg/L at GP-20. Toluene was detected above the ground water standard in 11 of the samples obtained from this area with concentrations ranging from 7.4 µg/L at GP-36 to 9,800 µg/L at MW-6S. Xylenes were also detected above the ground water standard of 5 µg/L in six of the samples obtained from this area with concentrations ranging from 24 µg/L at GP-28 to 390 µg/L in the duplicate sample from GP-25.

Area F

A total of nine ground water samples were obtained from the eight ground water sample locations in this area for VOC analysis. One sample location (GP-61) was dry at the time of sampling. As shown on Table 6-7, no VOCs were detected at concentrations above ground water standards in this area.

Area G

A total of 19 ground water samples were obtained from the 24 ground water sample locations in this area for VOC analysis. Six sample locations (GP-21, GP-48, GP-52, GP-55, GP-57, GP-58) were dry at the time of sampling. Detectable concentrations of VOCs were found in each of the samples collected from this area. As shown on Table 6-8, 23 VOC parameters were detected and 17 of those were detected at levels above the ground water standards. Of the 17 compounds detected above the ground water standards, eleven compounds were detected once above the applicable standard. Nine of those detections were from the same location.

TCE was detected above the ground water standard in 13 samples from this area ranging in concentration from 5.9 µg/L at MW-1 to 540B µg/L at GP-15. With the exception of a detection of 60,000 µg/L of cis-1,2-DCE at GP-16, Cis-1,2-DCE was detected above the ground water standard in 14 of the samples obtained from this area with concentrations ranging from 5 µg/L at GP-30 to 6,000 µg/L at GP-51. Vinyl chloride was detected above the ground water standard in 12 samples ranging in concentration from 5.2 µg/L at GP-23 to 51,000 µg/L at GP-16. Toluene was detected above the ground water standard in five samples from this area ranging in concentration from 7.4J µg/L at GP-29 to 570 µg/L at GP-51. Xylenes were also detected above the ground water standard of 5 µg/L in two of the samples obtained from this area with concentrations ranging from 89 µg/L at GP-56 to 140 µg/L at GP-51.

Area H

A total of 10 ground water samples were obtained from the five ground water sample locations in this area and VOC analysis. As shown in Table 6-9, no VOCs were detected above the ground water standard.

Based on the results of the ground water sampling activities conducted during the RI, the extent of the dissolved phase VOC contamination has been defined. Figure 6-3 illustrates the total concentration of VOCs detected in ground water at the site. As shown in Figure 6-3, very low or non-detectable concentrations of VOCs were detected in ground water samples obtained in Areas A, B, C, and F. In addition, no contaminants of concern were detected in any of the samples collected from the wells located on the south side of the Clyde River. Elevated concentrations of VOCs occur in the areas southwest and south of the manufacturing building, near the acid shed, the former acid tank, and the filled in portion of the former barge turnaround (i.e., Areas D, E and G). As shown on Figure 6-3, the highest VOC concentrations were detected in the vicinity of the former barge turnaround and its confluence with the Old Erie Canal.

As discussed above, the VOCs most often detected at the Site are cis-1,2-DCE and vinyl chloride. Given that cis-1,2-DCE and vinyl chloride are known biodegradation products of TCE, this data indicates that natural attenuation is actively occurring at the Site. In addition, the concentrations of these degradation products are typically much greater than those of TCE indicating that much of the parent product has already been biodegraded.

6.2.2. Semi-volatile organic compounds

A detailed summary of the SVOC analytical results can be found in Appendix G.

Area A, F, and G

A total of five ground water samples were obtained from these areas for SVOC analysis. No SVOCs were detected above ground water standards in the samples obtained from these areas.

Area B and D

A total of four samples were obtained from these areas for SVOC analysis. No SVOCs were detected in the samples collected from these areas with the exception of a very low level of di-n-butylphthalate in the samples obtained from EMW-5 and MW-1S (both well below the ground water standard).

Area C

A total of two samples were obtained from this area for SVOC analysis. No SVOCS were detected in the samples collected from this area with the exception of a low level of bis(2-Ethylhexyl) phthalate in the sample obtained from MW-9S (slightly above the ground water standard).

Area E

A total of seven samples were obtained from this area for SVOC analysis. With the exception of two compounds, no SVOCs were detected above the ground water standard. Low levels of 2,4-Dimethylphenol and phenol were detected in the sample obtained from MW-6S.

Area H

Ground water samples were not collected from this area for SVOC analysis.

6.2.3. Polychlorinated biphenyls

A total of 18 ground water samples were obtained from across the Site and submitted for PCB analysis. No PCBs were detected in any of the ground water samples collected from the Site. A detailed summary of the PCB analytical results can be found in Appendix G.

6.2.4. Pesticides

A total of 18 ground water samples were obtained from across the Site and submitted for Pesticide analysis. No Pesticides were detected in any of the ground water samples collected from the Site. A detailed summary of the pesticide analytical results can be found in Appendix G.

6.2.5. Inorganics

A detailed summary of the inorganics analytical results can be found in Appendix G.

Area A

A total of two samples were obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, concentrations of a variety of inorganics were found in the samples obtained from this area with three compounds exceeding the ground water standards. Iron was detected in MW-2S at a concentration of 683J µg/L. Manganese was detected in MW-2S at a concentration of 444J µg/L. Sodium was detected in both of the samples collected from this

area at concentrations of 43,300J µg/L at MW-2S and 138,000J µg/L at MW-2B.

Area B

A total of three samples were obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the samples obtained from this area with detections at concentrations below the ground water standards. Three compounds were detected at concentrations above the ground water standards. Iron was detected in all three samples collected from this area ranging in concentration from 1910J µg/L at EMW-3 to 14,700J µg/L at EMW-5. Manganese was detected in two samples obtained from this area at concentrations of 418J µg/L at EMW-5 and 462J µg/L at MW-3S. Sodium was detected in two samples obtained from this area at concentrations of 28,300J µg/L at EMW-3 and 57,000J µg/L at EMW-5.

Area C

A total of two samples were obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the samples obtained from this area with detections at concentrations below ground water standards. However, four compounds were detected at concentrations above the ground water standards. Antimony was detected slightly above the standard in the sample collected from MW-8S at a concentration of 3.6BJ µg/L. Iron was detected in MW-8S with at 466J µg/L and in MW-9S at 1320J µg/L. Manganese was detected in MW-9S with a concentration of 429J µg/L. Sodium was detected in MW-9S with at 56,300J µg/L and in MW-8S with at 215,000J µg/L.

Area D

One sample was obtained from this area for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the sample with detections at concentrations below ground water standards. However, two compounds were detected above the ground water standards. Manganese was detected in MW-1S at 1,980J µg/L. Sodium was detected in MW-1S at a concentration of 60,800J µg/L.

Area E

A total of seven samples were obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the samples at concentrations below ground water standards. However, four compounds were detected above ground water standards. Antimony was detected at the standard of 3B µg/L in MW-7S. Iron was detected in sample obtained from this area ranging in concentration from 653J µg/L in the duplicate sample

obtained from MW-4S to 59,500J µg/L at MW-6S. Manganese was detected above the ground water standard in five samples obtained from this area with concentrations ranging from 332J µg/L in EMW-4 to 2,800J µg/L in MW-6S. Sodium was detected above the ground water standard in six of the samples obtained from this area ranging in concentration from 34,100J in EMW-4 to 126,000J µg/L in the duplicate sample obtained from MW-4B.

Area F

A total of two samples were obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the samples with detections at concentrations below ground water standards. However, three compounds were detected above ground water standards. Iron was detected above the standard in both samples at 636J µg/L at MW-7B and 9110J µg/L at MW-5S. Manganese was detected in MW-5S at 3970J µg/L. Sodium was detected in MW-7B at 76,700J µg/L.

Area G

One ground water sample was obtained from this area and submitted for analysis of inorganic compounds. As shown in Appendix G, several inorganic compounds were detected in the sample at concentrations below ground water standards.

Area H

Ground water samples were not collected from this area for analysis of inorganic compounds.

6.2.6. Results of natural attenuation monitoring

As discussed in Section 6.2, the presence of high concentrations of bio-transformation-products, such as cis-1,2-DCE and vinyl chloride, is strong evidence that natural attenuation is actively occurring at the site. Natural attenuation refers to the physical, chemical, and/or biological processes that act to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and ground water. These processes may include dispersion, advection, sorption, and volatilization, and chemical and/or biological stabilization, transformation, or destruction of contaminants.

As presented in a USEPA document titled “Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water” (Wiedemeier, et. al., 1998), hydrogeologic and geochemical data can be used to indirectly demonstrate the types of natural attenuation processes occurring at a site. As such, the data collected during the RI has been evaluated to determine if the geochemical conditions at the Site are amenable to biodegradation.

The discussion presented below regarding the results of the natural attenuation monitoring data focuses on the data obtained from monitoring wells located in the vicinity of the Old Erie Canal and the former barge turnaround [(i.e., within the dissolved phase VOC plume) MW-1S, MW-4S, MW-4B, MW-6S, MW-7S, EMW-2 and EMW-4]. As can be expected, in the areas of the Site where no VOCs have been detected, natural attenuation of site-related VOCs is not expected to be taking place.

As discussed in Section 3.6, in addition to VOC analyses, the RI included laboratory analysis of geochemical parameters to evaluate natural attenuation. A detailed summary of the natural attenuation monitoring analytical results can be found in Appendix G.

Distribution of TCE and daughter products

Site data provides strong evidence supporting the natural attenuation of the VOC ground water plume. One piece of supporting evidence is the relationship between the distribution of TCE and its daughter products, which demonstrates the degradation of chlorinated VOCs.

Reductive dechlorination is the most common process by which chlorinated VOCs undergo biodegradation. During reductive dechlorination, the chlorinated organic compound acts as an electron acceptor, and a chlorine atom on the organic compound is removed and replaced with a hydrogen atom, which results in the reduction of the organic compound (Wiedemeier, et. al., 1999).

An idealized distribution of chlorinated VOCs undergoing biodegradation via reductive dechlorination would consist of concentrations of TCE highest in the source area, with elevated DCE concentrations (mainly cis-1,2-DCE) within the source and extending downgradient, and vinyl chloride present in the source with the highest concentrations near the downgradient extent of the plume (Wiedemeier, et. al., 1999).

The Site analytical data reveal that the distribution of TCE and its daughter products at the Site correlate well with a plume that is undergoing reductive dechlorination.

Table 6-10 summarizes this parent-daughter product relationship where parent compound concentrations are lower than the daughter product concentrations. As indicated on Table 6-10, TCE (parent compound) concentrations are generally much lower than the cis-1,2-DCE and vinyl chloride concentrations. With the exception of EMW-4, the cis-1,2-DCE concentrations are approximately 3 to 405 times higher than the concentrations of TCE. These relationships are indicative of reductive dechlorination of chlorinated VOCs.

Ethene and ethane are the final products in the series of reductive dechlorination reactions involving chlorinated ethenes and ethanes.

Ethene has been detected in samples obtained from five of the seven monitoring wells located in the VOC plume at concentrations up to 3100J µg/L at well MW-6S. Ethane has been detected in samples obtained from all seven of the monitoring wells located in the VOC plume at concentrations up to 1500J µg/L at well MW-6S.

The presence of ethene and ethane further indicates that reductive dechlorination is occurring. Based on the high concentrations of ethene detected at the Site, the rate of attenuation of vinyl chloride is high.

Electron donors and acceptors, and metabolic by-products

In conjunction with chlorinated VOC distribution within a plume, it is also necessary to evaluate the presence of other compounds that are used in biologically mediated processes that degrade chlorinated VOCs. These compounds include electron donors, electron acceptors, and metabolic by-products. Electron donors include anthropogenic carbon (i.e. fuel hydrocarbons) and naturally occurring dissolved organic carbon. Electron acceptors include dissolved oxygen, nitrate, ferric iron, and sulfate. Metabolic by-products can include ferrous iron, methane, chloride, nitrite, and sulfide (Wiedemeier, et. al., 1999).

From a thermodynamic perspective, microbial communities prefer to utilize electron acceptors in a sequential process during the degradation of chlorinated VOCs. This sequence involves the reduction of oxygen, followed by nitrate, then, depending on availability, reduction of either iron, manganese, or sulfate, and finally acetate is split to form methane.

The presence and/or absence of cofactors can be used as a screen to indicate conditions conducive to biodegradation. If cofactors are absent as a whole, this would indicate that biodegradation cannot take place or is severely inhibited. Changes in cofactors can be used as an indication that biodegradation is occurring and the degree to which it takes place. However, in the presence of high concentrations of cofactor and low levels of contaminant to be degraded, the absence of or a reduction of a cofactor does not necessarily indicate the absence of biodegradation.

Table 6-10, and the data presented in Appendix G, provide a summary of the concentrations for the electron donors, electron acceptors, and metabolic by-products sampled at the Site, and are discussed below.

Dissolved organic carbon

Dissolved organic carbon can act as an electron donor during reductive dechlorination of Chlorinated VOCs.

Fuel hydrocarbons (toluene and xylenes) have been detected at many sample locations at the Site. In addition, dissolved organic carbon has been detected at concentrations ranging from 2.0 to 37.7 mg/L, indicating that a sufficient supply of organic carbon is available to act as a source of electron donors during reductive dechlorination.

Dissolved oxygen

Dissolved oxygen is the favored electron acceptor used by microbes for degradation of natural and/or anthropogenic carbon. Strictly anaerobic microbes cannot function at dissolved oxygen concentrations greater than approximately 0.5 mg/L, and reductive dechlorination cannot occur (Wiedemeier, et. al., 1999).

The low concentrations (<1 mg/L) of dissolved oxygen in ground water samples obtained from within the dissolved phase VOC plume are indicative of an anaerobic environment. The conditions at the Site are anaerobic within the contaminant plume as well as at some of the locations outside of the plume. This indicates that ground water conditions at the Site are naturally anaerobic. Therefore, these naturally occurring anaerobic conditions are conducive to reductive dechlorination of chlorinated VOCs.

Nitrate

Subsequent to depletion of dissolved oxygen, nitrate may be used as an electron acceptor for anaerobic degradation of organic carbon via a metabolic process known as denitrification. In order for reductive dechlorination to occur, in addition to anaerobic conditions, nitrate concentrations in the contaminated portion of the aquifer must be depleted (less than 1 mg/L (Wiedemeier, et. al., 1998)).

Nitrate was not detected in the shallow or deep bedrock ground water at concentrations greater than 1 mg/L, with the exception of MW-9S at a concentration of 3.3 mg/L. The low concentrations of nitrate will not suppress the reductive dechlorination pathway of chlorinated VOCs.

Ferric iron (Fe(III))

Fe(III) may be used as an electron acceptor during anaerobic biodegradation of organic carbon via a metabolic process known as iron reduction. During iron reduction, Fe(III) is reduced to Fe(II). Biodegradation within a contaminant plume via Fe(III) reduction is evidenced by increasing concentrations of Fe(II) in the plume when compared to background concentrations (Wiedemeier, et. al., 1998).

Based on the total iron concentrations and Fe(II) field tests, with the exception of wells MW-6S, EMW-2 and EMW-4, the data suggests that the total iron concentrations are made up mainly of Fe(II). Elevated Fe(II) concentrations are indicative that anaerobic conditions exist across the Site.

Manganese (Mn IV)

When Mn(IV) is used as an electron acceptor during anaerobic biodegradation of organic carbon, Mn(IV) is reduced to Mn(II). Biodegradation within a contaminant plume via Mn(IV) reduction is evidenced by increasing concentrations of Mn(II) in the plume when compared to background concentrations (Wiedemeier, et. al., 1998).

Based on the total Mn concentrations detected in wells located within and outside of the VOC plume, it appears that total Mn concentrations are increasing in the plume when compared to background concentrations

Sulfate

Subsequent to depletion of dissolved oxygen and nitrate, sulfate may be used as an electron acceptor for anaerobic biodegradation via a metabolic process known as sulfate reduction, where sulfate is reduced to sulfide. Decreasing sulfate concentrations and increasing sulfide concentrations within a contaminant plume indicates sulfate reduction (Wiedemeier, et. al., 1998).

Sulfate was detected in ground water samples obtained at the Site at concentrations ranging from 1.7 mg/L at EMW-4 to 1750 mg/L at MW-11B. The Site sulfate data do not indicate decreases in sulfate concentrations within the Site contaminant plume as compared to background locations. However, the lack of apparent decreases in sulfate may be the result of the naturally high concentrations masking small decreases in sulfate concentrations and the overall variability in the sulfate concentration range.

Chloride

During anaerobic biodegradation of chlorinated VOCs, chloride is released into the ground water in stoichiometric amounts equivalent to the amount of chlorinated solvent degraded. This results in elevated chloride concentrations in a contaminant plume compared to background locations (Wiedemeier, et. al., 1998).

Chloride was detected in the overburden ground water underlying the Site at concentrations ranging between 2.4 mg/L and 329 mg/L. Chloride was detected in the bedrock ground water underlying the Site at concentrations ranging between 33.1 mg/L and 682 mg/L.

The Site chloride data do not indicate an increase in chloride concentrations within the site contaminant plume as compared to background locations. The lack of apparent increases is the result of the naturally high chloride concentrations and variabilities masking small increases in chloride concentrations in the contaminant plume.

Methane

Methane is a by-product of biodegradation of organic carbon. The presence of methane in ground water is indicative of strongly reducing conditions, and indicates that the ground water chemistry is favorable for reductive dechlorination (Wiedemeier, et. al., 1998).

Methane was detected in the site monitoring wells located within the VOC plume at concentrations ranging from 3.4 ug/L at MW-7S to 7000 ug/L at EMW-4. The presence of methane is indicative of conditions conducive to biodegradation.

Bioattenuation screening process

Further evidence for biodegradation was evaluated by completing the initial step of the bioattenuation screening process described in USEPA protocol Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (Wiedemeier, et. al., 1998).

This USEPA protocol describes the implementation of the screening process to provide an initial evaluation whether biodegradation may be occurring. The screening process involves awarding points based on concentrations of various analytical parameters. The degree of evidence for anaerobic degradation (reductive dechlorination) is based on the total points awarded after assigning points to site-specific data. Table 6-11 summarizes the point values for analytical and field parameters at the Site. Monitoring wells located within the VOC plume (MW-1S, MW-4S, MW-4B, MW-6S, MW-7S, EMW-2 and EMW-4) were used in the evaluation as these wells represent the extent of the ground water contaminant plume.

According to the screening process, scores between 0 and 5 indicate inadequate evidence for reductive dechlorination of chlorinated organic compounds. Scores between 6 and 14, 15 and 20, and greater than 20 indicate limited, adequate, and strong evidence of reductive dechlorination, respectively. The scoring totals ranged from 10 for MW-1S to 32 at EMW-4, indicating that there is limited to strong evidence for reductive dechlorination.

Based on the results of the evaluation presented above, there is strong evidence indicating natural processes are attenuating the VOC contaminant plume at the Site. The primary pathway for natural attenuation appears to be biodegradation. The biological processes involve the transformation of higher chlorinated organic compounds to less chlorinated organic compounds (daughter products) and ultimately to innocuous end products (e.g. ethane and ethene) via reductive dechlorination. In addition, physical processes including advection, dispersion, sorption, and volatilization may also be contributing to the overall attenuation.

Evidence of microbial mediated degradation is supported by the presence of both daughter products and end products. TCE concentrations at the Site are generally low in comparison to the concentrations of DCE and vinyl chloride and ethene and ethane are present in the groundwater within the contaminant plume.

Geochemical evidence that indicates subsurface conditions amenable for microbially mediated degradation include the following:

- An abundance of dissolved TOC that can be utilized as a carbon source (electron donor) by microbes.

- Depleted dissolved oxygen and nitrate levels and elevated ferrous iron concentrations, indicating that anaerobic conditions exist across the Site.
- The presence of methane, suggesting that highly reducing conditions are present, supportive of the reductive dechlorination of TCE and its daughter compounds to innocuous end products.

7. Nature and extent of constituents in surface water

7.1. General

The analytical results for surface water samples collected during the Old Erie Canal Site RI are presented in the following sections. Discussions of the analytical data are based on samples obtained during the initial sampling event performed in accordance with the NYSDEC-approved RI/FS Work Plan, as well as samples obtained during an additional phase of sampling.

As described in Section 3.9, eight surface water samples were collected on May 21, 2002 from eight locations (SW-01 through SW-05 and SW-07 through SW-09). One additional surface water sample, designated SW-06, was proposed to be collected from the wetland area located along the western side of the Site; however, the location was dry at the time of the sampling event. The surface water samples were submitted to STL for the following analyses:

- VOCs by USEPA SW-846 Method 8260B;
- SVOCs by USEPA SW-846 Method 8270C;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A;
- Pesticides by USEPA SW-846 Method 8081A;
- PCBs by USEPA SW-846 Method 8082; and
- pH by USEPA SW-846 Method 9045C.

Based on the analytical results from the May 2002 sampling event, surface water samples were collected from locations SW-5, SW-9, and from two additional down-stream surface water locations (SW-10 and outfall) on November 21, 2002 for laboratory analysis of VOCs. The supplemental surface water samples were submitted to STL for analysis of TCL VOCs via EPA SW-846 Method 8260B.

In total, 13 surface water samples were collected from ten sample locations as part of the Old Erie Canal Site RI. The results of the surface water quality analyses are presented in tabular form in Appendix J. Laboratory reporting forms from the surface water quality analyses are provided in Appendix K.

The remainder of this section presents the distribution of the constituent concentrations in surface water at the Site. As shown on Figure 7-1 and discussed below, the surface water sample locations have been organized into the same ground water management areas discussed in Section 6.0.

The analytical results for surface water samples are compared to Class C surface water standards (hereafter referred to as “surface water standards”). Standards for the detected constituents (that have standards) are as follows:

TCE	40 µg/L
Methylene chloride	200 µg/L
PCE	1 µg/L

Area B

As presented in the RI/FS Work Plan, to compare surface water conditions at and downgradient of the Site, two background/upgradient samples (SW-1 and SW-2) were obtained from the unfilled portion of the Old Erie Canal located east of the Site.

Area E

To assist in identifying the nature of the constituents which may be leaching out of the filled in portion of the Old Erie Canal, one sample was obtained at the western end of the 48-inch CMP (SW-3). To assist in identifying the nature of the constituents which may be leaching out of the old fill material in the former barge turnaround, sample locations SW-4, SW-6, SW-7, SW-8, and SW-9 were located along the western boundary of the Site, including two locations relatively close to catch basin CB-3 (SW-8 and SW-9).

Area F

To evaluate potential down-stream impact of Site-related constituents, sample location SW-5 was located in the stream within the Old Erie Canal, west of the confluence of the various streams that feed into that area.

Area H

To help delineate the extent of VOCs in surface water that may be Site-related, two surface water samples were collected down-stream of the Site. One sample location (SW-10) was collected within the former Barge Canal prior to where the surface water flow within the former Barge Canal combines with the storm water discharge from the Village of Clyde storm sewer system. A second surface water sample was collected from a location designated as Outfall. As shown on Figure 7-1, this sample is representative of the combined flow from former Barge

Canal and the storm water discharging from the Village of Clyde storm sewer system.

7.2. Distribution of constituents in surface water

7.2.1. Volatile organic compounds

Area B

Analysis of surface water samples collected at SW-1 and SW-2 showed that VOCs were detected at low concentrations. Low levels of acetone were detected at both locations. Low levels of cis-1,2-DCE and TCE were also detected at SW-1.

Area E

Analysis of the surface water sample obtained at SW-3 shows that low concentrations of VOCs were detected in the water discharging from the 48-inch CMP that runs through the filled in portion of the former Barge Canal. Low concentrations of 1,1-dichloroethene, cis-1,2-DCE, TCE, and vinyl chloride were detected.

Analysis of the surface water sample obtained from SW-7 shows that VOCs are detectable in the small stream that drains the wetland area located along the western side of the Site. Cis-1,2-DCE was detected at 100 µg/L. Low levels of methylene chloride and TCE were also detected.

Analysis of the surface water samples obtained from SW-8 and SW-9 show that TCE is detectable at both locations at concentrations above the surface water standard. As shown on Figure 7-1, these sample locations are located relatively close to catch basin CB-3 and the former septic tank. A low level of methylene chloride was detected. PCE was detected at an estimated concentration of 3.9J µg/L which is slightly above the surface water standard. Other VOCs detected at SW-8 include cis-1,2-DCE, trans-1,2-DCE and vinyl chloride.

Surface water sample location SW-9 was sampled twice during the RI. The results of sampling at SW-9 show that TCE was detected during both sampling events at concentrations of 75 and 120 µg/L. Methylene chloride was detected at a low level during the May 2002 sampling event. PCE was also detected during the May 2002 sampling event at an estimated concentration of 8.7J µg/L which is slightly above the surface water standard. Cis-1,2-DCE, and vinyl chloride were detected during both sampling events at maximum concentrations of 530 and 36 µg/L, respectively. Other VOCs detected were at low levels.

As a result of the TCE concentrations in the samples collected at SW-8 and SW-9 an expanded storm sewer evaluation was conducted and ultimately a storm sewer IRM was proposed and approved by NYSDEC. Additional details are included in Section 3.11.3.

Analysis of the surface water sample obtained from SW-4 shows that VOC concentrations in the stream within the Old Erie Canal, west of the confluence of the various streams which feed into that area, decrease due to the effects of dilution and volatilization. TCE was detected at SW-4 at a concentration below the surface water standard. Other VOCs were detected at SW-4 at low concentrations.

Area F

Analysis of the surface water sample obtained from SW-5 shows that VOC concentrations in the stream further downgradient of the Site persist at low concentrations. TCE and methylene chloride were detected at SW-5 at concentrations below the surface water standards. Cis-1,2-DCE and vinyl chloride were also detected at SW-5.

Area H

A total of two surface water samples were obtained from the two surface water sample locations in this area (SW-10 and Outfall). The surface water samples were collected as part of the additional sampling event. TCE was detected at SW-10 and the Outfall at levels below the surface water standard. Cis-1,2-DCE and vinyl chloride were also detected in surface water samples SW-10 and the Outfall.

7.2.2. Semi-volatile organic compounds

A detailed summary of the SVOC analytical results can be found in Appendix J.

Area B

The results of the analysis of surface water samples collected at locations SW-1 and SW-2 showed that no SVOCs were detected at SW-1 or in the field duplicate sample collected at SW-2. Very low levels of SVOCs were detected at SW-2.

Area E

Analysis of surface water samples SW-3 and SW-7 show that one SVOC was detected at a very low concentration at each location.

Analysis of the surface water sample SW-8 shows that various SVOCs were detected at low concentrations ranging from 0.6 to 6 µg/L. No SVOCs were detected at surface water sample location SW-9.

Analysis of the surface water sample SW-4 shows that low concentrations of various SVOCs were detected ranging from 4 to 8 µg/L.

Area F

Analysis of the surface water sample SW-5 shows that no SVOCs were detected.

7.2.3. Polychlorinated biphenyls

A total of nine surface water samples were obtained across the Site for PCB analysis. No PCBs were detected in any of the surface water samples collected from the Site. A detailed summary of the PCB analytical results can be found in Appendix J.

7.2.4. Pesticides

A total of nine surface water samples were obtained across the Site pesticide analysis. No Pesticides were detected in any of the surface water samples collected from the Site. A detailed summary of the analytical results can be found in Appendix J.

7.2.5. Inorganics

A total of nine surface water samples were obtained across the Site for analysis of inorganic compounds. As shown in Appendix J, concentrations of a variety of inorganic compounds were found in these samples. The surface water samples collected from hydraulically upgradient locations SW-1 and SW-2 were used to establish background conditions of the Old Erie Canal for each parameter, thus allowing evaluation of which inorganic compounds are detected at levels consistent with “background” concentrations for the area, and determination of indications that the chemical’s presence is related to activities at the Site.

In general, only surface water locations SW-4 and SW-8 exhibited elevated detections of inorganic compounds with respect to upgradient sample locations SW-1 and SW-2. A detailed summary of the analytical results of the sampling can be found in Appendix J.

8. Nature and extent of constituents in sediment and surface soil

8.1. General

The analytical results for sediment samples and a surface soil sample collected during the Old Erie Canal Site RI are presented in the following sections. Discussions of the analytical data are based on samples obtained during the initial sampling event performed in accordance with the NYSDEC-approved RI/FS Work Plan, as well as samples obtained during an additional phase of sampling.

As described in Section 3.10, ten sediment samples and one surface soil sample were obtained from ten sample locations on May 21, 2002. Based on the analytical results from the May 2002 sampling event, one additional sediment sample (SED-10) was obtained downgradient of the Site on November 21, 2002. All sediment samples and the surface soil sample collected were submitted to STL for the following analyses:

- VOCs by USEPA SW-846 Method 8260B;
- SVOCs by USEPA SW-846 Method 8270C;
- Total cyanide by USEPA SW-846 Method 9010B/9012A or 9014;
- TAL total metals by USEPA SW-846 Methods 6010B and 7470A;
- Pesticides by USEPA SW-846 Method 8081A;
- PCBs by USEPA SW-846 Method 8082; and
- pH by USEPA SW-846 Method 9045C.

During the process of data validation it was noted that the sediment samples contained a low percentage of solid material. This resulted in all analytical results for the sediment samples collected during the preliminary phase to be qualified estimated (J). This does not affect the use of these results.

The results of the sediment and surface soil quality analyses are presented in tabular form in Appendix L. Laboratory reporting forms from the sediment and surface soil quality analyses are provided in Appendix M.

To facilitate the following discussions, the sediment and surface soil results will be discussed based on the areas that were described in Section 7.0 Nature and Extent of Constituents in Surface Water. As

discussed below, sediment and surface soil samples were obtained from the following areas:

Area B

To compare sediment conditions at and downgradient of the Site, two background/upgradient samples (SED-1 and SED-2) were obtained from the unfilled portion of the Old Erie Canal located east of the Site. The sediment samples collected from upstream locations SED-1 and SED-2, were used to establish background conditions of the Old Erie Canal for each parameter. Chemicals detected at levels that are consistent with “background” concentrations for the area show no indications that the chemical’s presence is related to activities at the Site.

Area C

One surface soil sample was obtained from the adjacent property to the west of the Site.

Area E

One sample was obtained at the western end of the 48-inch CMP (SED-3). Sample locations SED-4, SED-6, SED-7, SED-8, and SED-9 were located along the western boundary of the Site, including two locations relatively close to catch basin CB-3 (SED-8 and SED-9).

Area F

Sample location SED-5 was located in the stream within the Old Erie Canal, west of the confluence of the various streams that feed into that area.

Area H

Sample location SED-10 was located within the former Barge Canal prior to where the surface water flow within the former Barge Canal combines with the storm water discharge from the Village of Clyde storm sewer system.

8.2. Distribution of constituents in sediment and surface soil

8.2.1. Volatile organic compounds

The results of the VOC sediment and surface soil analyses are presented in Appendix L.

Area B

A total of three sediment samples were obtained from sediment sample locations SED-1 and SED-2 and submitted for VOCs analysis. These

samples include a blind duplicate sample collected from sediment sample location SED-2. VOCs were not detected in the upgradient sediment samples.

Area C

One surface soil sample was obtained from the adjacent property to the west of the Site. Analysis of the surface soil sample (SS-1) indicates that no VOCs are present in the surface soil confirming that no Site-related constituents have impacted the adjacent residential property.

Area E

Analysis of the sediment sample obtained from sediment sample location SED-3 indicates that low concentrations of VOCs were detected in the sediment in the area where water discharges from the 48-inch CMP that runs through the filled in portion of the former Barge Canal. Consistent with the surface water sample from this location, very low concentrations of 1,1-dichloroethene, cis-1,2-DCE, and vinyl chloride were detected.

Analysis of the sediment sample obtained from SED-4 shows that VOC concentrations in the sediment within the Old Erie Canal, west of the confluence of the various streams which feed into that area, decrease consistent with decreases in VOC concentrations in surface water in this area. Cis-1,2-DCE, TCE, and vinyl chloride were detected at estimated concentrations of 42J µg/kg, 17J µg/kg, and 6J µg/kg, respectively.

Analysis of the sediment samples obtained from SED-6 and SED-7 show that cis-1,2-DCE is detectable at low levels in SED-6 and SED-7 at a concentration of 15J and 28J µg/kg, respectively. TCE was detected at a concentration of 7J µg/kg. No other VOCs were detected in the samples from this area.

Analysis of the sediment samples obtained from SED-8 and SED-9 indicate that VOCs were detected in sediment in the vicinity of catch basin CB-3 and in the vicinity of the former septic tank. The results of sampling at SED-8 show that cis-1,2-DCE and TCE were detected at estimated concentrations of 990J µg/kg and 230J µg/kg, respectively. Other VOCs detected include trans-1,2-DCE and PCE, vinyl chloride, 1,1-DCA, and 1,1,1-TCA. The results of sampling at SED-9 show that cis-1,2-DCE, TCE, and vinyl chloride were detected at estimated concentration of 1000J µg/kg, 80J µg/kg, and 120J µg/kg, respectively. Lower levels of other VOCs detected at SED-9 include trans-1,2-DCE, PCE, carbon disulfide, and 1,1-DCA.

Area F

Analysis of the sediment sample obtained from SED-5 shows that concentrations of cis-1,2-DCE were detected in the sediment further

downgradient of the Site. Cis-1,2-DCE was detected at an estimated concentration of 37J µg/kg. No other VOCs were detected in SED-5.

Area H

Analysis of the sediment sample obtained from SED-10 shows that concentrations of VOCs were detected in the sediment further downgradient of the Site. Acetone and Cis-1,2-DCE, were detected at 41 µg/kg and 44 µg/kg, respectively. Low levels of TCE and vinyl chloride were also detected.

8.2.2. Semi-Volatile organic compounds

A detailed summary of the SVOC analytical results can be found in Appendix L.

Area B

Concentrations of a variety of SVOCs were found in upgradient sample locations SED-1 and SED-2; PAHs were the most commonly detected constituents with concentrations ranging from 640J µg/kg to 35,000J µg/kg. In addition, bis(2-Ethylhexyl)phthalate was detected in each of these samples ranging in concentration from 3,300J µg/kg in sediment sample SED-2 to 5,600J µg/kg in sample SED-1. The presence of PAHs in Site background sediment indicates that PAHs are ubiquitous in the environment and not associated with Site activities.

Area C

Concentrations of a variety of SVOCs were found in surface soil sample SS-1; PAHs were the most commonly detected constituents with concentrations ranging from 38J µg/kg to 110J µg/kg. In addition, bis(2-Ethylhexyl)phthalate was detected at a concentration of 130J µg/kg and Di-n-butylphthalate was detected at a concentration of 28J µg/kg.

Areas E, F and H

Analysis of the sediment samples obtained from SED-3, SED-4, SED-5, SED-6, SED-7, SED-8, SED-9, and SED-10 show that, consistent with Site background sediment samples, PAHs were the most commonly detected constituents with concentrations ranging from 270J µg/kg to 230,000J µg/kg. In addition, bis(2-Ethylhexyl)phthalate was detected at concentrations ranging from 880J µg/kg to 8,800J µg/kg. SVOCs detected at SED-5 were lower than those found in other sediment samples collected from Area E

8.2.3. Polychlorinated biphenyls

A total of 11 sediment samples and one surface soil sample were obtained from the Site for PCB analysis. A detailed summary of the analytical results of the sampling can be found in Appendix L.

Areas B and C

No PCBs were detected in sediment samples SED-1, SED-2, SED-3, the field duplicate sample obtained from SED-2 or in the surface soil sample SS-1.

Areas E, F and

Aroclor 1260 was detected in sediment samples SED-4, SED-5, SED-6, SED-7, SED-8, and SED-9 ranging in concentration from 64 ug/kg in sediment sample SED-5 to 540 ug/kg in sediment sample SED-8.

Area H

Aroclor 1254 was detected in sediment sample SED-10 collected as part of the additional sampling event at 180 ug/kg.

8.2.4. Pesticides

A total of 11 sediment samples and one surface soil sample were obtained from the Site for pesticide analysis. A detailed summary of the analytical results of the sampling can be found in Appendix L.

Areas B and F

No pesticides were detected in sediment samples SED-1, SED-2, the field duplicate sample obtained from SED-2 or SED-5.

Area C

Pesticides were detected in the surface soil sample SS-1. 4,4'DDD, 4,4'DDE, and 4,4'-DDT were detected in surface soil sample SS-1 ranging in concentration from 370 ug/kg to 2,100 ug/kg.

Areas E

In Area E, pesticides were only detected in sediment sample SED-3. 4,4'DDD, 4,4'DDE, and 4,4'-DDT were detected in sediment sample SED-3 ranging in concentration from 58 ug/kg to 70 ug/kg.

Area H

Pesticides were detected in sediment sample SED-10. 4,4'DDE was detected in sediment sample SED-10 at a concentration of 32 ug/kg.

8.2.5. Inorganics

A total of 11 sediment samples and one surface soil sample were obtained from the Site for analysis of inorganic compounds. Concentrations of a variety of inorganic compounds were found in the samples. Consistent with other media at the Site, compounds with the most significant detections are aluminum, iron, and magnesium. Concentrations of aluminum range from 1,610 ug/kg in SED-1 to 14,400 ug/kg in SED-6. Concentrations of iron range from 7,830 ug/kg in SS-1 to 119,000 ug/kg in SED-4. Concentrations of magnesium range from 1,040 ug/kg in SS-1 to 18,700 ug/kg in SED-9. A detailed summary of the analytical results of the sampling can be found in Appendix L.

9. Nature and extent of constituents in subsurface soil

9.1 General

The analytical results for the subsurface soil samples collected during the Old Erie Canal Site RI are presented in the following sections. Discussions of the analytical data are based on samples obtained during the preliminary screening program performed in accordance with the NYSDEC-approved RI/FS Work Plan.

In total, nine subsurface soil samples were obtained from eight sample locations during the preliminary screening program conducted between April 22 and May 2, 2002. As described in Section 3.4.2, subsurface soil samples were obtained from a combination of background locations and suspected source areas. For the purposes of this sampling activity, suspected source areas were defined as being locations where soil samples exhibited visual contamination (e.g., oils and/or sheens) or elevated concentrations of VOCs as indicated by field screening observations (e.g., PID measurements greater than 50 ppm).

To facilitate the following discussions, the subsurface soil samples will be discussed based on the areas that were described in Section 6.0 Nature and Extent of Constituents in Ground Water. In Section 6.0 the Site was organized into separate areas based on historical Site use, geologic, and hydrogeologic setting, as illustrated in Figure 6-1. As discussed below, subsurface soil samples were obtained from Area A (background locations), Area B (southeast of barge turnaround), Area E (barge turnaround) and from Area G (between the barge turnaround and manufacturing building). For a more detailed description of each of these areas please refer to Section 6.0 Nature and Extent of Constituents in Ground Water.

Area A

One subsurface soil sample was obtained from this area. Subsurface soil sample SS-GP-7-S-1 (S-1) was obtained at location GP-7 from a depth of 0.0 to 4.0 feet bgs.

Area B

One subsurface soil sample was obtained from this area. Subsurface soil sample SS-39-S-2 (S-2) was obtained at location GP-39 from a depth of 8.0 to 12.0 feet bgs.

Area E

A total of six subsurface soil samples were obtained from the five subsurface soil sample locations in this area. These samples include SS-GP-20-S-3 (S-3) collected at location GP-20 at a depth of 12 to 16 feet bgs and a duplicate from this location (S-3 Dup), SS-GP-26-S-4 (S-4) collected from GP-26 from a depth of 12 to 14 feet bgs, SS-GP-33-S-5 (S-5) collected from GP-33 from a depth of 12 to 16 feet bgs, SS-GP-32-S-6 (S-6) collected from GP-32 from a depth of 12 to 16 feet bgs, SS-GP-25-S-7 (S-7) collected from GP-25 from a depth of 8 to 12 feet bgs.

Area G

One subsurface soil sample was obtained from this area. Subsurface soil sample SS-GP-16-S-9 (S-9) was obtained at location GP-16 from a depth interval of 8.0 to 12.0 feet bgs.

The subsurface soil samples were analyzed for the full TCL/TAL list of parameters, which includes VOCs using USEPA SW-846 Method 8260B, SVOCs using USEPA SW-846 8270C, PCBs using USEPA SW-846 8082, Pesticides using USEPA SW-846 8081A, Metals using USEPA SW-846 6010B and 7470A, Cyanide using USEPA SW-846 9012A and pH with method 9045C.

The results of the subsurface soil quality analyses are presented in tabular form in Appendix N. Laboratory reporting forms from the subsurface soil quality analyses are provided in Appendix P.

The remainder of this section presents the distribution of the constituent concentrations in subsurface soil at the Site as well as a comparison of detected concentrations to recommended soil cleanup objectives found in NYSDEC Technical Assistance Guidance Memorandum (TAGM) #4046. Standards for the detected constituents (that have standards) are as follows:

TCE	700 ug/kg
Methylene chloride	100 ug/kg
Cis-1,2-DCE	250 ug/kg
4-methyl-2-pentanone	1000 ug/kg
Vinyl chloride	200 ug/kg
Benzo(a)pyrene	61 ug/kg
Dibenzo(a,h)anthracene	14 ug/kg
Dieldrin	44 ug/kg

9.2. Distribution of constituents in subsurface soils

9.2.1. Volatile organic compounds

A detailed summary of the VOC analytical results can be found in Appendix N.

Area A

Based on the results of subsurface soil sample SS-GP-7-S-1, no VOCs were detected within this area above the subsurface soil standards.

Area B

Based on the results of subsurface soil sample SS-39-S-2, no VOCs were detected in the sample obtained from this area.

Area E

Based on the results of the six subsurface soil samples obtained from this area, cis-1,2-DCE, methylene chloride, 4-methyl-2-pentanone, TCE and vinyl chloride were each detected at least once above the subsurface soil standards. No VOCs were found in sample S-4 above the subsurface soil standards. Cis-1,2-DCE was detected above the subsurface soil standards in samples S-3, S-5, S-6, S-7 and in the field duplicate sample S-3 Dup at concentrations ranging from 250 ug/kg in S-5 to 14,000 ug/kg in the duplicate sample. Methylene chloride was detected in samples S-5 and S-6 at concentrations of 200 and 180 ug/kg, respectively. 4-methyl-2-pentanone was detected in sample S-7 at 1,400 ug/kg. TCE was detected in sample S-7 at a concentration of 4,700 ug/kg. Vinyl chloride was detected in samples S-3, S-6 and the duplicate sample S-3 Dup with concentrations ranging from 200 ug/kg in sample S-6 to 1,200 ug/kg in the duplicate sample.

Area G

Based on the results of subsurface soil sample SS-GP-16-S-9, VOCs detected within this area include cis-1,2-DCE at a concentration of 1,400 ug/kg, and TCE at a concentration of 2,100 ug/kg. No other VOCs were detected in the sample obtained from this area.

9.2.2. Semi-volatile organic compounds

A detailed summary of the SVOC analytical results can be found in Appendix N.

Area A

As discussed above, the subsurface soil sample obtained from this area (S-1) represents Site background conditions and was collected from location GP-7 at a depth of 0.0 to 4.0 feet bgs. Concentrations of a variety of SVOCs were found in this sample. PAHs were the most commonly detected constituents and in some cases exceeded the subsurface soil standards with concentrations ranging from 260 ug/kg to 4,500 ug/kg. The presence of PAHs in Site background soils indicates that PAHs are ubiquitous in the environment and not associated with Site activities.

Area B

Based on the results of subsurface soil sample S-2 collected from GP-39, no SVOCs were detected in the sample obtained from this area.

Area E

Based on the results of the six subsurface soil samples obtained from this area, SVOCs were only detected above the subsurface soil standards in samples obtained from GP-20 (S-3 and the duplicate). Benzo(a)pyrene was detected in sample S-3 and in the duplicate sample from this location at 96 and 100 ug/kg, respectively. Dibenzo(a,h)anthracene was detected in sample S-3 and the duplicate at concentrations of 25 and 26 ug/kg, respectively. SVOCs detected in the remaining samples were either at the detection limits or well below the subsurface soil standards.

Area G

Based on the results of subsurface soil sample S-9 collected from GP-16, no SVOCs were detected within this sample above the subsurface soil standards.

9.2.3. Polychlorinated biphenyls

A total of nine subsurface soil samples were obtained from across the Site and submitted for PCB analysis. No PCBs were detected in any of the subsurface soil samples collected from the Site. A detailed summary of the PCB analytical results can be found in Appendix N.

9.2.4. Pesticides

A detailed summary of the pesticide analytical results can be found in Appendix N.

Area A

The results of the subsurface soil sample S-7 collected from GP-7 show that only one pesticide, Dieldrin, was detected within this area at a concentration above the subsurface soil standards at 130 ug/kg.

Areas B, E, and G

Pesticides were not detected above the subsurface soil standards in any of the samples obtained from these areas.

9.2.5. Inorganics

A total of nine subsurface soil samples were obtained from across the Site and submitted for analysis of inorganic compounds. Concentrations

of a variety of inorganic compounds were found in the samples obtained from the Site; however, none of the detections exceeded the subsurface soil standards. In the cases where the standard is Site background conditions, these results were compared to S-1 and S-2. In each case (with one exception) the detected concentrations across the Site are consistent with those found in background sample locations S-1 and S-2. The one exception is the detection of lead in sample S-7 from GP-25 at a depth of 8.0 to 12.0 feet. In this case, the lead detection is not within the same order of magnitude as the rest of the Site. A detailed summary of the analytical results of the sampling can be found in Appendix N.

10. Nature and extent of volatile organic compounds in storm water

10.1. General

As discussed in Section 3.11, storm water samples were collected from each of the two influent lines to catch basin CB-3 and the two upgradient manholes (i.e., MH-3A and MH-3B) for analysis of VOCs by USEPA Method 8260B. The analytical results for the storm water samples collected during the RI are presented in tabular form in Appendix P. Laboratory reporting forms from the storm water quality analyses are provided in Appendix Q.

Based on a review of the analytical results generated during the storm water sampling event, VOCs were detected in storm water discharging to catch basin CB-3. Manholes MH-3A and MH-3B are located along storm sewer Line 3. Surface drainage collected in catch basin CB-3E is conveyed through MH-3B and MH-3A to catch basin CB-3 through a 6-inch influent line where it discharges to the Old Erie Canal. The 8-inch influent line to CB-3 represents storm sewer Line 4.

The VOCs which have been identified in the storm water at the Site include 1,1,1 TCA, 1,1-DCA, TCE, cis and trans-1,2-DCE, vinyl chloride, methylene chloride, and PCE.

The highest VOC concentrations were located in manhole MH-3B where 82 ug/l of TCE, 920 ug/l of cis-1,2-DCE, 65 ug/l of vinyl chloride, and 69 ug/l of PCE were identified. VOC concentrations generally decreased downstream where 78 ug/l of TCE, 300 ug/l of cis-1,2-DCE, 2.1 ug/L of trans-1,2-DCE, 2J ug/L of 1,1,1-TCA, 20 ug/l of vinyl chloride, and 6.2 ug/l of PCE were identified

VOCs detected in the sample discharging from Line 4 to CB-3 include 50 ug/l of acetone, 160 ug/l of cis-1,2-DCE, 1.9 ug/L of methylene chloride, 12 ug/L of TCE and 47 ug/l of vinyl chloride.

Based on the results of the storm water sampling and the subsequent storm sewer evaluations, an IRM consisting of the in-place decommissioning of catch basins CB-3 and CB-3E, manholes MH-3A and MH-3B, storm sewer line 3 and storm sewer line 4 is anticipated to be completed in November 2003.

11. Risk assessment

11.1. General

This section presents the results of a qualitative human health risk assessment (HHRA) which was conducted in accordance with the NYSDEC-approved RI/FS Work Plan. The qualitative HHRA consists of an assessment of the exposure setting, an exposure pathway analysis, and a fate and transport evaluation for Site-related constituents detected in media at the Site.

The goal of the qualitative HHRA is to complete a conservative assessment to evaluate if complete exposure pathways exist at the Site between Site-related constituents and human receptors. The following USEPA documents were used as principal guidance in the preparation of the HHRA:

- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A) (RAGS) Interim Final, EPA/540/1089/002 (USEPA 1989).
- Guidance for Risk Characterization (USEPA 1995).
- Guidelines for Exposure Assessment. (USEPA 1992a.) 57 FR 104, May 29, 1992.

11.2. Methodology

A chemical substance may pose a risk to human health only if receptor populations have the potential to be exposed to the chemical substance in sufficient quantities to affect their health. As such, the HHRA involves the identification of chemical substances detected at the Site and, the evaluation of potential pathways to receptors.

The risk assessment process was conducted in the following phases:

1. Characterization of exposure setting. The first step in the assessment process was to characterize the Site with respect to its physical characteristics as well as those of the human populations at or near the Site. The output of this step was a qualitative evaluation of the Site and surrounding populations with respect to those characteristics that potentially influence exposure.

2. Constituent fate and transport analysis. The fate and transport analysis applies constituent and Site-specific considerations to evaluate the potential persistence and environmental transport of constituents detected at the Site. The information is used to identify and quantify potential Site-specific current and future human and ecological exposure point concentrations.
2. Exposure assessment. In the exposure assessment, the mechanisms by which human receptors may be exposed to constituents detected at or migrating from the Site are identified, and the concentrations of the constituents to which receptors may be exposed are estimated.
3. Conclusions. Summarizes the results of the qualitative human health risk assessment based on the current understanding of conditions at the Site.

11.3. Characterization of exposure setting

The key elements of the Site with respect to the human health considerations are summarized below.

11.3.1. Chemical and physical site characteristics

A brief description of the Site characteristics relevant to the human health risk assessment is presented below. A more detailed description of the characteristics is presented in Sections 4, 5, and 6 of this report.

Physical setting

The Old Erie Canal Site includes the southern and southwestern portions of property owned by Parker-Hannifin at 124 Columbia Street in the Village of Clyde, Town of Galen, Wayne County, New York. The Site includes portions of the Parker-Hannifin Property as well as portions of the abandoned Erie Canal, which is currently owned by the Village of Clyde. The Site is approximately 10.5 acres in size and is bounded to the north by Columbia Street, to the east by the P&C Grocery Store property, and to the west by private residential property(ies). An active rail line and the New York State Barge Canal border the Site to the south. The Parker-Hannifin Property is serviced by public water and sewer. In addition, as discussed in Section 3.2, public water and sewer is available to all residences and businesses within the Village of Clyde boundary and therefore within a one-half mile radius of the Site.

Site hydrogeology

A brief summary of the Site geology and hydrology is presented below. However, a detailed description of the Site hydrogeology is presented in Sections 4 and 5 of this report.

Geology

With the exception of fill, unconsolidated deposits of glacial origin overlie the bedrock throughout most of the Old Erie Canal Site. Three types of unconsolidated deposits have been identified at the Site. These include artificial fill material, glaciofluvial channel deposits, and glacial till.

The bedrock immediately underlying the unconsolidated deposits in the vicinity of the Site consists of shale and dolomitic limestone. Generally, the bedrock surface dips gently, with a fairly uniform gradient, from the northeast to the southwest.

Hydrogeology

Two hydrogeologic units have been identified at the Site, the shallow unconsolidated unit and the shallow bedrock unit. The majority of the shallow unconsolidated unit is hydraulically separated from the shallow bedrock unit by a low permeability, dense glacial till unit.

The shallow unconsolidated unit is composed of fill material and glaciofluvial deposits. The water table generally occurs in this hydrogeologic unit under unconfined conditions and is free to rise and fall in response to ground water recharge and discharge.

Ground water flow in the western and central portions of the Site is generally to the west toward the buried channel deposit and to the south toward the Clyde River. The channel located in the western portion of the Site appears to represent a local ground water drainage point where ground water flow paths converge from the east, north, and west. Once the ground water converges within the permeable channel deposits it generally flows south.

The shallow bedrock hydrogeologic unit at the Site consists of interbedded shale and limestone. In the portions of the Site where the glacial till unit is present, ground water in the shallow bedrock unit is observed under semi-confined conditions. Along the western portion of the Site where the glacial till unit is absent in the vicinity of the channel deposit, the shallow bedrock unit is observed under unconfined conditions.

Ground water flow within the shallow bedrock unit is generally to the southwest and occurs principally through secondary porosity features such as fractures, joints, and bedding planes.

Nature and extent of site-related chemical compounds

A brief description of the nature and extent of Site-related compounds relevant to the human health risk assessment is presented below. A more detailed description presented in Sections 6 through 10 of this report. Tables 11-1 through 11-6 present a summary of constituents detected in

storm water, surface water, sediment, subsurface soil, surface soil, and ground water at the Site during sampling events conducted in 2002.

Based on the land uses and related exposure scenarios expected to occur across the Site, for the purpose of the HHRA the Site will be addressed as three adjacent but discrete sub-areas. These land use/exposure scenario based sub-areas include: (1) industrial property, (2) the Old Erie Canal and Barge Turnaround, and (3) the Clyde River. These sub-areas and the nature and extent of Site related chemical compounds in each sub-area are briefly described below:

Parker-Hannifin's Property

Parker-Hannifin's Property is comprised of the land currently covered by pavement and buildings. This area is currently used by Parker-Hannifin for the manufacture, testing, and overhaul of military fuel injection nozzles. Parker-Hannifin employs approximately one hundred employees at the Property. There are no tenants or other users of the Industrial Property.

Parker-Hannifin's Property comprises the eastern portion of Area D and Area G as described in Section 6.1. Area D represents the area west of the manufacturing building and is hydraulically up gradient of the Barge Turnaround and represents the northern portion of the glaciofluvial channel deposit. Area G represents the area between barge turnaround and the manufacturing building and is hydraulically the up gradient portion of the Site. This portion of the Site includes an abundance of active and abandoned sanitary and storm sewer lines and is characterized as having a relatively limited saturated thickness.

As discussed in Sections 6 through 10, historical releases of chlorinated solvents at the Site have resulted in VOC contamination in subsurface soil, ground water, and storm water in the areas south and west of the manufacturing building.

Old Erie Canal and Barge Turnaround

This sub-area is defined as the segment of the Canal bordered to the north and east by Parker-Hannifin's Property and to the south by an active rail line and the Clyde River. This area is comprised of a swampy area associated with the former canal bed and the former barge turnaround. This section of the Site is undeveloped and does not contain any buildings or above-ground structures. However, construction and demolition debris associated with dumping by local contractors is visible at the land surface. Portions of the Old Erie Canal and former barge turnaround are underlain by the Village of Clyde's abandoned septic tank and associated sanitary sewer lines as well as storm sewer lines 3 and 4 that collect water from Parker-Hannifin's Property. Active railroad tracks are located at the southernmost boundary of this sub-area. Beyond the tracks the land slopes steeply downward into the Clyde River.

Historical releases of chlorinated solvents have resulted in VOC contamination in subsurface soil, ground water, and storm water in the area of the former barge turnaround and the portion of the Old Erie Canal immediately adjacent to the former barge turnaround.

Clyde River

The Clyde River is located south of the Old Erie Canal and Barge Turnaround area of the Site, south and downgradient from the railroad tracks.

In August and September 1994 surface water samples SW-4 and SW-5 were collected from the Barge Canal (Clyde River) and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. Only one VOC (2-butanone), which is unrelated to the Site, was detected in the surface water sample collected from location SW-4. Otherwise no VOCs, SVOCs, pesticides, or cyanide were detected in surface water samples SW-4 or SW-5.

Off-Site Residential Area

In addition to the three on-Site sub-areas identified above, the residential areas adjacent to the property are considered in the qualitative HHRA. Historically, chlorinated VOCs have been detected in off-Site residential areas. As discussed in Section 2.4.2, the NYSDOH has performed sampling and analysis on water samples obtained from ground water and residential basement sumps and on air samples collected from residential basements, living rooms, and outdoor (background) samples. The results of these analyses indicate that chlorinated VOCs were not detected in the residential well water sample collected from 30 Sibley Street located approximately 0.5 miles west of the Site, and from the basement sump of 176 Columbia Street located west of the Parker-Hannifin Property.

In addition, VOCs were not detected in six of the eight water samples collected from the basement sump of 170 Columbia Street, which is located immediately west of the Parker-Hannifin Property. Vinyl chloride and cis-1,2-dichloroethene were detected at concentrations below ground water standards. Various VOCs were detected in indoor air samples collected at 170 Columbia Street; however, NYSDOH concluded that the low concentrations of VOCs detected in the air samples were consistent with background conditions and were not attributable to the Site.

11.4. Constituent fate and transport

In this section, the potential for constituents to migrate from the source areas at the Site to receptors is evaluated, including a description of potential chemical migration pathways. The section is presented in two parts. First, a brief review of the general environmental fate of the selected constituents in soil and aquatic systems is reviewed and discussed. Following that, the general information is applied to Site-specific considerations to evaluate the potential environmental fate at the Site.

11.4.1. Constituent-specific considerations

The physical and chemical properties of a compound will influence the environmental fate and transport of that substance. Once released to the environment, constituents may migrate via several means (*i.e.*, volatilization, leaching, runoff, and food chain bioaccumulation). The physical and chemical properties of a constituent that influence how it will migrate in the environment include water solubility, volatility, persistence or half life, partition coefficients, etc. Each of these considerations is briefly discussed below for the Site-related constituents.

11.4.1.1. Inorganic constituents

The fate and transport of inorganic constituents is dependent on several factors, including concentration at the source, valence state, soil type, surface water chemistry, tendency to complex, presence of other constituents, and the media in the source area. This general discussion presents the chemical and physical processes, which control the environmental fate of metals and inorganic metal constituents.

Most elemental metals and inorganic metal constituents detected at Sites are naturally occurring in soil and water at various “background” concentration ranges, depending on Site specific geology, current and historical land use, and other factors. Many metals and inorganic metal constituents are natural constituents of soil, and many are also essential nutrients for flora and fauna.

Elemental and other inorganic forms or complexes of metals in fully mineralized states cannot be further degraded. Therefore, in contrast to organic constituents, inorganic metal constituents and elemental metals are relatively stable over time. Exceptions are certain metals such as elemental mercury and lead, which can be biomethylated when specific conditions exist. Metals can be detected in oxidized or reduced states, or complexed with organic or inorganic materials. Dissociated metal constituents (ionized) may undergo ion exchange in soil and water.

Metals tend to accumulate in soil and sediment, becoming relatively immobile. Metals in high concentrations at source areas may leach downgradient with soil moisture and washload, and can also vertically migrate through soil horizons. Since metals accumulate in sediment and soil, these media can become barriers or sinks that limit further migration. Metals in soil can be transported in air to downwind areas through dust generation and deposition. Dust suspension and deposition depends on precipitation, soil moisture, wind speeds, and amount and type of vegetation at the Site. Metals also have the potential to be absorbed from media by biota.

In surface and ground waters, concentrations of soluble and insoluble metal constituents will generally disperse (dilute) gradually downgradient from source areas. In lotic (flowing) surface water, elemental metals and metal constituents can disperse further downgradient from contaminant sources than in lentic water. Metals can also accumulate in the benthos of lakes, and in lentic areas of streams. In surface and ground waters, metal constituents in the form of soluble salts will generally dissociate to form metal ions. Insoluble salts tend to aggregate with other metals, or may bind with ligands and other organic constituents. Depending on valence state, metals in water may also chelate with inorganic chelating agents. The form of metal or metal constituent found in surface and ground water depends greatly on water chemistry, such as pH, hardness, and alkalinity, and on the presence of dissolved organic material. Reducing and acid conditions of water promote the solubility of many metals. In more common alkaline and oxidized surface and ground waters, many metal constituents are insoluble and form precipitates. Thus, under proper conditions, metals can concentrate in sediment and sorb to particulates in the water column.

Dissolved organic carbon (DOC) in water from humic materials, photosynthates, faunal excretions, and other detritus greatly affects the fate of metals. Water containing high concentrations of DOC can contain greater soluble quantities of metals, as compared to low DOC waters. In waters containing high DOC, trace levels of metals have been found to be less bioavailable, as compared to low DOC waters, thus lowering their relative toxicity. In contrast, acidified waters may contain greater quantities of metals in more ionized forms (soluble state), as opposed to neutral/alkaline waters.

11.4.1.2. VOCs

VOCs in the environment tend to be moderately mobile and persistent depending on the chemical/physical characteristics of the individual compound and environmental conditions. For example, most VOCs are not very persistent and bioaccumulative, but chlorinated VOCs such as those associated with historical disposal practices at the Site exhibit greater stability and therefore exhibit moderate environmental persistence and potential to bioaccumulate.

TCE is slightly soluble in water and can remain in ground water for a long time. However, it is very volatile and may rapidly evaporate from any media. TCE evaporates less easily from the soil than from surface water. Under certain conditions TCE may adhere to particles in soil and the water column and can therefore remain in the environment for longer periods of time.

1,2-DCE is volatile and therefore will evaporate rapidly into air when present in surface soil and/or surface water. Once in the air, it takes 5 to 12 days for half of it to break down (ATSDR 1997). 1,2-dichloroethene is soluble in water and mobile in the environment and can therefore move through soil or dissolve in water in the soil. If present in ground water, 1,2-DCE can break down in approximately 13 to 48 weeks. 1,2-DCE can break down into vinyl chloride. Vinyl chloride is volatile and therefore evaporates easily into the air.

TCE, 1,2-DCE and vinyl chloride, also have the ability to attenuate naturally. Natural attenuation refers to the physical, chemical, and/or biological processes that act to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and ground water. The physical processes include advection, dispersion, sorption, and volatilization. The biological processes involve the transformation of higher chlorinated organic compounds to less chlorinated organic compounds (daughter products) via reductive dechlorination.

Reductive dechlorination is the most common process by which chlorinated VOCs undergo biodegradation. During reductive dechlorination, the chlorinated organic compound acts as an electron acceptor, and a chlorine atom on the organic compound is removed and replaced with a hydrogen atom, which results in the reduction of the organic compound (Wiedemeier, et. al., 1999).

11.4.1.3. PAHs

PAHs in the environment tend to exhibit low water solubility, medium to low volatility, and a moderate to high tendency to adsorb to organic carbon. In soils, PAHs tend to adhere to particles; certain PAHs move through soil to contaminate ground water. Most PAHs in water do not exhibit high water solubility and therefore are likely to adhere to solid particles and settle out. Some PAHs readily evaporate into the air from soil or surface waters. PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks. Microorganisms can also metabolize and break down PAHs in soil or water over a period of weeks to months. PAHs can bioaccumulate in plants and animals.

The exact physical and chemical properties, and therefore environmental fate and transport, depend partially on the molecular weight of the PAH being considered. Lower molecular weight PAHs (such as naphthalene) tend to adsorb less strongly to organic matter in soil and thus tend to have greater vertical mobility in soils and a higher leaching potential. Low molecular weight PAHs can volatilize extensively from surface

soils. Low molecular weight PAHs have been shown to be transported to ground water from contaminated soils, as well as being transported laterally within aquifers. Desorption of PAHs also can occur from soils and sediment.

PAHs can undergo photooxidation and chemical oxidation in the atmosphere and water. The most important transformation mechanism for PAHs in soils is considered to be microbial degradation. The rate and extent of PAH biodegradation in the soil is affected by environmental factors, characteristics of the microbial population, and the physical and chemical properties of the PAH being considered. The rate of biodegradation may also be affected by other contaminants that may have been detected in the soils. There is potential for PAHs to degrade in all media and under aerobic and anaerobic conditions.

If transported to surface waters, PAHs can volatilize, but higher molecular weight PAHs tend to partition to sediments and DOC, and sorb to particulates in the water column. PAHs transported to ground waters will tend to sorb to particulates and partition to DOC. PAHs sorbed to soils can also be transported downwind through suspension and deposition of dust.

11.5. Exposure assessment

The next step of the qualitative HHRA is the exposure assessment. A qualitative exposure assessment consists of characterizing the exposure setting (including the physical environment and potentially exposed human populations), identifying exposure pathways, and evaluating contaminant fate and transport. A constituent may pose a risk to human health only if receptor populations have the potential to be exposed to the substance in sufficient quantities to adversely affect the health of exposed individuals. An exposure pathway describes the course a constituent takes from the point of release to the exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine human exposure.

An exposure pathway consists of the following four elements:

- A source and mechanism of chemical release. If the detected constituents are less than background, or no constituents of potential concern are identified, then there is no source of exposure, and therefore the pathway is incomplete.
- A retention or transport medium for the constituent once it has entered the environment.
- A point of potential human contact with the contaminated medium (referred to as the exposure point). If there are no human receptors

who may contact Site-related constituents, then the pathway is incomplete.

- An exposure route (*e.g.*, ingestion) at the contact point. The exposure route represents the mechanism by which human receptors may intake chemicals of potential concern (COPCs). For example, ingestion, dermal contact, inhalation are potential exposure routes.

A pathway is considered to be *complete* if all of the conditions listed above are satisfied for that pathway. If one or more of these conditions are not met, there is no physical means by which a receptor may be exposed to the Site-related constituents, and the pathway is classified as *incomplete*. Incomplete pathways are not considered further in the HHRA.

The exposure pathway analysis includes the following elements:

- *Comparison with Background:* The objective of this section is to identify constituents which occur at levels exceeding background concentrations, and therefore may be attributable to Site sources. Constituents that occur at levels less than or equal to background may not be related to the Site, and therefore are excluded from further evaluation.
- *Identification of Receptors:* Potential human receptors who may be active at the Site are identified and briefly described.
- *Exposure Pathway Analysis:* An exposure pathway analysis is conducted for each sub-area respectively. The exposure pathway analysis integrates information relating to potential sources, constituents, receptors, and exposure patterns to identify potentially *complete* and *incomplete* exposure pathways. Only complete pathways are evaluated further in the HHRA.

11.5.1. Comparison with background

According to USEPA guidance (USEPA 1989) inorganic constituents may be eliminated as COPCs if the detected concentrations are less than *naturally occurring* background concentrations. However, land use in the area has been associated with industrial use since the 1800's. This means that limited data are available by which to evaluate naturally occurring background levels in the Site vicinity. Therefore detected Site concentrations were compared with Site-specific background concentrations. It is recognized that these data potentially represent *anthropogenic* background rather than naturally occurring levels based on historical uses of the canal area.

Site-specific background was derived from surface water and sediment samples collected from upstream locations as shown on Figure 3-3.

Table 11-7 presents a comparison of Site surface soil samples collected from SS-01 to Site-specific background sample (GP-7/S-1). The background sample contained the interval from 0 – 4 feet below land surface, which is not restricted to the surface soil. However, since the surface soil interval was included, this comparison is presented for discussion purposes. Based on the interval of the background sample, and the limited number of samples available, COPCs were not excluded from consideration based on this comparison. As shown on Table 11-7, the organic constituents were detected at higher concentrations in the background sample than from the Site sample. This suggests that although the background sample may not be impacted by the Site, it may be impacted from other general urban/industrial sources in the vicinity. The Site sample contained higher concentrations of 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE than the background sample. Since this pesticide is not associated with the known historical operations at the Site, the source of these detected compounds is not clear. The sample collected from the Site contained detected concentrations of several inorganic constituents lower than the background sample (aluminum, barium, calcium, chromium, copper, iron, magnesium, nickel, potassium, silver, vanadium, and zinc). A few constituents detected at the Site were detected at concentrations near the background concentrations (arsenic and mercury). Antimony, beryllium, cadmium, cobalt, and silver were detected in the Site sample but not in the background sample.

Table 11-8 presents a summary of the minimum and maximum detected concentrations of constituents in surface water to the concentrations detected in Site-specific background samples. Due to the low number of Site-specific background samples collected, these comparison are presented but were not used to identify COPCs. The maximum detected concentrations of the inorganic constituents were higher in the Site samples than the background samples.

Table 11-9 presents a summary of the minimum and maximum detected concentrations of constituents in sediment to the concentrations detected in Site-specific background samples. Due to the low number of Site-specific background samples collected, these comparison are presented but were not used to identify COPCs. The maximum detected concentrations of the inorganic constituents were higher in the Site samples than the background samples.

11.5.2. Identification of potential human receptors

The following potential human receptor populations were identified relative to potential human exposures at the Site:

- Current and future Site industrial workers,
- Current and future utility workers,
- Current and future on-Site adolescent trespassers,

- Current and future adult and child recreators in the Old Erie Canal and former barge turnaround area,
- Current and future adult and child recreators on the Clyde River, and
- Current and future permanent residents in the immediate off-site, area.

Current Site conditions and land uses at the Site are consistent with the conditions and land uses described in the Work Plan. Each of these potential receptor populations is briefly described in this section.

11.5.2.1. Current and future industrial workers

Currently, there are active operations at the former manufacturing facility. Site employees could include manufacturing workers, contractors, office support, and security personnel. Employees at the Site do not perform maintenance activities on the sewer lines or the catch basin located beneath the Site.

Site workers do not routinely access the Old Erie Canal and Barge Turnaround portion of the Site. Their activities are largely limited to the Industrial Property.

Ground water at the Site is not currently used by the Site workers for industrial or potable applications. However, since there are no restrictions on the use of this ground water, it is possible that future workers could be directly exposed to constituents in the ground water.

Industrial workers may be indirectly exposed to constituents in ground water via vapor migration to indoor air in the on-Site buildings. Sufficient data were not available to exclude this pathway, so as a conservative measure it is considered a complete pathway.

11.5.2.2. Current and future maintenance workers

As discussed above, maintenance workers are not expected to come into contact with sediment or surface water in the Old Erie Canal and Barge Turnaround area or the Clyde River.

Current and future maintenance workers could be exposed to Site-related constituents in the industrial property area during maintenance and/or utility work. In addition, off-site employees of utility companies and railroad maintenance workers may also be active at the Site, both at the industrial property and the Old Erie Canal and barge turnaround area. For example, these areas are underlain by storm sewers and as noted on Figure 1-2, an active railroad track is located along the southern portion of the Site. Therefore current and future maintenance workers are considered to have a complete exposure pathway to Site-related constituents.

11.5.2.3. Current and future adolescent trespasser

The Site is not fenced and therefore access to the Site is not restricted. While it is unlikely that trespassers would access the industrial property, they have been observed at the Old Erie Canal and Barge Turnaround area. Therefore, as a conservative measure it is assumed that adolescent trespassers may access the Old Erie Canal and Barge Turnaround area on an intermittent basis. However, this section of the Site is not actively used for recreational purposes, and the generally low quality of the environment suggests that trespassers in this area would not be a persistent, pervasive situation.

11.5.2.4. Current and future adults and children recreators

Access to the Old Erie Canal and former barge turnaround area is not restricted. The section of the Site by the Old Erie Canal is currently used as a nature trail and dog walking area/path. Since these receptors have been observed in the area, contact with Site-related constituents in the Old Erie Canal area by adult and child recreators is considered a complete exposure pathway.

The section of the Clyde River adjacent to the Site is an active part of the canal system. Therefore as a conservative measure, adult and child recreational users of the Clyde River are identified as potential receptor populations. Fishing on the river is not restricted and there are no fish advisories in effect in this portion of the Clyde River, therefore the ingestion of fish by recreators will also be evaluated as a complete exposure pathway.

In August and September 1994 surface water samples SW-4 and SW-5 were collected from the Barge Canal (Clyde River) and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. Only one VOC (2-butanone), which is unrelated to the Site, was detected in the surface water sample collected from location SW-4. Otherwise no VOCs, SVOCs, pesticides, or cyanide was detected in surface water samples SW-4 or SW-5.

11.5.2.5. Current and future residents

Currently, residential properties are located adjacent to the Site. VOC constituents have historically been detected in residential basement sumps. The NYSDOH has performed several sampling events at residences of concern in the immediate area and concluded that there is no exposure to residents of VOC constituents detected in ground water. Both indoor air sampling and basement sump water sampling were performed over several years and conducted in different seasons to reach this conclusion. In accordance with NYSDOH conclusions, residential exposure to ground water constituents in indoor air and basement sump water is considered an incomplete pathway.

To assess if residents could be exposed to VOC constituents in ground water by direct contact, a search was performed by O'Brien & Gere to identify all residences and/or businesses located in the immediate vicinity of the Site that might not be connected to the Village of Clyde public water distribution system. O'Brien & Gere worked with the Village of Clyde water department personnel to verify that residences located within a one-half mile radius of the Site are connected to the Village of Clyde public water distribution system. Twenty-five houses within the Village of Clyde were identified as having private water wells. None of these residences are located within one-half mile of the Site and hydraulically downgradient. Based on these considerations, exposure to ground water by current residents in the adjacent is classified as incomplete.

There are no prohibitions on the installation of new residential wells within the Village of Clyde. Therefore exposure to ground water by future residents in the adjacent area is classified as complete.

11.6. Conclusions

This qualitative HHRA evaluates the potential sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure at the Site.

As described in Section 11.5, receptor populations and complete exposure routes exist for several human receptor populations. The conclusions of the qualitative HHRA are presented below.

Industrial Property

The portion of the Site identified as the industrial property has documented historical contamination in ground water, subsurface soil, and surface soil. This portion of the Site is currently used by Parker-Hannifin for manufacturing operations and therefore workers related to these operations could potentially be exposed to Site-related constituents. Current industrial workers may be exposed to constituents in ground water and subsurface soil via vapor migration to indoor air in the on-Site buildings. Since there are no statutory restrictions on ground water use at the Site, future industrial workers may have a complete exposure pathway to ground water used for industrial or potable applications at the facility.

Old Erie Canal and Barge Turnaround area

Site-related constituents have been detected in surface water, sediment, and subsurface soil samples collected from this area. This Old Erie Canal area is sometimes accessed by individuals using it as a nature trail

or dog walking path. Therefore, current and future adult and child recreators may have a complete exposure pathway to constituents detected in environmental media at this section of the Site.

The former barge turnaround area is not actively used and therefore most receptors would not be anticipated to access this area. As a conservative measure, it will be assumed that adolescent trespassers could access the area and therefore have a complete exposure pathway.

Since there are no prohibitions on utility work in this section of the Site, as a conservative measure it will be assumed that a utility or sewer maintenance worker could access the area and would therefore have a complete exposure pathway to Site-related constituents.

Clyde River

Based on the available surface water data, there are no Site-related constituents present in the Clyde River. Although human receptors could access the area, residential exposure to surface water of the Clyde River is considered an incomplete pathway.

Off-Site Residential Properties

Potentially complete exposure pathways were identified for future residents that may install potable wells in areas impacted by Site-related constituents.

Residential exposure to ground water constituents in indoor air and basement sump water is considered an incomplete pathway.

11.7. Fish and Wildlife Impact Analysis

In addition to the components of the qualitative HHRA discussed above, a Fish and Wildlife Impact Analysis (FWIA) was completed as a screening tool. The FWIA was conducted according to the NYSDEC document entitled *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC 1994; Guidance). Step I - *Site Description* and Step IIB – *Contaminant-Specific Impact Assessment* of the NYSDEC document is addressed in this report. The purpose of Step I of an FWIA is to characterize the physical and biological characteristics of a Site. The purpose of Step II is to determine the potential impacts of site-related constituents on fish and wildlife resources. The specific objectives of this FWIA are to:

- describe the ecology of the Site and surrounding environs within a half-mile radius of the Site (study area).
- describe fish and wildlife resources including observed vegetation and associated fauna for each cover type within the study area

- identify other natural resources such as NYSDEC significant habitats and endangered or threatened species
- qualitatively describe the value of the identified resources to associated wildlife and humans
- identify potentially complete pathways between site-related constituents and fish and wildlife resources
- compare site chemical data to applicable ecologically-based criteria or screening values.

The results of the FWIA are presented in Appendix R.

12. Summary and conclusions

The Old Erie Canal Site Remedial Investigation was conducted in accordance with Order-on-Consent #B8-0533-98-06. An RI/FS Work Plan, including a HASP, SAP, and CPP, was approved by the NYSDEC and was incorporated by reference into the Order-on-Consent. This RI was successful in defining the nature and extent of Site-related contamination which will allow for the development and evaluation of remedial alternatives during preparation of the Feasibility Study.

The scope of the RI was expanded several times during the course of the investigation. These additional activities included the following:

- Additional temporary soil borings/monitoring wells were installed during the preliminary screening program to better define the extent of VOC impacts and to characterize the nature and extent of the glacial till.
- Additional surface water and storm water samples were collected and an expanded storm sewer evaluation was conducted.
- Additional overburden and bedrock monitoring wells were installed to more fully characterize the nature and extent of subsurface impacts.
- An expanded hydrogeologic and groundwater investigation was conducted to more fully investigate the relationship between groundwater and surface water elevations and to verify the distribution of site related VOCs.

The remaining sections provide a brief summary of the results of this investigation, and the conclusions drawn from those results.

Site background, ownership and utilities

The Old Erie Canal Site is shown on Figure 2-1. The Site includes portions of the Parker-Hannifin property and the abandoned Erie Canal, which is currently owned by the Village of Clyde. The Site is approximately 10.5 acres in size and, as shown on Figure 2-2, is bounded to the north by Columbia Street, to the east by the P&C Grocery Store property, and to the west by private residential properties. An active rail line and the Barge Canal border the Site to the south.

Based on information obtained from the Office of Canals, the original Erie Canal became operational in 1825. The original Erie Canal was 40 feet wide and four feet deep. The canal was enlarged to a width of 70 feet and a depth of seven feet between 1836 and 1862. Based on survey maps dated 1862 the enlarged Erie Canal now included the barge

turnaround located in the southwestern portion of the Site. Between 1908 and 1917, construction of a new canal, which utilized a portion of the Clyde River was performed. At the conclusion of the navigation season in November 1917, the Old Erie Canal was formally abandoned. As shown on Figure 2-3, the portion of the Old Erie Canal located along the southern portion of Parker-Hannifin's property and the eastern portion of the former barge turnaround is currently owned by Parker-Hannifin. The western portion of the former barge turnaround and the portions of the Old Erie Canal located east and west of Parker-Hannifin's property are currently owned by the Village of Clyde.

The Property has been used for manufacturing operations since the early 1800's. Glass manufacturing dominated Site operations into the early 1930's. Based on a field survey conducted in 1932 for the preparation of Sanborn Fire Insurance maps, the Clyde Glass Works were abandoned and all but one building had been removed.

By 1941 the Property was reportedly purchased by Acme Electric. Acme Electric reportedly occupied the Property from 1941 to 1945 and produced transformers for the United States Navy. GE reportedly purchased the Property in 1945 and manufactured electrical equipment, including ballast for fluorescent lights, rectifiers, transistors, and diodes. In 1965 Parker-Hannifin reportedly purchased the Property from GE and initially manufactured components for automobile air conditioning systems. Parker-Hannifin's current operations include the manufacture, testing, and overhaul of fuel injection nozzles used in industrial and military operations.

Although the site has been used for manufacturing since the early 1800's, the existing manufacturing building was constructed in 1941. The manufacturing building has been expanded several times since its original construction and three additional buildings, including a concrete block building, a pole barn, and a small metal building are located along the western side of the property. The Property also contains a loading dock, several fenced storage tank areas and parking areas. In addition, the limits of the Property have been expanded since Parker-Hannifin's purchase from GE in 1965, and now include portions of the Old Erie Canal and former barge turnaround. The present structures at the Site are shown on Figure 2-4.

Originally both the storm and sanitary sewer systems discharged into an outfall structure located adjacent to the Old Erie Canal. Based on available maps, this portion was abandoned prior to September 1954. In the early 1950's a number of additional storm and sanitary sewer lines had been installed at the Property (see Figure 2-3). A 6-inch diameter sanitary sewer pipe extended from the eastern portion of the building to the west where it connected to the Village of Clyde's sanitary system. The Village's sanitary sewer system discharged into a septic tank, located within the former barge turnaround. The discharge from the septic tank was directed into catch basin CB-3 located in the unfilled portion of the Old Erie Canal, and ultimately into the Clyde River. Between 1968 and

1972 the Village of Clyde abandoned this septic tank and plugged the 10-inch outlet pipe discharging to catch basin CB-3.

After the demolition of the Village of Clyde's septic tank, Parker-Hannifin's sanitary sewer system was upgraded to connect to the new sanitary sewer system located along Columbia Street. The Site is currently serviced by the Village of Clyde's sanitary sewer system through pipes located both north and south of the building with several laterals feeding into them from the building.

The Site's storm sewer system is shown on Figure 2-3 and included three 6-inch vitreous clay pipes (VCPs) that extended south from the western end of the manufacturing building and discharged into a 500-gallon equalization basin. The equalization basin subsequently discharged into catch basin CB-3. Concurrent with an expansion to the southeastern portion of the building in 1971, Parker-Hannifin installed two PVC storm sewer pipes. These storm sewer pipes discharge south into the 48-inch corrugated metal pipe (CMP). Also during this time frame, Parker-Hannifin installed a catch basin near the present loading dock on the west end of the building which discharges to the surface as shown on Figure 2-3.

As of the date of this report, an IRM has been proposed and approved, that will address the discharge of VOC impacted groundwater to CB-3. The IRM will be completed in the fall of 2003. The IRM work plan specifies that all the lines leading into CB-3 will be plugged and abandoned in place, and surface run off will be directed towards the PVC storm sewer pipes installed in 1971.

The Village of Clyde also maintains a storm sewer system that is located just north of the manufacturing building along Columbia Street. This portion of the Villages' storm sewer system discharges to the Old Erie Canal approximately 530 feet west of catch basin CB-3.

In 1971 the Village of Clyde installed a 48-inch CMP traversing the southern portion of the property. The 48-inch CMP directs surface water from the eastern unfilled portion of the former canal through the filled in portion of the former canal bed and discharges into the unfilled portion of the former canal in the western portion of the Site.

Past waste disposal practices

Based on information reported in the Preliminary PSA Report (URS, 1991), the Old Erie Canal was reportedly used as a historical disposal location for spent solvents, acids, polychlorinated biphenyls (PCBs), and manufacturing wastes. According to the NYSDEC, wastes including trichloroethene (TCE), acetone, PCBs, phenol, arsenic, and cyanide were disposed of at the Site. Additionally, a shallow pit was reportedly utilized to dispose of solvents by either evaporation or burning. However, based on subsequent interviews of former Parker-Hannifin employees conducted by O'Brien & Gere during the RI, a shallow pit was never present in the southern portion of the site. It was reported that

there was a single occurrence when Parker-Hannifin employees burned used calibrating fluid on the ground in an area south of the southern parking lot. The burning of calibration fluid was discontinued on the same day following complaints from a local doctor and was never performed again.

Acids were reportedly treated to neutralize the pH of solutions and then disposed of in the former canal bed. Additional information suggests that a pH neutralization pit was located under the existing pole barn (Figure 2-4) and that the pit was later filled in with sand and covered with concrete (URS, 1995). Spent solvents and paint residues were also reportedly disposed of in a landfill area which was reportedly located west of the manufacturing building (URS, 1995).

Subsequent to the abandonment of the Old Erie Canal, throughout New York State, many sections of the abandoned canal have been filled in and/or used as historical disposal locations. In the Village of Clyde, portions of the former barge turnaround and the Old Erie Canal were used for the disposal of construction and demolition debris. In addition, based on a review of available data, the portion of the Old Erie Canal located along the southern section of Parker-Hannifin's property was filled in by Parker-Hannifin sometime between 1968 and 1979.

Previous Investigations

Surface water, surface soil/sediment, subsurface soil, and ground water samples were collected from the Site between July 1989 and December 1994 by NYSDEC as part of a PSA. The findings from these investigations are summarized in Section 2.4.2 and included in the Working Copy of the PSA Report (Preliminary PSA Report) dated January 1991 prepared by URS Consultants, Inc. (URS) and the Final Preliminary Site Assessment (PSA) Report dated September 1995, also prepared by URS. In general the findings within the Site are consistent with, and have been confirmed by, the results of the recent RI activities and therefore will not be reiterated here. The sampling of media on private residential properties, and within the Barge Canal, (Clyde River), are summarized below.

NYSDOH collected water samples from a residential well and residential basements several times between April 1989 and July 2002. The results of these analyses are summarized briefly as follows:

In April 1989, the NYSDOH collected a water sample for laboratory analysis from a residential well at 30 Sibley Street located approximately 0.5 miles west of the Site. Results of the NYSDOH's analyses indicate that no VOCs, SVOCs, pesticides or PCBs were detected in these samples. Total metals were detected in the residential well water sample.

In June 2002, NYSDOH collected a water sample from the basement sump of 176 Columbia Street located west of the manufacturing building, no VOCs were detected in this sample.

The NYSDOH collected water samples for VOC analysis from the basement sump of 170 Columbia Street located directly west of the manufacturing building on eight occasions between April 1989 and June 2002 (i.e., April 1989, July 12, 1995, March 25, 1996, October 1, 1996, November 4, 1996, September 23, 1997, March 27, 2000 and June 2, 2002). In total, chlorinated VOCs were not detected in six of the eight water samples. Vinyl chloride and cis-1,2-dichloroethene were detected during the March 1996 sampling event at concentrations of 0.5 µg/L, each, well below ground water standards. Based on these results, NYSDOH collected a water sample from the basement sump again in October 1996. The detected concentration of vinyl chloride (1.9 µg/L) and cis-1,2-dichloroethene (1.1 µg/L) prompted the agency to collect indoor air samples from the residence in November 1996. VOCs were not detected in the water sump samples collected in November 1996 in conjunction with the air samples. Various VOCs were detected in the indoor air samples; however, NYSDOH concluded that the low concentrations of VOCs detected in the air samples were consistent with background conditions and were not attributable to the Site.

Water samples were collected from the basement sump in September 1997, March 2000 and June 2002. No VOCs were detected in any of these samples.

In August and September 1994 surface water samples SW-4 and SW-5 were collected from the Barge Canal (Clyde River) and submitted for VOC, SVOC, pesticide, PCB, cyanide, and total metals analyses. Only one VOC (2-butanone), which is unrelated to the Site, was detected in the surface water sample collected from location SW-4. Otherwise no VOCs, SVOCs, pesticides, or cyanide was detected in surface water samples SW-4 or SW-5.

Public water connection verification program

A public water connection verification program was conducted during the late Spring and early Summer of 2002. The objective of the public water connection verification program was to identify residences and/or businesses located within a one half-mile radius of the Site that may not be serviced by the Village of Clyde's public water distribution system.

A total of 25 twenty-five properties within the Village Boundary were identified as having a water supply well on their property. Seven of the 25 are located within a one half-mile radius of the Site. Of the seven three rely on their well as a water supply source however all three are hydraulically up gradient of the site. The remaining four properties have both a well and public water supply servicing their property.

Based on discussions with Village of Clyde Water Department personnel, public water is available to all residences and businesses within the Village of Clyde boundary. However, outside of the Village boundary, public water is not available. Also, according to the Village of

Clyde Zoning department, if a property has a residential well they are not required to connect to the public water distribution system. However, if the property has a well and a public water connection, the well must be decommissioned.

As discussed above, the closest residential well to the Site is located at 30 Sibley Street, approximately 0.5 miles west of the Site. Results of the NYSDOH's analyses indicate that no VOCs, SVOCs, pesticides, or PCBs were detected in these samples.

Electromagnetic survey

On April 16 and 17, 2002, O'Brien & Gere performed a variable frequency electromagnetic (VFEM) survey using a GEM-300. The VFEM survey was conducted to evaluate whether the septic tank associated with the Village of Clyde's former sanitary sewer system was still present, so its location could be avoided during the subsequent soil boring program. Due to the large amounts of surface debris (i.e., concrete block and construction demolition debris) overlying the reported location of the septic tank, the results of the survey are inconclusive as to whether or not the septic tank has been removed from the Site.

The result of this survey did not reveal any anomalies that warranted additional investigation, and verified the location of several historic structures. Other items that can be observed include: several large positive anomalies that are attributed to surficial metallic objects and structures; the 48-inch corrugated metal pipe that conveys surface water beneath the southern portion of the Site; the outfall structure located in the Old Erie Canal abandoned prior to 1954; other anomalies likely associated with surficial debris. Contour maps representing the results of the VFEM survey are presented in Appendix A.

Remedial Investigation site characterization program.

With the overall objective of determining the nature and extent of contamination at the Site, a site characterization program was implemented at the site. The primary components of the site characterization program included a preliminary screening program, a drilling and well installation program, a storm sewer investigation and a soil and water sampling program that were performed in accordance with the approved work plans as described in Sections 3.4 through 3.12. The qualitative and quantitative data generated during the site characterization program have been integrated to form the basis for the development and evaluation of remedial alternatives during the FS. The results of the site characterization program are summarized in the remainder of this section. These results are presented in detail in Sections 4 through 11 of this RI Report.

Geology

The Old Erie Canal Site is located on the lake Ontario plain within the Finger Lakes physiographic region of New York State. This broad flat plain at the northern end of the Ontario basin is the result of the flat

underlying sedimentary rocks and the deposition of glacial deposits as the remnants of the Laurentide ice sheet retreated out of New York State about 10,000 years ago.

With the exception of fill, unconsolidated deposits of glacial origin overlie the bedrock throughout most of the Old Erie Canal Site. Three types of unconsolidated deposits have been identified at the Site. These include artificial fill material, glaciofluvial channel deposits, and glacial till. The unconsolidated deposits are underlain by shale and dolomitic limestones of the Syracuse-Camillus Formation.

Based on the soil borings conducted during the RI, the combined maximum thickness of the unconsolidated deposits is approximately 31 feet. The overburden is thickest in the southwestern portion of the site and is thinnest near the northeastern portion of the site. The overburden is contiguous across the site with no bedrock exposures.

The fill material observed throughout the majority of the Site is associated with historical landfilling, manufacturing operations at the Site, as well as the demolition of historical structures on the Property. The majority of fill exists in the filled in portion of the Old Erie Canal located along the southern boundary of Parker-Hannifin's property, in the eastern portion of the former barge turn around area, located southwest of the manufacturing building, and in the area surrounding the manufacturing building. The fill material appears to be absent in the area located along the western boundary of the Site.

Glaciofluvial channel deposits of varying composition were generally observed directly beneath the fill material. The glaciofluvial channel deposits are the result of a former glaciofluvial environment that scoured a channel into the glacial till unit, resulting in the deposition of glaciofluvial sand and gravel. The wetland conditions present along the western Site border were formed by deposition of silt and clay layers (i.e., backswamp deposits) due to periodic flooding of the Clyde River.

A glacial till unit is encountered across the majority of the site. The characteristics of the glacial till unit (e.g., hard, dry, dense, and friable) are indicative of Lodgment Till. Lodgment Till was deposited during the advancement of the glacial ice sheet, and compacted by the weight of the glacial ice mass.

The dense glacial till unit acts as an aquitard, or an underlying confining unit that hydraulically separates the fill and glaciofluvial units from the shallow bedrock unit. The glacial till unit appears to be absent beneath the glaciofluvial channel located along the western portion of the Site, but is observed again along the westernmost property boundary.

The bedrock immediately underlying the unconsolidated deposits in the vicinity of the Site consists of shale and dolomitic limestone. The depths to bedrock observed during the drilling program ranged from 16.5 to 31

feet bgs. Generally, the bedrock surface dips gently, with a fairly uniform gradient, from the northeast to the southwest.

Hydrogeology

A conceptual hydrogeologic model for the Site has been developed and includes two hydrogeologic units: the shallow unconsolidated unit and the shallow bedrock unit. The majority of the shallow unconsolidated unit is hydraulically separated from the shallow bedrock unit by a low permeability, dense glacial till unit.

The water table generally occurs in the shallow unconsolidated unit under unconfined conditions and is free to rise and fall in response to ground water recharge and discharge. With the exception of less permeable surface areas (e.g., parking lots, roads, and buildings), precipitation appears to result in uniformly distributed recharge to the shallow unconsolidated unit.

Ground water flow in the western and central portions of the Site is generally to the west toward the buried channel deposit and to the south toward the Clyde River. The permeable channel deposits appear to represent a local ground water drainage point where ground water flow paths converge from the east, north, and west. Once the ground water converges within the permeable channel deposits it generally flows south. However, ground water in the southeastern margin of the Site flows to the south-southwest toward the Clyde River and does not appear to be influenced by the buried channel.

In addition to naturally occurring variations in ground water elevations, the Site ground water system appears to be influenced by the operation of the New York State Canal system (Clyde River). In particular, during the navigation season, which commonly occurs from early May to early November, the gates at each of the Canal Locks are activated to allow for navigation of the Clyde River. During the navigation season, the water level upstream of Canal Lock 26 is maintained at an elevation of approximately 386 feet above mean sea level. During these periods of high surface water in the Clyde River, the hydraulic head in the Clyde River and the channel deposits is similar, resulting in a low ground water flow velocities in the channel deposits towards the river.

During the non-navigation season from November to early May, the gates are kept open at each of the locks and the surface water elevations are lowered. Surface water elevations during non-navigation season are variable due to seasonal variations in surface water flow in the Clyde River. During the periods of low surface water in the Clyde River, the hydraulic head in the Clyde River is lower than that in the channel deposits, resulting in a higher ground water flow velocities within the channel deposits towards the river. During the non-navigation season the average ground water velocity across the Site is nearly four times greater than during navigation season.

The shallow bedrock hydrogeologic unit at the Site consists of interbedded shale and limestone. In the portions of the Site where the glacial till unit is present, ground water in the shallow bedrock unit is observed under semi-confined conditions. Along the western portion of the Site where the glacial till unit is absent in the vicinity of the channel deposit, the shallow bedrock unit is observed under unconfined conditions.

In the areas north of the Clyde River, ground water flow within the shallow bedrock unit is generally to the southwest and occurs principally through secondary porosity features such as fractures, joints and bedding planes. South of the Clyde River, shallow bedrock ground water flow is generally to the northeast.

In the area north of the Clyde River, a downward vertical hydraulic gradient exists between the unconsolidated and shallow bedrock units at the site. The ground water elevation in the shallow bedrock unit is approximately 0.54 to 0.97 feet lower than the ground water elevation in the unconsolidated unit. South of the Clyde River, an upward vertical hydraulic gradient is observed between the unconsolidated and shallow bedrock hydrogeologic units. The ground water elevation in the shallow bedrock unit is approximately 3.7 to 4.6 feet higher than the ground water elevation in the unconsolidated unit.

The results of the hydraulic conductivity testing for the unconsolidated unit indicate that the overburden unit has a hydraulic conductivity that ranges from 1.15×10^{-4} cm/sec (0.33 ft/day) to 6.93×10^{-3} cm/sec (19.65 ft/day). The average hydraulic conductivity estimate for the unconsolidated hydrogeologic unit is 2.40×10^{-3} cm/sec (6.81 ft/day).

The horizontal hydraulic conductivity for the shallow bedrock at the site ranged from 3.00×10^{-4} cm/sec (0.85 ft/day) to 3.79×10^{-6} cm/sec (0.01 ft/day). The average hydraulic conductivity estimate for the shallow bedrock unit is 1.13×10^{-4} cm/sec (0.320 ft/day).

Nature and Extent of Contamination

VOCs are the dominant, if not the only, contaminants of concern at the Site based on analytical results for VOCs, SVOCs, pesticides, PCBs, cyanide, and metals data obtained during the RI.

The primary VOCs detected at the site are TCE and its degradation products (i.e., cis-1,2-DCE and vinyl chloride), toluene, and xylenes. Other VOCs detected during the RI were generally detected at the same locations as the primary VOCs and at lower concentrations. Elevated concentrations of VOCs occur in the areas southwest and south of the manufacturing building, and near the acid shed, the former acid tank, and the filled in portion of the former barge turnaround. The lateral migration of VOCs from these areas appears to be controlled by the surface topography of the glacial till unit. As shown on Figure 6-2, most of the

VOC contamination is limited to the vicinity of the former barge turnaround and its confluence with the Old Erie Canal. No contaminants of concern were detected in any of the samples collected from the wells installed on the south side of the Barge Canal.

Constituents in ground water

Based on the results of ground water samples collected from fifty-two of the sixty-one temporary well points, sixteen overburden monitoring wells, and six bedrock monitoring wells sampled as part of the RI, VOCs are the dominant, if not the only, contaminants of concern in ground water at the Site.

No pesticides or PCBs were detected in any of the ground water samples collected from the Site. With the exception of detections of bis(2-Ethylhexyl) phthalate, 2,4-Dimethylphenol, and phenol, no SVOCs were detected at concentrations above the Class GA ground water standard. Bis(2-Ethylhexyl) phthalate was detected at a concentration of 9J µg/L in the sample obtained from MW-9S, slightly above the Class GA ground water standard of 5 µg/L. 2,4-Dimethylphenol and phenol were detected in the sample obtained from MW-6S at concentrations of 3J µg/L and 5J µg/L, respectively, each slightly above the Class GA ground water standard of 1 µg/L.

Concentrations of a variety of inorganics were found in the samples obtained at the site. Antimony, iron, manganese and sodium were the only inorganic compounds detected above their respective Class GA ground water standards. The highest concentrations of antimony and sodium were detected at monitoring well MW-8S, which is located north of the site along Columbia Street. The highest concentrations of iron were found at well MW-6S, which is located in the filled in portion of the barge turnaround and the highest concentrations of manganese were detected at well MW-5S.

The concentrations of VOCs in the shallow bedrock ground water are the greatest at well location MW-4B. The source of the VOCs to shallow bedrock ground water appears to be from the areas where the glacial till unit is absent beneath the glaciofluvial channel located along the western portion of the Site.

Based on the results of the evaluation presented in Section 6.2.6, there is strong evidence indicating natural processes are attenuating the VOC contaminant plume at the Site. The primary pathway for natural attenuation appears to be biodegradation. The biological processes involve the transformation of higher chlorinated organic compounds to less chlorinated organic compounds (daughter products) and ultimately to innocuous end products (e.g. ethane and ethene) via reductive dechlorination. In addition, physical processes including advection, dispersion, sorption, and volatilization may also be contributing to the overall attenuation.

Evidence of microbial mediated degradation is supported by the presence of both daughter products and end products. TCE concentrations at the Site are generally low in comparison to the concentrations of DCE and vinyl chloride and ethene and ethane are present in the groundwater within the contaminant plume.

Geochemical evidence that indicates subsurface conditions amenable for microbially mediated degradation include the following:

- An abundance of dissolved TOC that can be utilized as a carbon source (electron donor) by microbes.
- Depleted dissolved oxygen and nitrate levels and elevated ferrous iron concentrations, indicating that anaerobic conditions exist across the Site.
- The presence of methane, suggesting that highly reducing conditions are present, supportive of the reductive dechlorination of TCE and its daughter compounds to innocuous end products.

VOCs in storm water

Storm water sampling conducted at the Site indicates that VOCs were detected in storm water discharging to catch basin CB-3. Samples were collected from each of the two influent lines to catch basin CB-3 and the two upgradient manholes (i.e., MH-3A and MH-3B) located along storm sewer Line 3. Storm sewer Line 3 discharges to catch basin CB-3 through a 6-inch influent line. Storm sewer Line 4 discharges to catch basin CB-3 through an 8-inch influent line.

The highest VOC concentrations were located in manhole MH-3B and generally decreased downstream towards catch basin CB-3. VOCs were also detected in the sample discharging from Line 4 to CB-3. As discussed above, a storm water IRM has been proposed and approved, that will address the discharge of VOC impacted groundwater to CB-3.

Constituents in surface water

With respect to surface water, the Old Erie Canal flows from east (upgradient of the Site) to west through the southern portion of Parker-Hannifin's property. Baseflow in the Old Erie Canal is derived from ground water discharge during wet portions of the year and discharge from storm drains within the Village of Clyde and the Parker-Hannifin property. Surface water flow ultimately discharges to the Barge Canal approximately 530 feet west of catch basin CB-3.

As discussed in Section 7, surface water samples were collected from two locations upgradient of the Site and from seven locations downgradient of the Site. The results of these analyses generally

confirmed prior analytical results that indicated multiple VOCs, SVOCs, and total metals in the surface water samples collected from the western end of the Old Erie Canal. However, similar to ground water at the Site, VOCs are the dominant, if not the only, contaminants of concern in surface water at the Site.

Analysis of the surface water samples indicates that the only VOCs detected above the standards for Class C surface waters were PCE and TCE at locations SW-8 and SW-9. As discussed previously, these two sample locations are located near catch basin CB-3 which receives VOC impacted ground water via storm drain Lines 3 and 4.

Consistent with the results for ground water at the Site, no PCBs, cyanide, or pesticides were detected in any of the surface water samples collected from the Site.

As discussed in Section 7.2.2, with the exception of low concentrations of Benzo(a)anthracene, Benzo(a)pyrene and pyrene, no SVOCs were detected above the standards for Class C surface waters. Benzo(a)pyrene was detected at estimated concentrations of 0.7J, 4J and 2J ug/L at surface water sample locations SW-2, SW-4 and SW-8, respectively. Benzo(a)anthracene was detected at an estimated concentration of 1J ug/L at SW-8 and pyrene was detected at an estimated concentration of 6 ug/L at location SW-4.

Concentrations of a variety of inorganic compounds were found in surface water at the Site. The surface water samples collected from hydraulically upgradient locations SW-1 and SW-2 were used to establish background conditions of the Old Erie Canal for each parameter, thus allowing us to evaluate which inorganic compounds are present at levels which are consistent with “background” concentrations for the area and determine if there are indications that the chemical’s presence is related to activities at the Site.

In general, only surface water locations SW-4 and SW-8 exhibited elevated detections of inorganic compounds with respect to upgradient sample locations SW-1 and SW-2.

Constituents in sediment and surface soil

In total, eleven sediment samples and one surface soil sample were collected from eleven sample locations as part of the Old Erie Canal Site RI. The sediment samples collected from upstream locations SED-1 and SED-2, were used to establish background conditions of the Old Erie Canal for each parameter. Chemicals detected at levels which are consistent with “background” concentrations for the area indicate that there are no indications that the chemical’s presence is related to activities at the Site.

One surface soil sample was obtained from the adjacent residential property to the west of the Site. Analysis of the surface soil sample (SS-1) indicates that no VOCs are present in the surface soil.

No VOCs were detected in the upgradient sediment sample locations SED-1 and SED-2.

VOCs are detectable in the sediment sample locations downgradient of the Site in the Old Erie Canal. One or more of the primary VOCs (i.e., cis-1,2-DCE, TCE and vinyl chloride) are detectable in the Old Erie Canal west of the Site. At sample locations SED-8 and SED-9, elevated concentrations of other VOCs were detected at lower concentrations than the primary VOCs discussed above.

Concentrations of a variety of SVOCs were found in surface soil sample SS-1; PAHs were the most commonly detected constituents with concentrations ranging from 38J µg/kg to 110J µg/kg. In addition, bis(2-Ethylhexyl)phthalate was detected at a concentration of 130J µg/kg and Di-n-butylphthalate was detected at a concentration of 28J µg/kg.

Concentrations of a variety of SVOCs were found in the samples obtained from upgradient sample locations SED-1 and SED-2; again PAHs were the most commonly detected constituents. The presence of PAHs in Site background sediment indicates that PAHs are ubiquitous in the environment and not associated with Site activities.

Analysis of the sediment sample obtained from sediment sample location downgradient of the Site indicate that, consistent with Site background sediment samples, PAHs were the most commonly detected constituents. The maximum concentrations of SVOCs were generally detected at sediment sample locations SED-8 and SED-9. With the exception of two compounds at SED-3 and one compound at SED-6, the concentrations of SVOCs at sediment sample locations SED-3, SED-5, SED-6, and SED-10 were all lower than the SVOC concentrations detected at background sample locations SED-1 and SED-2.

A total of eleven sediment samples and one surface soil sample were obtained from the Site and submitted for PCB analysis. Aroclor 1260 was detected in sediment samples SED-4, SED-5, SED-6, SED-7, SED-8, and SED-9 ranging in concentration from a low of 64 ug/kg in sediment sample SED-5 to a high of 540 ug/kg in sediment sample SED-8. Aroclor 1254 was detected in sediment sample SED-10 collected as part of the additional sampling event at a concentration of 180 ug/kg. No PCBs were detected in sediment samples SED-1, SED-2, SED-3, or in the field duplicate sample obtained from SED-2. PCBs were also not detected in surface soil sample SS-1.

A total of eleven sediment samples and one surface soil sample were obtained from the Site and submitted for Pesticide analysis. Pesticides were not found in the majority of the samples collected; pesticides were detected in sediment samples SED-3 and SED-10 as well as in the

surface soil sample SS-1. 4,4'DDD, 4,4'DDE, and 4,4'-DDT were detected in sediment sample SED-3 ranging in concentration from 58 ug/kg to 70 ug/kg. 4,4'DDE was detected in sediment sample SED-10 at a concentration of 32 ug/kg. 4,4'DDD, 4,4'DDE, and 4,4'-DDT were detected in surface soil sample SS-1 ranging in concentration from 370 ug/kg to 2,100 ug/kg.

A total of eleven sediment samples and one surface soil sample were obtained from the Site and submitted for analysis of inorganic compounds. Concentrations of a variety of inorganic compounds were found in the samples obtained from the Site. Consistent with other media at the Site compounds with the most significant detections are aluminum, iron, and magnesium.

Constituents in subsurface soils

In total, nine subsurface soil samples were obtained from eight sample locations. Subsurface soil samples were obtained from a combination of background locations and suspected source areas.

As discussed above, VOCs are the dominant, if not the only, contaminants of concern in subsurface soils at the Site. Elevated concentrations of VOCs occur in the areas west, and south of the manufacturing building and near the filled in portion of the former barge turnaround. The highest concentrations of VOCs occur in the vicinity of the former barge turnaround and the area in the vicinity of the former barge turnaround and its confluence with the Old Erie Canal. Cis-1,2-DCE, methylene chloride, 4-methyl-2-pentanone, TCE, and vinyl chloride were each detected at least once above the NYSDEC TAGM #4046 standards in samples obtained from locations SS-GP-20-S-3, SS-GP-33-S-5, SS-GP-32-S-6, SS-GP-25-S-7, SS-GP-16-S-9 and in the field duplicate sample from GP-20(S-3 Dup). No VOCs were detected above the NYSDEC TAGM #4046 standards at subsurface soil sample locations SS-GP-7-S-1, SS-39-S-2 and S-4.

As discussed previously, the subsurface soil sample location GP-7 represents Site background conditions. Concentrations of a variety of SVOCs were found in this sample. PAHs were the most commonly detected constituents and in some cases exceeded the NYSDEC TAGM #4046 standards with concentrations ranging from 260 ug/kg to 4,500 ug/kg. The presence of PAHs in Site background soils indicates that PAHs are ubiquitous in the environment and not associated with Site activities. With the exception of sample location GP-20 (S-3 and the duplicate), SVOC concentrations in the soil samples obtained at the Site were all non-detect at the detection limits or well below the NYSDEC TAGM #4046.

With the exception of one pesticide, Dieldrin, which was detected at background sample location GP-7 at a concentration above the NYSDEC TAGM #4046 standard, no PCBs or pesticides were detected in any of the subsurface soil samples collected from the Site.

Concentrations of a variety of inorganic compounds were found in the samples obtained from the Site however, none of the detections exceeded the NYSDEC TAGM #4046 standards. In the cases where the NYSDEC TAGM #4046 standard is Site background conditions, these results were compared to S-1 and S-2 in order to gain an understanding of Site conditions. With one exception, the detected concentrations across the Site are consistent with those found in background sample locations S-1 and S-2. The one exception is the detection of lead in sample S-7 from GP-25 at a depth of 8.0 to 12.0 feet; in this case the lead detection is not within the same order of magnitude as the rest of the Site.

Risk assessment

Human Health Risk Assessment

The qualitative HHRA evaluated the potential sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure at the Site. As described in Section 11.5, receptor populations and complete exposure routes exist for several human receptor populations.

The portion of the Site identified as the industrial property has documented historical contamination in ground water, subsurface soil, and surface soil. This portion of the Site is currently used by Parker-Hannifin for manufacturing operations and therefore workers related to these operations could potentially be exposed to Site-related constituents. Current industrial workers may be exposed to constituents in ground water and subsurface soil via vapor migration to indoor air in the on-Site buildings. Since there are no restrictions on ground water use at the Site, future industrial workers may have a complete exposure pathway to ground water used for industrial or potable applications at the facility.

Site-related constituents have been detected in surface water, sediment, and subsurface soil samples collected from the Old Erie Canal area. This area is sometimes accessed by individuals using it as a nature trail or dog walking path. Therefore, current and future adult and child recreators may have a complete exposure pathway to constituents detected in environmental media at this section of the Site.

The former barge turnaround area is not actively used and therefore most receptors would not be anticipated to access this area. As a conservative measure, it will be assumed that adolescent trespassers could access the area and therefore have a complete exposure pathway.

Since there are no prohibitions on utility work in this section of the Site, as a conservative measure it will be assumed that a utility or sewer maintenance worker could access the area and would therefore have a complete exposure pathway to Site-related constituents.

Based on the available surface water data, which indicates that there are no Site-related constituents present in the Clyde River, residential exposure to surface water of the Clyde River is considered an incomplete pathway.

Residential exposure to ground water constituents in indoor air and basement sump water is considered an incomplete pathway. However, potentially complete exposure pathways may be possible if future residents in the area of the Site install potable wells.

Fish and Wildlife Impact Analysis

This FWIA evaluated the physical and biological characteristics and potential ecological receptors at the Old Erie Canal Site in Clyde, New York. Step IIB of the FWIA Guidance was performed for this assessment. The results and conclusions of this assessment are presented below.

Site

- The terrestrial portion of the Site is developed with buildings, asphalt, and/or maintained lawns, which prevent or limit use by transient or residential wildlife species. In addition, the active rail line located along the southern portion of the Site further limits use of the Site by transient or residential wildlife species. Ecological receptors are unlikely to utilize the terrestrial portions of the Site due to the lack of and/or poor quality habitat.
- A palustrine habitat, the former Barge Canal turnaround, exists at the western border of the Site. This *Phragmites*-dominated area provides limited habitat for foraging and resting for terrestrial and semi-aquatic receptors. There are no state-regulated wetlands or NWI wetland habitats on the Site. Aquatic areas do not exist on-site.

Study Area

- The terrestrial areas within the Study Area consist of a mixture of natural communities, agricultural fields, and areas exhibiting urban/suburban land use. The northern portion of the Study Area is developed and consists of residential and light commercial areas which prevent or limit use by transient or residential wildlife species.
- The southern portion of the Study Area consists largely of cropland, which provides little fish and wildlife resource value. The cropland areas are interspersed with natural covertypes including successional northern hardwood forests, freshwater wetland, and open water areas that provide appropriate habitat for a variety of fish and wildlife species.

- The Clyde River/Barge Canal dissects the center of the Study Area and likely contains appropriate habitat for a variety of small mammal, avian, reptilian, amphibian and fish species. There are no state-regulated wetlands or NWI wetland habitats in the Study Area.
- The USFWS has indicated that no Federally-listed or proposed endangered or threatened species are known to exist in the Study Area.

Resource Area

- Based on the available mapping, several state-regulated wetlands and NWI wetland habitats are located within two miles of the site.
- The NYNHP has identified a significant natural community located approximately one mile west of the site. This community includes various wetland habitats associated with the floodplain of the Clyde River upstream of the site.

Chemical Constituents

Concentrations of chemical constituents in Site media (surface soil, surface water, and sediment) were detected above conservative, ecologically-based criteria and/or screening values. Based on the data collected during the RI, and the initial screening of that data using applicable criteria, sufficient information is available to proceed to the Feasibility Study.

13. Recommendations

Based on the results of the RI, there is sufficient information to develop a Feasibility Study of remedial alternatives. The Feasibility Study should be conducted to evaluate remedial alternatives that address contamination on a Site wide basis, such that a cost-effective remedy can be proposed for the Site, which is protective of human health and the environment and meets applicable regulatory requirements.

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Tables

Table 3-1
Summary of Residences with
Private Wells on Their Property

Parcel Address	Parcel ID	Village and/or Well	Located Within One Half-Mile Radius of the Site
165 Elm	42112-10-260575	Well	Yes
21 John	42112-9-180578	Well	Yes
30 Sibley	42112-13-074410	Well	Yes
211 West Genesee	42112-09-014501	Village and Well	Yes
206 West Genesee	42112-13-018472	Village and Well	Yes
137 Caroline	42112-13-221488	Village and Well	Yes
89 Duncan	42112-9-072606	Village and Well	Yes
206 East Genesee	42112-19-563141	Well	No
224 East Genesee	42112-19-634090	Well	No
230 East Genesee	42112-19-636051	Well	No
15 Burton	42112-10-302619	Well	No
25 Burton	42112-10-299646	Well	No
40 Meadow	42112-18-405179	Well	No
50 Burrell	42112-18-460060	Well	No
18 New	42112-18-468098	Well	No
22 New	42112-18-445091	Well	No
208 Lock	42112-10-320627	Well	No
6 Gravel	42112-18-380168	Village and Well	No
122 Mill	42112-18-292021	Village and Well	No
36 New	42112-18-432081	Village and Well	No
153 Cayuga	42112-18-337008	Village and Well	No
99 Sodus	42112-10-389570	Village and Well	No
232 East Genesee	42112-19-641042	Village and Well	No
38 East Dezens	42112-14-428440	Village and Well	No
104 East Dezens	42112-15-520409	Village and Well	No

TABLE 3-2
DIRECT PUSH BORING SUMMARY

Old Erie Canal Site
Clyde, New York

Boring No.	Date Completed	Ground Elevation	Total Depth of Boring	End of Boring Elevation	Depth To Glacial Till	Top of Glacial Till Elevation	Depth To Bedrock	Top of Bedrock Elevation
GP-1	04/24/02	397.6	6.5	391.1	5.0	392.6	---	---
GP-2	04/24/02	397.7	6.5	391.2	6.3	391.5	---	---
GP-3	04/24/02	397.7	4.0	393.7	3.5	394.2	---	---
GP-4	04/23/02	391.7	18.0	373.7	17.0	374.7	---	---
GP-5	04/24/02	393.7	8.0	385.7	7.0	386.7	---	---
GP-6	04/24/02	396.2	6.0	390.2	5.0	391.2	---	---
GP-7	04/24/02	397.9	4.0	393.9	3.5	394.4	---	---
GP-8	04/23/02	389.5	10.5	379.0	9.8	379.7	---	---
GP-9	04/25/02	395.6	9.0	386.6	6.0	389.6	---	---
GP-10	04/23/02	389.7	18.5	371.2	17.5	372.2	---	---
GP-11	04/26/02	390.5	10.0	380.5	7.5	383.0	---	---
GP-12	04/25/02	396.0	11.0	385.0	7.0	389.0	---	---
GP-13	04/29/02	389.3	20.0	369.3	---	---	19.0	370.3
GP-14	04/25/02	394.6	13.5	381.1	10.5	384.1	---	---
GP-15	04/24/02	396.8	11.0	385.8	7.0	389.8	---	---
GP-16	04/24/02	398.2	12.0	386.2	7.8	390.4	---	---
GP-17	04/24/02	398.0	4.0	394.0	3.5	394.5	---	---
GP-18	04/23/02	391.1	13.0	378.1	12.0	379.1	---	---
GP-19	04/29/02	389.3	20.0	369.3	15.5	373.8	19.0	370.3
GP-20	05/01/02	395.0	16.0	379.0	15.0	380.0	---	---
GP-21	04/25/02	397.4	10.5	386.9	6.0	391.4	---	---
GP-22	04/24/02	397.8	4.0	393.8	3.8	394.0	---	---
GP-23	04/24/02	398.1	8.0	390.1	7.0	391.1	---	---
GP-24	04/23/02	393.7	20.0	373.7	19.0	374.7	---	---
GP-25	04/26/02	389.2	22.0	367.2	---	---	21.0	368.2
GP-26	04/26/02	395.4	16.0	379.4	13.0	382.4	---	---
GP-27	04/25/02	396.6	10.0	386.6	6.5	390.1	---	---
GP-28	04/30/02	394.2	24.0	370.2	22.5	371.7	---	---
GP-29	04/25/02	395.8	12.0	383.8	9.5	386.3	---	---
GP-30	04/25/02	396.9	8.0	388.9	3.7	393.2	---	---
GP-31	04/23/02	394.9	17.0	377.9	16.5	378.4	---	---
GP-32	04/23/02	389.4	22.0	367.4	21.5	367.9	---	---
GP-33	04/30/02	394.4	16.0	378.4	15.0	379.4	---	---
GP-34	05/01/02	395.2	29.2	366.0	---	---	29.2	366.0
GP-35	05/22/02	393.3	11.0	382.3	10.0	383.3	---	---

Notes:

1. All depths in feet below ground surface
2. All elevations in feet above mean sea level.

TABLE 3-2
DIRECT PUSH BORING SUMMARY

Old Erie Canal Site
Clyde, New York

Boring No.	Date Completed	Ground Elevation	Total Depth of Boring	End of Boring Elevation	Depth To Glacial Till	Top of Glacial Till Elevation	Depth To Bedrock	Top of Bedrock Elevation
GP-36	04/22/02	393.2	24.0	369.2	23.0	370.2	---	---
GP-37	04/22/02	393.8	20.0	373.8	16.5	377.3	---	---
GP-38	04/22/02	394.1	12.0	382.1	11.0	383.1	---	---
GP-39	04/22/02	393.5	12.0	381.5	10.2	383.3	---	---
GP-40	05/01/02	398.2	7.0	391.2	3.0	395.2	---	---
GP-41	05/01/02	398.1	4.0	394.1	2.0	396.1	---	---
GP-42	05/01/02	391.8	20.0	371.8	17.0	374.8	---	---
GP-43	05/02/02	391.0	20.5	370.5	---	---	20.5	370.5
GP-44	05/02/02	395.4	8.0	387.4	3.0	392.4	---	---
GP-45	11/19/02	398.0	9.0	389.0	8.6	389.4	---	---
GP-46	11/19/02	398.1	8.5	389.6	8.5	389.6	---	---
GP-47	11/19/02	398.5	5.0	393.5	4.6	393.9	---	---
GP-48	11/20/02	396.2	10.2	386.0	6.5	389.7	---	---
GP-49	11/19/02	397.9	10.5	387.4	5.0	392.9	---	---
GP-50	11/19/02	398.3	6.0	392.3	6.0	392.3	---	---
GP-51	11/20/02	396.2	10.1	386.1	8.0	388.2	---	---
GP-52	11/19/02	397.9	10.5	387.4	4.0	393.9	---	---
GP-53	11/19/02	398.1	7.0	391.1	7.0	391.1	---	---
GP-54	11/19/02	398.0	6.0	392.0	6.0	392.0	---	---
GP-55	11/19/02	398.1	8.2	389.9	4.7	393.4	---	---
GP-56	11/20/02	396.2	12.6	383.6	9.5	386.7	---	---
GP-57	11/20/02	397.7	6.0	391.7	4.0	393.7	---	---
GP-58	11/20/02	398.2	7.5	390.7	5.2	393.0	---	---
GP-59	11/20/02	393.1	10.0	383.1	8.0	385.1	---	---
GP-60	11/20/02	393.3	17.0	376.3	16.8	376.5	---	---
GP-61	11/20/02	393.7	11.5	382.2	6.0	387.7	---	---

Notes:

1. All depths in feet below ground surface
2. All elevations in feet above mean sea level.

TABLE 3-3
MONITORING WELL CONSTRUCTION DETAILS

Old Erie Canal Site
Clyde, New York

Well No.	Date Completed	Measuring Point Elevation	Ground Elevation	Screen Depth		Screen Elevation		Sand Pack Depth		Sand Pack Elevation	
				Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
MW-1S	30-May-02	394.16	394.6	2.3	7.3	392.3	387.3	2.1	8.0	392.5	386.6
MW-2S	21-May-02	397.91	398.5	1.6	11.6	396.9	386.9	1.6	11.7	396.9	386.8
MW-2B	29-May-02	398.08	398.4	18.5	28.5	379.9	369.9	16.0	28.5	382.4	369.9
MW-3S	21-May-02	393.64	394.0	1.3	11.3	392.7	382.7	1.3	11.5	392.7	382.5
MW-4S	22-May-02	393.02	393.3	10.3	20.3	383.0	373.0	8.3	20.3	385.0	373.0
MW-4B	28-May-02	392.97	393.3	28.9	38.9	364.4	354.4	26.9	38.9	366.4	354.4
MW-5S	21-May-02	392.86	393.1	1.2	11.2	391.9	381.9	1.1	38.9	392.0	354.2
MW-6S	30-May-02	394.66	395.0	5.0	15.0	390.0	380.0	3.0	15.0	392.0	380.0
MW-7S	24-May-02	396.92	394.9	6.5	16.5	388.4	378.4	5.0	17.5	389.9	377.4
MW-7B	28-May-02	399.10	397.4	28.9	38.9	368.5	358.5	26.9	38.9	370.5	358.5
MW-8S	29-May-02	389.91	390.3	11.5	12.0	378.8	378.3	10.0	22.0	380.3	368.3
MW-9S	22-May-02	391.39	391.8	7.4	17.4	384.4	374.4	5.4	17.5	386.4	374.3
MW-10B	25-Nov-02	390.99	391.2	32.7	42.7	358.5	348.5	30.2	42.7	361.0	348.5
MW-11S	20-Nov-02	390.04	390.4	5.0	12.0	385.4	378.4	4.0	12.0	386.4	378.4
MW-11B	25-Nov-02	389.75	389.8	34.0	44.0	355.8	345.8	31.0	44.0	358.8	345.8
MW-12S	22-Nov-02	390.43	391.1	5.0	10.0	386.1	381.1	4.0	10.0	387.1	381.1
MW-12B	22-Nov-02	391.32	391.4	34.0	44.0	357.4	347.4	31.0	44.0	360.4	347.4
EMW-1	14-Oct-94	394.30	394.6	8.0	18.0	386.6	376.6	6.0	18.5	388.6	376.1
EMW-2	17-Oct-94	394.72	395.0	6.0	11.0	389.0	384.0	5.0	12.0	390.0	383.0
EMW-3	14-Oct-94	396.94	394.2	6.0	11.0	388.2	383.2	4.0	12.3	390.2	381.9
EMW-4	18-Oct-94	395.51	392.9	6.0	11.0	386.9	381.9	5.0	12.0	387.9	380.9
EMW-5	17-Oct-94	395.53	393.0	6.0	11.0	387.0	382.0	5.0	12.0	388.0	381.0

Notes:

1. All depths in feet below ground surface
2. All elevations in feet above mean sea level.

TABLE 3-4 **WATER LEVEL MONITORING DATA**

Old Erie Canal Site
Clyde, New York

Well Id.	25-Jun-02	17-Jul-02	27-Aug-02	17-Sep-02	22-Nov-02	16-Dec-02	10-Apr-03	24-Apr-03	27-May-03	01-Jul-03	07&08-Oct-03	04-Nov-03
MW-1	394.65	394.33	394.31	393.73	394.74	394.98	394.99	394.75	394.87	394.52	394.54	394.83
MW-1S	389.44	388.93	389.24	389.39	390.13	390.25	390.10	389.63	390.19	Dry	389.88	390.19
MW-2S	395.15	394.63	394.78	394.71	395.32	395.66	395.49	395.24	395.25	394.98	395.01	395.21
MW-2B	394.61	394.06	393.97	393.74	394.54	395.05	394.81	394.30	394.80	394.23	394.32	394.63
MW-3S	389.20	388.10	386.99	386.60	388.51	389.63	389.89	389.12	389.70	388.53	387.98	389.12
MW-4S	388.79	387.08	386.81	386.47	387.19	387.80	387.97	387.51	387.91	387.47	387.42	387.73
MW-4B	386.89	386.24	386.11	385.94	384.98	386.13	386.60	384.70	386.99	386.39	386.55	386.87
MW-5S	388.43	387.15	385.88	385.16	387.14	389.32	389.34	388.22	389.22	387.58	387.15	388.30
MW-6S	390.01	389.28	388.90	388.50	389.18	391.24	390.75	389.92	391.09	389.62	389.85	390.36
MW-7S	387.68	387.42	386.94	386.59	387.70	387.98	387.90	387.70	387.87	387.42	387.58	387.82
MW-7B	388.85	387.74	387.29	386.94	387.40	388.27	388.26	387.00	388.41	387.79	387.82	388.63
MW-8S	389.08	387.91	387.16	386.83	388.97	>389.91	389.81	389.30	>389.91	388.46	388.95	>389.91
MW-9S	387.43	387.48	386.78	386.51	389.08	390.03	389.97	388.90	389.64	387.80	388.51	389.47
MW-10B	NI	NI	NI	NI	NI	390.46	>390.99	>390.99	>390.99	>390.99	390.79	>390.99
MW-11S	NI	NI	NI	NI	NI	386.43	386.45	385.88	386.42	385.39	385.69	386.04
MW-11B	NI	NI	NI	NI	NI	389.89	389.65	>389.75	>389.75	>389.75	>389.75	>389.75
MW-12S	NI	NI	NI	NI	NI	381.87	388.85	387.93	388.38	386.36	383.17	383.62
MW-12B	NI	NI	NI	NI	NI	389.46	>391.32	>391.32	391.13	391.02	390.43	390.92
EMW-2	392.18	391.25	390.81	390.48	393.35	394.05	393.63	392.46	393.56	391.85	392.21	393.23
EMW-3	388.89	388.17	387.68	387.37	388.00	389.37	389.33	389.16	389.33	388.76	388.60	389.20
EMW-4	388.50	387.83	387.25	386.95	388.60	388.91	388.93	388.57	388.86	388.21	388.21	388.70
EMW-5	388.27	388.72	387.84	387.53	389.93	390.15	390.25	390.12	390.14	389.42	389.61	390.11
SG-1	390.05	390.05	Dry	Dry	390.22	390.39	390.44	390.37	390.32	Dry	Dry	390.64
SG-2	387.05	387.05	Dry	Dry	387.72	387.96	387.84	387.68	387.83	Dry	Dry	388.39
Clyde River	387.87	384.87	NA	385.10	<380.19	382.49	383.64	<380.19	385.08	384.75	384.87	385.04

Notes:

1. All depths are in feet below ground surface.
2. All elevations are in feet above mean sea level.
3. "NA" designates no measurement taken.
4. "NI" designates well not installed.
5. ">" designates flowing well.
6. "<" designates water level below staff gauge.

TABLE 3-5 **HYDRAULIC CONDUCTIVITY DATA**

Old Erie Canal Site
Clyde, New York

Well Identification	Bouwer and Rice	Arithmetic Mean	
	K Estimate (cm/sec)	(cm/sec)	(ft/day)
Unconsolidated Hydrogeologic Unit Wells			
MW-2S	3.04E-03	3.66E-03	10.36
	4.27E-03		
MW-3S	3.84E-04	5.08E-04	1.44
	6.31E-04		
MW-4S	2.59E-03	2.81E-03	7.95
	3.03E-03		
MW-5S	1.94E-03	6.93E-03	19.65
	1.20E-02		
	6.83E-03		
MW-6S	3.54E-04	3.49E-04	0.99
	3.43E-04		
MW-7S	7.22E-03	6.64E-03	18.81
	6.06E-03		
MW-8S	1.07E-03	1.07E-03	3.04
MW-9S	1.15E-04	1.15E-04	0.33
MW-11S	3.29E-03	3.29E-03	9.33
	3.29E-03		
	3.29E-03		
EMW-2	1.55E-04	1.52E-04	0.43
	1.49E-04		
EMW-3	2.86E-03	2.67E-03	7.55
	2.47E-03		
EMW-4	5.39E-04	6.55E-04	1.86
	7.72E-04		
EMW-5	3.29E-03	3.29E-03	9.33
	3.29E-03		
Shallow Bedrock Hydrogeologic Unit Wells			
MW-2B	3.79E-06	3.79E-06	0.01
MW-4B	2.65E-04	3.00E-04	0.85
	3.36E-04		
MW-10B	1.49E-05	1.49E-05	0.04
MW-11B	1.33E-04	1.33E-04	0.38

Notes:

1. The geometric mean hydraulic conductivity of the unconsolidated hydrogeologic unit at the Site is 2.40E-03 (6.81 ft/day).
2. The geometric mean hydraulic conductivity for the shallow bedrock hydrogeologic unit is 1.13E-04 (0.32 ft/day).

TABLE 4-1
DEPTH TO BEDROCK AND BEDROCK
SURFACE ELEVATIONS

OLD ERIE CANAL
CLYDE, NEW YORK SITE

Well/Boring No.	Ground Elevation (ft amsl)	Depth To Bedrock (ft)	Bedrock Elevation (ft amsl)
MW-2B	398.4	16.5	381.9
MW-4B	393.3	26.0	367.3
MW-7B	397.4	28.2	369.2
MW-8S	390.3	21.5	368.8
MW-10B	391.2	29.0	362.2
MW-11B	389.8	30.8	359.0
MW-12B	391.4	31.0	360.4
EMW-1 (abandoned)	394.6	25.2	369.4
GP-13	389.3	19.0	370.3
GP-19	389.3	19.0	370.3
GP-25	389.2	21.0	368.2
GP-34	395.2	29.2	366.0
GP-43	391.0	20.5	370.5

TABLE 6-1
GROUND WATER MONITORING AREAS

OLD ERIE CANAL
CLYDE, NEW YORK SITE

Area A	Area B	Area C
<i>Background Locations</i>	<i>Southeastern Portion of the Site</i>	<i>Northern Portion of the Site</i>
GP-7	GP-38	GP-1
MW-2B	GP-39	GP-2
MW-2S	MW-3S	GP-3
	EMW-3	GP-4
	MW-5S	GP-42
		GP-43
		GP-44
		MW-8S
		MW-9S
Area D	Area E	Area F
<i>Area West of manufacturing Building</i>	<i>Barge Turnaround Area</i>	<i>Area West of Barge Turnaround</i>
GP-5	GP-19	GP-18
GP-6	GP-20	GP-35
GP-8	GP-24	GP-40
GP-9	GP-25	GP-41
GP-10	GP-26	GP-59
GP-11	GP-28	GP-61
GP-12	GP-31	MW-5S
GP-13	GP-32	MW-7B
GP-14	GP-33	
MW-1S	GP-34	
	GP-36	
	GP-37	
	GP-60	
	EMW-2	
	EMW-4	
	MW-4B	
	MW-4S	
	MW-6S	
	MW-7S	

TABLE 6-1
GROUND WATER MONITORING AREAS

OLD ERIE CANAL
CLYDE, NEW YORK SITE

Area G	Area H
<i>Area Between Barge Turnaround and Manufacturing Building</i>	<i>Area South of Barge Canal and Clyde River</i>
GP-15	MW-10B
GP-16	MW-11B
GP-17	MW-11S
GP-21	MW-12B
GP-22	MW-12S
GP-23	
GP-27	
GP-29	
GP-30	
GP-45	
GP-46	
GP-47	
GP-48	
GP-49	
GP-50	
GP-51	
GP-52	
GP-53	
GP-54	
GP-55	
GP-56	
GP-57	
GP-58	
MW-1	

Table 6-2**Summary of Detected Compounds**

Old Erie Canal Site
Clyde, New York

		Area A	Background Locations			
Compound	Class GA Standard (ug/L)	GW-GP-7 Dry	MW-2B 6/25/02	MW-2B-PB 5/28/03	MW-2S 6/24/02	MW-2S-PB 5/28/03
Acetone	NC	---	1.9 J	11 R	5 R	8.1 R

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SVW-846 Method 8260B.
5. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
6. "NC" designates no standard exists for the compound.
7. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
8. "PB" designates Passive Bag sampling technique.
9. "---" designates compound not analyzed.

Table 6-3

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area B Southeastern Portion of the Site

COMPOUND	Class GA Standard (ug/L)	GW-GP-38 4/23/02	GW-GP-39 4/23/02	MW-3S 6/25/02	MW-3S-PB 5/27/03	EMW-3 6/26/02	EMW-3-PB 5/27/03	EMW-5 6/26/02	EMW-5-PB 5/27/03
1,2,4-Trimethylbenzene	5	0.34 J	5 U	---	---	---	---	---	---
Acetone	NC	---	---	2.8 J	10 R	5 U	6.1 R	5 U	8.4 R
Benzene	1	5 U	0.32 J	1 U	1.0 U	1 U	1.0 U	1 U	1.0 U
cis-1,2-Dichloroethene	5	5 U	5 U	1 U	1.0 U	0.51 J	1.0 U	1 U	1.0 U
Toluene	5	5 U	0.32 J	1 U	1.0 U	1 U	1.0 U	1 U	1.0 U
Xylene (total)	NC	5 U	5 U	0.7 J	1.0 U	3 U	1.0 U	3 U	1.0 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "NC" designates no standard exists for the compound.
8. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
9. "PB" designates Passive Bag sampling technique.
10. "--" designates compound not analyzed.

Table 6-4

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area C Northern Portion of the Site

COMPOUND	Class GA Standard (ug/L)	GW-GP-1 4/26/02	GW-GP-2 4/25/02	GW-GP-3 Dry	GW-GP-4 4/24/02	GW-GP-42 5/2/02	GW-GP-43 5/2/02
1,2,4-Trimethylbenzene	5	0.28 J	0.21 J	---	5 U	1 U	1 U
Benzene	1	5 U	5 U	---	5 U	0.4 BJ	0.39 BJ
Chlorobenzene	5	5 U	5 U	---	5 U	1 U	0.21 J
cis-1,2-Dichloroethene	5	5 U	2.9	---	8.7	0.46 J	0.69 J
Cymene	5	0.45 J	5 U	---	5 U	1 U	1 U
Ethylbenzene	5	0.33 J	5 U	---	5 U	1 U	1 U
m&p-xylene	5	1.3 J	2 U	---	2 U	2 U	2 U
Methylene chloride	5	5 U	0.66 J	---	5 U	1 U	1 U
Naphthalene	NC	0.91 J	0.95 J	---	5 U	1 U	1 U
Tetrachloroethene	5	5 U	0.28 J	---	5 U	1 U	1 U
Toluene	5	1.3 J	0.4 J	---	5 U	0.59 BJ	0.37 BJ
trans-1,2-Dichloroethene	5	5 U	0.23 J	---	5 U	1 U	1 U
Trichloroethene	5	0.24 BJ	2.6	---	0.5 J	0.34 BJ	0.35 BJ
Vinyl chloride	2	5 U	3.9 J	---	2.4 J	1 U	1.8

COMPOUND	Class GA Standard (ug/L)	GW-GP-X-4 (Dup of GP-43) 5/2/02	GW-GP-44 Dry	MW-8S 6/24/02	MW-8S-PB 5/27/03	MW-9S 6/24/02	MW-9S 12/19/02	MW-9S-PB 5/27/03
1,2,4-Trimethylbenzene	5	1 U	---	1 U	---	1 U	---	---
Benzene	1	1 U	---	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	---	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	0.59 J	---	2.6	1 U	0.55 J	1 U	1 U
Cymene	5	1 U	---	1 U	---	1 U	---	---
Ethylbenzene	5	1 U	---	1 U	1 U	1 U	1 U	1 U
m&p-xylene	5	2 U	---	1 U	1 U	1 U	1 U	1 U
Methylene chloride	5	1 U	---	2 U	1 U	2 U	2 U	1 U
Naphthalene	NC	1 U	---	1 U	---	1 U	1 U	---
Tetrachloroethene	5	1 U	---	1 U	1 U	1 U	1 U	1 U
Toluene	5	0.3 BJ	---	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	---	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	---	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	2	1.7	---	1 U	1 U	1 U	1 U	1 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "PB" designates Passive Bag sampling technique.
10. "---" designates compound not analyzed.

Table 6-5

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area D Area West of Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GW-GP-5 4/25/02	GW-GP-6 4/26/02	GW-GP-8 4/24/02	GW-GP-9 4/26/02	GW-GP-10 4/24/02
1,1-Dichloroethene	5	5 U	20 U	0.37 J	2 U	5 U
1,2,4-Trimethylbenzene	5	5 U	29	5 U	2 U	5 U
1,3,5-Trimethylbenzene	5	5 U	7.9 J	5 U	2 U	5 U
Benzene	1	0.3 J	20 U	5 U	2 U	0.21 J
cis-1,2-Dichloroethene	5	170 BD	30	230 D	14	22 D
Ethylbenzene	5	5 U	360	5 U	2 U	5 U
m&p-xylene	5	5 U	1600	5 U	4 U	5 U
Methylene chloride	5	5 U	20 U	5 U	2 U	5 U
Naphthalene	NC	5 U	22	5 U	2 U	5 U
o-Xylene	5	5 U	520	5 U	2 U	5 U
Tetrachloroethene	5	5 U	20 U	5 U	2 U	5 U
Toluene	5	0.55 J	660	5 U	0.58 J	0.28 J
trans-1,2-Dichloroethene	5	0.46 J	20 U	1 J	2 U	5 U
Trichloroethene	5	1.5	4.5 J	0.4 J	4.4 B	0.5 J
Vinyl chloride	2	31	5.7 J	45 D	1 J	12

COMPOUND	Class GA Standard (ug/L)	GW-GP-11 4/30/02	GW-GP-12 4/26/02	GW-GP-13 4/30/02	GW-GP-14 4/26/02	MW-1S 6/26/02
1,1-Dichloroethene	5	20 U	5 U	22	200 U	100 U
1,2,4-Trimethylbenzene	5	20 U	5 U	10 U	200 U	---
1,3,5-Trimethylbenzene	5	20 U	5 U	10 U	200 U	---
Benzene	1	20 U	5 U	3.3 J	200 U	100 U
cis-1,2-Dichloroethene	5	420	21	9100 D	180 J	3700
Ethylbenzene	5	20 U	5 U	10 U	200 U	100 U
m&p-xylene	5	40 U	5 U	20 U	400 U	100 U
Methylene chloride	5	8.6 J	5 U	10 U	200 U	200 U
Naphthalene	NC	20 U	5 U	10 U	200 U	10 U
o-Xylene	5	20 U	5 U	10 U	200 U	100 U
Tetrachloroethene	5	4.5 J	5 U	10 U	200 U	100 U
Toluene	5	9 BJ	0.27 BJ	29 B	200 U	100 U
trans-1,2-Dichloroethene	5	4.1 J	5 U	40	200 U	32 J
Trichloroethene	5	140 B	2.5 BJ	1900 BD	73 J	1000
Vinyl chloride	2	28	7.2	490 D	2700	280

Notes:

1. All units in ug/L.
2. All analyses performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
4. "U" designates that the compound was not detected at or above the quantitation limit shown.
5. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
6. "B" designates that the compound was detected in the associated blank as well.
7. "NC" designates no standard exists for the compound.
8. "D" designates that the detected concentration is from the diluted analysis.
9. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	GW-GP-19 5/1/02	GW-GP-20 5/2/02	GW-GP-24 4/24/02	GW-GP-25 4/30/02	(Dup of GP-25) 4/30/02
1,1,2-Trichloroethane	1	10 U	100 U	5 U	6.5 J	7.6 J
1,1-Dichloroethane	5	10 U	100 U	5 U	10 U	10 U
1,1-Dichloroethene	5	5.4 J	27 J	0.52 J	210	220
1,1-Dichloropropene	5	10 U	100 U	5 U	6.2 J	6.9 J
1,2,4-Trimethylbenzene	5	10 U	100 U	5 U	2.9 J	3 J
2-Butanone	NC	---	---	---	---	---
4-Methyl-2-pentanone	NC	---	---	---	---	---
Acetone	NC	---	---	---	---	---
Benzene	1	10 U	23 BJ	5 U	19	20
Chloroethane	5	10 U	100 U	5 U	10 U	10 U
Chloroform	7	10 U	100 U	5 U	14	14
Chloromethane	5	10 U	100 U	5 U	10 U	10 U
cis-1,2-Dichloroethene	5	1500 BD	44000 D	310 D	170000 BD	180000 BD
Ethylbenzene	5	10 U	30 J	5 U	87	92
m&p-xylene	5	20 U	150 J	5 U	370	390
Methylene chloride	5	10 U	100 U	5 U	3.5 J	3.7 J
Naphthalene	NC	10 U	100 U	5 U	8.7 J	9.1 J
o-Xylene	5	10 U	30 J	5 U	61	63
Tetrachloroethene	5	10 U	100 U	5 U	5.5 J	6 J
Toluene	5	56 B	4800 BD	5 U	8400 BD	6700 BD
trans-1,2-Dichloroethene	5	9.9 J	170	0.68 J	5000 U	5000 U
Trichloroethene	5	43 BDJ	82 BJ	5 U	71000 BD	69000 BD
Vinyl chloride	2	320	44000 D	31	22000 D	22000 D
Xylenes (total)	5	---	---	---	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	GW-GP-26 5/1/02	GW-GP-28 5/1/02	GW-GP-31 4/24/02	GW-GP-32 4/24/02	GW-GP-33 5/1/02
1,1,2-Trichloroethane	1	20 U	10 U	5 U	200 U	1 U
1,1-Dichloroethane	5	20 U	28	0.3 J	200 U	1 U
1,1-Dichloroethene	5	20 U	4.1 J	1.3	200 U	1 U
1,1-Dichloropropene	5	20 U	10 U	5 U	200 U	1 U
1,2,4-Trimethylbenzene	5	20 U	10 U	5 U	200 U	1 U
2-Butanone	NC	---	---	---	---	---
4-Methyl-2-pentanone	NC	---	---	---	---	---
Acetone	NC	---	---	---	---	---
Benzene	1	20 U	6.6 J	0.56 J	200 U	1 U
Chloroethane	5	20 U	10 U	5 U	200 U	1 U
Chloroform	7	20 U	10 U	5 U	200 U	1 U
Chloromethane	5	20 U	10 U	5 U	200 U	1 U
cis-1,2-Dichloroethene	5	120 B	3700 D	500 D	16000 BD	0.98 BJ
Ethylbenzene	5	20 U	17	5 U	200 U	1 U
m&p-xylene	5	40 U	98	0.43 J	400 U	2 U
Methylene chloride	5	20 U	10 U	5 U	200 U	1 U
Naphthalene	NC	20 U	2.9 J	5 U	200 U	1 U
o-Xylene	5	20 U	24	5 U	200 U	1 U
Tetrachloroethene	5	20 U	10 U	5 U	200 U	1 U
Toluene	5	7.5 BJ	610 BD	0.77 J	440	0.3 BJ
trans-1,2-Dichloroethene	5	20 U	15	3.4 J	93 J	1 U
Trichloroethene	5	200 B	110 BDJ	2.1	200 U	1 B
Vinyl chloride	2	380	7500 D	160 D	16000 D	0.45 J
Xylenes (total)	5	---	---	---	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	GW-GP-34 5/2/02	(Dup of GP-34) 5/2/02	GW-GP-36 4/23/02	GW-GP-37 4/23/02	GP-60 11/21/02
1,1,2-Trichloroethane	1	100 U	100 U	5 U	5 U	5 U
1,1-Dichloroethane	5	100 U	100 U	0.43 J	0.58 J	5 U
1,1-Dichloroethene	5	160	170	0.88 J	5 U	5 U
1,1-Dichloropropene	5	100 U	100 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	5	100 U	100 U	5 U	5 U	5 U
2-Butanone	NC	---	---	---	---	---
4-Methyl-2-pentanone	NC	---	---	---	---	---
Acetone	NC	---	---	---	---	---
Benzene	1	100 U	100 U	0.38 J	5 U	5 U
Chloroethane	5	100 U	100 U	5 U	5 U	5 U
Chloroform	7	100 U	100 U	5 U	5 U	5 U
Chloromethane	5	100 U	100 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	5	100000 D	200000 D	1900 D	5.2	46
Ethylbenzene	5	52 J	55 J	5 U	5 U	5 U
m&p-xylene	5	220	240	10 U	10 U	10 U
Methylene chloride	5	100 U	100 U	5 U	5 U	5 U
Naphthalene	NC	100 U	100 U	5 U	5 U	5 U
o-Xylene	5	42 J	45 J	5 U	5 U	5 U
Tetrachloroethene	5	100 U	100 U	5 U	5 U	5 U
Toluene	5	3800 B	5000 U	7.4	0.26 J	5 U
trans-1,2-Dichloroethene	5	400	420	3.1 J	5 U	5 U
Trichloroethene	5	3600 BDJ	4600 DJ	0.63 J	5 U	170 D
Vinyl chloride	2	31000 D	11000 D	2500 D	6.8	8.8
Xylenes (total)	5	---	---	---	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. "- - -" designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	EMW-2 6/26/02	EMW-2 12/19/02	EMW-2-PB 5/27/03	Dup of EMW-2-PB 5/27/03	EMW-4 6/26/02
1,1,2-Trichloroethane	1	2 U	2 U	2.5 U	1 U	1 U
1,1-Dichloroethane	5	2 U	2 U	2.5 U	1 U	2
1,1-Dichloroethene	5	2 U	2 U	2.5 U	1 U	1 U
1,1-Dichloropropene	5	---	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---	---
2-Butanone	NC	10 U	10 U	13 UR	5 UR	5 U
4-Methyl-2-pentanone	NC	10 U	10 U	13 UR	5 UR	5 U
Acetone	NC	10 U	10 R	13 UR	6.2 R	5 U
Benzene	1	2 U	2 U	2.5 U	1 U	1 U
Chloroethane	5	2 U	2 U	2.5 U	1 U	0.64 J
Chloroform	7	2 U	2 U	2.5 U	1 U	1 U
Chloromethane	5	2 U	2 U	2.5 U	1 U	1 U
cis-1,2-Dichloroethene	5	26	63 D	15	16 J	1.1
Ethylbenzene	5	2 U	2 U	2.5 U	1 U	1 U
m&p-xylene	5	---	---	2.5 U	2.1 J	---
Methylene chloride	5	0.8 J	4 U	2.5 U	1 U	2 U
Naphthalene	NC	---	---	---	---	---
o-Xylene	5	---	---	2.5 U	1 U	---
Tetrachloroethene	5	2 U	2 U	2.5 U	1 U	1 U
Toluene	5	2 U	3	20	23 J	1 U
trans-1,2-Dichloroethene	5	0.54 J	2 U	2.5 U	1 U	1 U
Trichloroethene	5	2 U	1 J	2.5 U	1 U	1 U
Vinyl chloride	2	53	130 D	640	530 EJ	11
Xylenes (total)	5	6 U	0.71 J	---	---	3 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	EMW-4 12/19/02	EMW-4-PB 5/27/03	MW-4B 6/25/02	Dup. Of MW-4B 6/25/02	MW-4B 12/19/02
1,1,2-Trichloroethane	1	1 U	1 U	2000 U	2000 U	2000 U
1,1-Dichloroethane	5	1.8	1.6	2000 U	2000 U	2000 U
1,1-Dichloroethene	5	1 U	1 U	2000 U	2000 U	2000 U
1,1-Dichloropropene	5	---	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---	---
2-Butanone	NC	5 U	5 UR	10000 U	10000 U	10000 R
4-Methyl-2-pentanone	NC	5 U	5 UR	10000 U	10000 U	10000 U
Acetone	NC	5 U	5 UR	10000 U	10000 U	10000 R
Benzene	1	1 U	1 U	2000 U	2000 U	2000 U
Chloroethane	5	0.61 J	1 U	2000 U	2000 U	2000 U
Chloroform	7	1 U	1 U	2000 U	2000 U	2000 U
Chloromethane	5	1 U	1 U	2000 U	2000 U	2000 U
cis-1,2-Dichloroethene	5	0.76 J	1 U	58000	79000	100000 D
Ethylbenzene	5	1 U	1 U	2000 U	2000 U	2000 U
m&p-xylene	5	---	1 U	---	---	---
Methylene chloride	5	2 U	1 U	1200 J	1200 J	4000 U
Naphthalene	NC	---	---	---	---	---
o-Xylene	5	---	1 U	---	---	---
Tetrachloroethene	5	1 U	1 U	2000 U	2000 U	2000 U
Toluene	5	1 U	1 U	2000 U	2000 U	2000 U
trans-1,2-Dichloroethene	5	1 U	1 U	2000 U	2000 U	2000 U
Trichloroethene	5	1 U	1 U	1900 J	2600	680 J
Vinyl chloride	2	14	2 NJ	27000	42000	33000
Xylenes (total)	5	1 U	---	6000 U	6000 U	2000 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	Dup. Of MW-4B 12/19/02	MW-4B-PB 5/28/03	MW-4S 6/25/02	MW-4S 12/19/02	MW-4S-PB-TOP 4/24/03
1,1,2-Trichloroethane	1	2000 U	100 U	1 U	4 U	1 U
1,1-Dichloroethane	5	2000 U	100 U	1 U	2 J	1 U
1,1-Dichloroethene	5	2000 U	100 U	1 U	5.4	1 U
1,1-Dichloropropene	5	---	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---	---
2-Butanone	NC	10000 R	500 UR	5 U	20 U	5 UR
4-Methyl-2-pentanone	NC	10000 U	500 UR	5 U	20 U	5 UR
Acetone	NC	10000 R	500 UR	4 J	20 U	5 UR
Benzene	1	2000 U	100 U	1 U	1.1 J	1 U
Chloroethane	5	2000 U	100 U	1 U	4 U	1 UJ
Chloroform	7	2000 U	100 U	1 U	4 U	1 U
Chloromethane	5	2000 U	100 U	0.48 J	4 U	1 U
cis-1,2-Dichloroethene	5	100000 D	32000	120 D	6400 D	8.7
Ethylbenzene	5	2000 U	100 U	1 U	4 U	1 U
m&p-xylene	5	---	100 U	---	---	1 U
Methylene chloride	5	4000 U	100 U	2 U	8 U	1 U
Naphthalene	NC	---	---	---	---	---
o-Xylene	5	---	100 U	---	---	1 U
Tetrachloroethene	5	2000 U	100 U	1 U	4 U	1 U
Toluene	5	2000 U	100 U	1.2	9	1 U
trans-1,2-Dichloroethene	5	2000 U	100 U	0.76 J	37	1 U
Trichloroethene	5	750 J	100 U	0.36 J	3 J	1 U
Vinyl chloride	2	35000	14000	110 D	6600 D	13
Xylenes (total)	5	2000 U	---	3 U	4 U	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	MW-4S-PB-BOTTOM 4/24/03	MW-4S-PB-TOP 5/28/03	MW-4S-PB-BOTTOM 5/28/03	MW-4S-PB-TOP 7/2/03
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U
1,1-Dichloropropene	5	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---
2-Butanone	NC	5 UR	5 UR	5 UR	4.6 JR
4-Methyl-2-pentanone	NC	5 UR	5 UR	5 UR	5 UR
Acetone	NC	5 UR	10 R	9.5 R	7.6 R
Benzene	1	1 U	1 U	1 U	1 U
Chloroethane	5	1 UJ	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U
Chloromethane	5	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	3.9	1.6	3.2	2.9
Ethylbenzene	5	1 U	1 U	1 U	1 U
m&p-xylene	5	1 U	1 U	1 U	1 U
Methylene chloride	5	1 U	1 U	1 U	1 U
Naphthalene	NC	---	---	---	---
o-Xylene	5	1 U	1 U	1 U	1 U
Tetrachloroethene	5	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U
Vinyl chloride	2	3.6	1 U	1.4	1 U
Xylenes (total)	5	---	---	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	MW-4S-PB-BOTTOM 7/2/03	MW-6S 6/26/02	MW-6S-PB-TOP 5/28/03	MW-6S-PB-BOTTOM 5/28/03
1,1,2-Trichloroethane	1	1 U	1000 U	5 U	100 U
1,1-Dichloroethane	5	1 U	1000 U	5 U	100 U
1,1-Dichloroethene	5	1 U	1000 U	5 U	100 U
1,1-Dichloropropene	5	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---
2-Butanone	NC	5 UR	5000 U	25 UR	500 UR
4-Methyl-2-pentanone	NC	5 UR	1000 J	25 UR	500 UR
Acetone	NC	10 R	5000 U	25 UR	500 UR
Benzene	1	1 U	1000 U	5 U	100 U
Chloroethane	5	1 U	1000 U	5 U	100 U
Chloroform	7	1 U	1000 U	5 U	100 U
Chloromethane	5	1 U	1000 U	5 U	100 U
cis-1,2-Dichloroethene	5	2.3	80000 D	1500	9500
Ethylbenzene	5	1 U	1000 U	5 U	100 U
m&p-xylene	5	1 U	---	6.8	100 U
Methylene chloride	5	1 U	100 U	100 U	100 U
Naphthalene	NC	---	---	---	---
o-Xylene	5	1 U	---	5 U	100 U
Tetrachloroethene	5	1 U	1000 U	5 U	100 U
Toluene	5	1 U	9800	26	670
trans-1,2-Dichloroethene	5	1 U	1000 U	5 U	100 U
Trichloroethene	5	1 U	960 J	5 U	960 J
Vinyl chloride	2	0.85 J	38000	650	4800
Xylenes (total)	5	---	3000 U	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. "- - -" designates compound not analyzed.

Table 6-6

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area E Barge Turnaround Area

COMPOUND	Class GA Standard (ug/L)	MW-7S 6/24/02	MW-7S 12/18/02	MW-7S-PB 5/27/03	(Dup of MW-7S-PB) 5/27/03
1,1,2-Trichloroethane	1	1 U	50 U	1 U	1 U
1,1-Dichloroethane	5	1 U	50 U	1 U	1 U
1,1-Dichloroethene	5	1.2	50 U	1 U	1 U
1,1-Dichloropropene	5	---	---	---	---
1,2,4-Trimethylbenzene	5	---	---	---	---
2-Butanone	NC	5 U	250 R	5 UR	5 UR
4-Methyl-2-pentanone	NC	5 U	250 U	5 UR	5 UR
Acetone	NC	5 R	250 R	11 R	13 R
Benzene	1	1 U	50 U	1 U	1 U
Chloroethane	5	1 U	50 U	1 U	1 U
Chloroform	7	1 U	50 U	1 U	1 U
Chloromethane	5	1 UJ	50 U	1 U	1 U
cis-1,2-Dichloroethene	5	1500 D	2100 D	140	130
Ethylbenzene	5	1 U	50 U	1 U	1 U
m&p-xylene	5	---	---	1 U	1 U
Methylene chloride	5	2 U	100 U	1 U	1 U
Naphthalene	NC	---	---	---	---
o-Xylene	5	---	---	1 U	1 U
Tetrachloroethene	5	1 U	50 U	1 U	1 U
Toluene	5	1 U	50 U	1 U	1 U
trans-1,2-Dichloroethene	5	14	50 U	1 U	1 U
Trichloroethene	5	3.7	50 U	1 U	1 U
Vinyl chloride	2	81 D	220	2	2.1
Xylenes (total)	5	3 U	50 U	---	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "NC" designates no standard exists for the compound.
9. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone, 2-butanone, and 4-methyl-2-pentanone are "R" flagged due to slow diffusion rates for the compound.
10. "D" designates that the detected concentration is from the diluted analysis.
11. "N" designates tentatively identified compound.
12. "E" designates that the compound concentration exceeds the calibration range of the instrument.
13. "PB" designates Passive Bag sampling technique.
14. " - - " designates compound not analyzed.

Table 6-7

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area F Area West Of Barge Turnaround

COMPOUND	Class GA Standard (ug/L)	GW-GP-18 4/24/02	GW-GP-35 4/23/02	GW-GP-40 5/2/02	GW-GP-41 5/2/02	GP-59 11/21/02	GP-61 DRY	MW-5S 6/25/02	MW-5S-PB 5/28/03	MW-7B 6/25/02	MW-7B-PB 5/27/03
1,2,4-Trimethylbenzene	5	5 U	0.21 J	1 U	1 U	1 U	---	---	---	---	---
Acetone	NC	---	---	---	---	---	---	3.8 J	11 R	0.75 J	9.3 R
Benzene	1	5 U	5 U	0.32 BJ	0.46 BJ	1 U	---	1 U	1 U	1 U	1 U
Chlorobenzene	5	5 U	5 U	1 U	0.21 J	1 U	---	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	0.82 J	5 U	0.4 J	0.35 J	0.31 J	---	1 U	1 U	1 U	10
Cymene	5	5 U	5 U	1 U	0.48 J	1 U	---	---	---	---	---
Naphthalene	NC	5 U	0.76 J	1 U	1 U	1 U	---	10 U	---	10 U	---
Toluene	5	5 U	5 U	0.38 BJ	0.68 BJ	0.32 J	---	1 U	1 U	1 U	1 U
Trichloroethene	5	5 U	5 U	0.48 BJ	0.43 BJ	1 U	---	1 U	1 U	1 U	4.7
Vinyl Chloride	2	5 U	5 U	1 U	1 U	1 U	---	1 U	1 U	1 U	2 NJ

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "N" designates tentatively identified compound.
9. "NC" designates no standard exists for the compound.
10. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
11. "PB" designates Passive Bag sampling technique.
12. "- - -" designates compound not analyzed.

Table 6-8

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area G Area Between Barge Turnaround and Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GW-GP-15 4/26/02	GW-GP-16 4/25/02	GW-GP-17 4/25/02	GW-GP-21 Dry	GW-GP-22 4/25/02
1,1,1-Trichloroethane	5	200 U	20 U	0.2 J	---	2 U
1,1-Dichloroethane	5	200 U	20 U	0.21 J	---	2 U
1,1-Dichloroethene	5	200 U	70	5 U	---	2 U
1,2,4-Trimethylbenzene	5	200 U	20 U	5 U	---	2 U
1,3,5-Trimethylbenzene	5	200 U	20 U	5 U	---	2 U
2-Phenylbutane	5	200 U	20 U	5 U	---	2 U
Acetone	NC	---	---	---	---	---
Benzene	1	200 U	20 U	5 U	---	2 U
Chlorobenzene	5	200 U	20 U	5 U	---	2 U
cis-1,2-Dichloroethene	5	3200	60000 D	0.27 J	---	1.5 J
Cymene	5	200 U	20 U	5 U	---	2 U
Ethylbenzene	5	200 U	20 U	5 U	---	2 U
Isopropylbenzene	5	200 U	20 U	5 U	---	2 U
m&p-xylene	5	400 U	40 U	0.61 J	---	4 U
Methylene chloride	5	200 U	20 U	5 U	---	0.77 J
Naphthalene	NC	200 U	15 J	1.4 J	---	2.7
n-Propylbenzene	5	200 U	20 U	5 U	---	2 U
o-Xylene	5	200 U	20 U	0.3 J	---	2 U
Tetrachloroethene	5	200 U	20 U	5 U	---	2 U
Toluene	5	62 J	23	1.6 J	---	0.5 J
trans-1,2-Dichloroethene	5	53 J	310	5 U	---	2 U
Trichloroethene	5	540 B	130	0.28 J	---	0.76 J
Vinyl chloride	2	720	51000 D	5 U	---	1.6 J

Notes:

- All units in ug/L.
- All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
- All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
- Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
- "U" designates that the compound was not detected at or above the quantitation limit shown.
- "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
- "B" designates that the compound was detected in the associated blank as well.
- "D" designates that the detected concentration is from the diluted analysis.
- "NC" designates no standard exists for the compound.
- "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
- "PB" designates Passive Bag sampling technique.
- "- - -" designates compound not analyzed.

Table 6-8

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area G Area Between Barge Turnaround and Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GW-GP-23 4/25/02	GW-GP-27 4/26/02	GW-GP-29 4/26/02	GW-GP-30 4/26/02	GP-45 11/21/02
1,1,1-Trichloroethane	5	5 U	5 U	10 U	5 U	4 U
1,1-Dichloroethane	5	5 U	0.21 J	10 U	5 U	1.6 J
1,1-Dichloroethene	5	5 U	0.21 J	10 U	5 U	4 U
1,2,4-Trimethylbenzene	5	5 U	5 U	10 U	5 U	4 U
1,3,5-Trimethylbenzene	5	5 U	5 U	10 U	5 U	4 U
2-Phenylbutane	5	5 U	5 U	10 U	5 U	4 U
Acetone	NC	---	---	---	---	---
Benzene	1	0.27 J	5 U	10 U	5 U	4 U
Chlorobenzene	5	5 U	5 U	10 U	5 U	4 U
cis-1,2-Dichloroethene	5	4.2 J	17	110	5	160 D
Cymene	5	5 U	0.36 J	10 U	5 U	4 U
Ethylbenzene	5	5 U	5 U	10 U	5 U	4 U
Isopropylbenzene	5	5 U	5 U	10 U	5 U	4 U
m&p-xylene	5	5 U	5 U	20 U	10 U	1.2 J
Methylene chloride	5	5 U	5 U	10 U	5 U	4 U
Naphthalene	NC	0.66 J	0.83 J	10 U	5 U	4 U
n-Propylbenzene	5	5 U	5 U	10 U	5 U	4 U
o-Xylene	5	5 U	5 U	10 U	5 U	0.9 J
Tetrachloroethene	5	5 U	5 U	10 U	5 U	3.2 J
Toluene	5	0.66 J	2	7.4 J	3.4 J	4 U
trans-1,2-Dichloroethene	5	5 U	0.43 J	10 U	5 U	4.6
Trichloroethene	5	0.97 J	2.2 B	27	80	280 D
Vinyl chloride	2	5.2	23	99	5 U	7.7

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "D" designates that the detected concentration is from the diluted analysis.
9. "NC" designates no standard exists for the compound.
10. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
11. "PB" designates Passive Bag sampling technique.
12. " - - - " designates compound not analyzed.

Table 6-8

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area G Area Between Barge Turnaround and Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GP-46 11/21/02	GP-47 11/21/02	GP-48 DRY	GP-49 11/21/02	GP-50 11/21/02
1,1,1-Trichloroethane	5	2 U	1 U	---	20 U	10 U
1,1-Dichloroethane	5	0.8 J	1 U	---	20 U	10 U
1,1-Dichloroethene	5	2 U	1 U	---	20 U	10 U
1,2,4-Trimethylbenzene	5	2 U	1 U	---	20 U	10 U
1,3,5-Trimethylbenzene	5	2 U	1 U	---	20 U	10 U
2-Phenylbutane	5	2 U	1 U	---	20 U	10 U
Acetone	NC	---	---	---	---	---
Benzene	1	2 U	1 U	---	20 U	10 U
Chlorobenzene	5	2 U	1 U	---	20 U	10 U
cis-1,2-Dichloroethene	5	11	6	---	600	120
Cymene	5	2 U	1 U	---	20 U	10 U
Ethylbenzene	5	2 U	1 U	---	20 U	10 U
Isopropylbenzene	5	2 U	1 U	---	20 U	10 U
m&p-xylene	5	4 U	2 U	---	40 U	20 U
Methylene chloride	5	6.1	1 U	---	20 U	10 U
Naphthalene	NC	2 U	1 U	---	20 U	10 U
n-Propylbenzene	5	2 U	1 U	---	20 U	10 U
o-Xylene	5	2 U	1 U	---	20 U	10 U
Tetrachloroethene	5	2 U	1 U	---	4.1 J	10 U
Toluene	5	0.67 J	1 U	---	20 U	10 U
trans-1,2-Dichloroethene	5	0.83 J	1 U	---	6.4 J	10 U
Trichloroethene	5	57	13	---	170	10 U
Vinyl chloride	2	8.1	0.65 J	---	80	240

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "D" designates that the detected concentration is from the diluted analysis.
9. "NC" designates no standard exists for the compound.
10. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
11. "PB" designates Passive Bag sampling technique.
12. " - - -" designates compound not analyzed.

Table 6-8

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area G Area Between Barge Turnaround and Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GP-51 11/21/02	GP-52 DRY	GP-53 11/21/02	GP-54 11/21/02	GP-55 DRY
1,1,1-Trichloroethane	5	200 U	---	50 U	1 U	---
1,1-Dichloroethane	5	200 U	---	50 U	1 U	---
1,1-Dichloroethene	5	200 U	---	50 U	1 U	---
1,2,4-Trimethylbenzene	5	200 U	---	50 U	1 U	---
1,3,5-Trimethylbenzene	5	200 U	---	50 U	1 U	---
2-Phenylbutane	5	200 U	---	50 U	1 U	---
Acetone	NC	---	---	---	---	---
Benzene	1	200 U	---	50 U	1 U	---
Chlorobenzene	5	200 U	---	50 U	0.33 J	---
cis-1,2-Dichloroethene	5	6000	---	1300	7.1	---
Cymene	5	200 U	---	50 U	1 U	---
Ethylbenzene	5	200 U	---	50 U	1 U	---
Isopropylbenzene	5	200 U	---	50 U	1 U	---
m&p-xylene	5	140 J	---	100 U	0.38 J	---
Methylene chloride	5	200 U	---	50 U	1 U	---
Naphthalene	NC	200 U	---	50 U	1 U	---
n-Propylbenzene	5	200 U	---	50 U	1 U	---
o-Xylene	5	200 U	---	50 U	1 U	---
Tetrachloroethene	5	200 U	---	50 U	0.3 J	---
Toluene	5	570	---	50 U	1 U	---
trans-1,2-Dichloroethene	5	200 U	---	50 U	1 U	---
Trichloroethene	5	110 J	---	110	6.2	---
Vinyl chloride	2	6500 D	---	200	0.59 J	---

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "D" designates that the detected concentration is from the diluted analysis.
9. "NC" designates no standard exists for the compound.
10. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
11. "PB" designates Passive Bag sampling technique.
12. " - - -" designates compound not analyzed.

Table 6-8

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area G Area Between Barge Turnaround and Manufacturing Building

COMPOUND	Class GA Standard (ug/L)	GP-56 11/21/02	GP-57 DRY	GP-58 DRY	MW-1 6/25/02	MW-1-PB 5/28/03
1,1,1-Trichloroethane	5	50 U	---	---	1 U	1.0 U
1,1-Dichloroethane	5	17 J	---	---	1 U	1.0 U
1,1-Dichloroethene	5	50 U	---	---	1 U	1.0 U
1,2,4-Trimethylbenzene	5	380	---	---	1 U	---
1,3,5-Trimethylbenzene	5	160	---	---	1 U	---
2-Phenylbutane	5	14 J	---	---	1 U	---
Acetone	NC	---	---	---	2.5 J	8.3 R
Benzene	1	50 U	---	---	1 U	1.0 U
Chlorobenzene	5	50 U	---	---	1 U	1.0 U
cis-1,2-Dichloroethene	5	1400	---	---	3.4	4.7
Cymene	5	46 J	---	---	1 U	---
Ethylbenzene	5	15 J	---	---	1 U	1.0 U
Isopropylbenzene	5	15 J	---	---	1 U	---
m&p-xylene	5	89 J	---	---	1 U	1.0 U
Methylene chloride	5	50 U	---	---	2 U	1.0 U
Naphthalene	NC	30 J	---	---	1 U	---
n-Propylbenzene	5	33 J	---	---	1 U	---
o-Xylene	5	62	---	---	1 U	1.0 U
Tetrachloroethene	5	14 J	---	---	1 U	1.0 U
Toluene	5	450	---	---	1 U	1.0 U
trans-1,2-Dichloroethene	5	11 J	---	---	1 U	1.0 U
Trichloroethene	5	37 J	---	---	5.9	3.2
Vinyl chloride	2	310	---	---	0.42 J	1.0 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "B" designates that the compound was detected in the associated blank as well.
8. "D" designates that the detected concentration is from the diluted analysis.
9. "NC" designates no standard exists for the compound.
10. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
11. "PB" designates Passive Bag sampling technique.
12. "- -" designates compound not analyzed.

Table 6-9

Summary of Detected Compounds

Old Erie Canal Site
Clyde, New York

Area H Area South of Barge Canal and Clyde River

Compound	Class GA Standard (ug/L)	MW-10B 12/17/02	MW-10B-PB 5/27/03	MW-11B 12/17/02	MW-11B-PB 5/27/03	MW-11S 12/17/02	MW-11S-PB 5/27/03	MW-12B 12/18/02	MW-12B-PB 5/27/03	MW-12S 12/18/02	MW-12S-PB 5/27/03
Acetone	NC	5 U	10 R	5 U	9.1 R	5 U	7.1 R	5 R	12 R	510 J	8.8 R
Chlorobenzene	5	1 U	1.0 U	1 U	1.0 U	0.29 J	1.0 U	1 U	1.0 U	5 U	1.0 U
Toluene	5	1 U	1.0 U	1 U	1.0 U	1 U	1.0 U	0.23 J	1.0 U	5 U	1.0 U

Notes:

1. All units in ug/L.
2. All analyses from 6/24/02 to 12/19/02 performed by Severn Trent Laboratories, Inc. of Buffalo, New York.
3. All analyses from 4/24/02 to present performed by Columbia Analytical Services, Inc. of Rochester, New York.
4. Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
5. "U" designates that the compound was not detected at or above the quantitation limit shown.
6. "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
7. "NC" designates no standard exists for the compound.
8. "R" designates that the reported sample result is not usable. Results obtained from passive bag samples for acetone are "R" flagged due to slow diffusion rates for the compound.
9. "PB" designates Passive Bag sampling technique.

Table 6-10

Natural Attenuation Parameters

Old Erie Canal Site
Clyde, New York

Constituent	MW-1S 6/26/02	MW-1S 5/28/03	MW-4S 6/25/02	MW-4S 5/29/03	MW-4B 6/25/02	Dup. Of MW-4B 6/25/02	MW-4B 5/29/03
Lab Tested							
Trichloroethene	1000	NA	0.36 J	1.0 U	1900 J	2600	100 U
cis-1,2-Dichloroethene	3700	NA	120 D	3.2	58000	79000	32000
Vinyl chloride	280	NA	110 D	1.4	27000	42000	14000
DCE to TCE Ratio	3.7		333.3	3.2	30.5	30.4	320.0
Chloride	75.4	173	7.5	5.42	204	204	207
Cyanide (total)	10 U	NA	10 U	NA	10 U	10 U	NA
Conductivity	922	1220	799	763	2660	2640	2540
Nitrate (as N)	0.22 J	0.500 U	0.19 J	0.500 U	0.05 UJ	0.05 UJ	0.500 U
pH (water)	6.98	6.81	7.14	7.02	6.92	7.01	6.76
Dissolved Organic Carbon (DOC)	2.1	2.26	3.6	4.62	4	4.2	7.23
Sulfate	26.7	25.6	77.6	74.7	965	938	991
Sulfide	1 U	1.1	1 U	1.00 U	1 U	1 U	1.00 U
Alkalinity, Total(As CaCO ₃)	359	391	358	358	382	378	401
Turbidity	5.8	0.960	19.3	29.7	5.9	5.2	2.30
Ethane	9.6 J	7.3	5.4 UJ	4.5	430 DJ	200 DJ	270
Ethene	2 UJ	1.0 U	13 UJ	12	1200 DJ	640 DJ	860
Methane	26 J	13	43 UJ	34	1400 J	1600 DJ	1200
Iron - Total	0.0197 BJ	NA	1.48 J	1.48 J	0.702 J	0.653 J	NA
Field Tested							
Iron II	NA	0.0	1.3	1.6	1.0	NA	1.0
Redox Potential	277.6	-42.0	-35.0	-15.2	41.8	NA	-62.7
Temperature	16.63	12.40	13.56	9.09	13.10	NA	10.71
Dissolved Oxygen	0.69	2.99	0.55	1.39	0.55	NA	1.89
pH	6.21	6.82	5.18	7.04	5.69	NA	6.87
Turbidity	4.21	0.76	45.50	11.90	1.92	NA	4.06

Notes:

- Units for chloride, soluble organic carbon, sulfate, sulfide, iron II, dissolved oxygen and total alkalinity are mg/L. Units for cyanide are ug/L. Units for Leachable Specific Conductance are umhos/cm. Units for pH are standard units. Units for turbidity are n.t.u. units for temperature are degrees Celsius. Units for methane, ethane, and ethene are ug/L.
- All analyses performed by Severn Trent Laboratories (STL), Inc. of Buffalo, New York with the exception of dissolved gases (methane, ethane, ethene), which was performed by STL Savannah.
- "U" designates that the compound was not detected at or above the quantitation limit shown.
- "NA" indicates the parameter was not analyzed for.
- "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
- "R" designates that the reported sample result is not usable.

Table 6-10

Natural Attenuation Parameters

Old Erie Canal Site
Clyde, New York

Constituent	MW-6S 6/26/02	MW-6S 5/28/03	MW-7S 6/24/02	MW-7S 5/28/03	EMW-2 6/26/02	EMW-2 5/28/03	EMW-4 6/26/02
Lab Tested							
Trichloroethene	960 J	960 J	3.7	1.0 U	2 U	2.5 U	1 U
cis-1,2-Dichloroethene	80000 D	9500	1500 D	140	26	15	1.1
Vinyl chloride	38000	4800	81 D	2.0	53	640	11
DCE to TCE Ratio	83.3	9.9	405.4	140.0	13.0	6.0	
Chloride	306	199	76.8	81.3	34.4	64.4	48.7
Cyanide (total)	3.1	NA	10 U	NA	10 U	NA	10 U
Conductivity	1890	1560	1340	1290	929	968	806
Nitrate (as N)	0.05 UJ	0.500 U	0.05 UJ	0.500 U	0.05 UJ	0.500 U	0.05 UJ
pH (water)	6.48	6.53	7.03	6.96	6.92	6.86	7.07
Dissolved Organic Carbon (DOC)	37.7	27.7	2	6.62	6.6	12.7	5
Sulfate	16.4	47.6	294	346	2	2.00 U	1.7
Sulfide	1 U	1.00 U	1 U	1.0	1 U	1.00 U	1 U
Alkalinity, Total(As CaCO3)	482	545	312	293	466	450	353
Turbidity	412	191	2.4	2.38	174	200	319
Ethane	1500 DJ	650	2 UJ	1.0 U	12 J	48	180 DJ
Ethene	3100 DJ	500	2 UJ	1.0 U	66 J	45	28 J
Methane	5300 J	1900	6.6 J	3.4	1700 J	1200	7000 J
Iron - Total	59.5 J	NA	0.712 J	NA	13.4 J	NA	27.9 J
Field Tested							
Iron II	4.5	3.6	0.8	0.0	6.0	3.4	4.5
Redox Potential	-92.3	-107.1	206.1	-16.1	-84.2	-106.3	-173.3
Temperature	15.84	11.84	11.40	9.38	16.15	12.19	14.46
Dissolved Oxygen	0.80	2.61	0.49	1.24	0.73	0.81	0.39
pH	5.57	6.61	6.93	6.93	6.34	6.94	6.15
Turbidity	23.00	26.60	14.20	6.32	1.62	5.01	12.30

Notes:

- Units for chloride, soluble organic carbon, sulfate, sulfide, iron II, dissolved oxygen and total alkalinity are mg/L. Units for cyanide are ug/L. Units for Leachable Specific Conductance are umhos/cm. Units for pH are standard units. Units for turbidity are n.t.u. units for temperature are degrees Celsius. Units for methane, ethane, and ethene are ug/L.
- All analyses performed by Severn Trent Laboratories (STL), Inc. of Buffalo, New York with the exception of dissolved gases (methane, ethane, ethene), which was performed by STL Savannah.
- "U" designates that the compound was not detected at or above the quantitation limit shown.
- "NA" indicates the parameter was not analyzed for.
- "J" designates that the detected concentration should be considered estimated because

TABLE 6-11

Bioattenuation Screening Process

Analyte	MW-1S		MW-4S		MW-4B		MW-6S		MW-7S		EMW-2		EMW-4	
	Concentration	Score	Concentration	Score	Concentration	Score	Concentration	Score	Concentration	Score	Concentration	Score	Concentration	Score
Chloride (mg/L)	75.4	1	5.42	0	204	1	306	1	76.8	1	34.4	1	48.7	1
Cyanide (total)	10		NA		10		3.1		10		10		10	
Conductivity	922		763		2660		1890		1340		929		806	
Nitrate (mg/L)	0.22	2	0.500	2	0.05	2	0.05	2	0.05	2	0.05	2	0.05	2
pH (water)	6.98	0	7.02	0	6.92	0	6.48	0	7.03	0	6.92	0	7.07	0
TOC (mg/L)	2.1	0	4.62	0	4	0	37.7	2	2	0	6.6	0	5	0
Sulfate (mg/L)	26.7	0	74.7	0	965	0	16.4	2	294	0	2	2	1.7	2
Sulfide	1	0	1.00	0	1	0	1	0	1	0	1	0	1	0
Alkalinity (mg/L)	359	1	358	1	382	1	482	1	312	1	466	1	353	1
Turbidity	5.8		29.7		5.9		412		2.4		174		319	
Ethane	0.0096	0	0.0045	0	0.43	3	1.5	3	0.002	0	0.012	2	0.18	3
Ethene	0.002	0	0.012	2	1.2	3	3.1	3	0.002	0	0.066	2	0.028	2
Methane (mg/L)	0.026	0	0.034	0	1.4	3	5.3	3	0.0066	0	1.7	3	7	3
Iron (II) (mg/L)	0.0	0	1.6	3	1.0	0	4.5	3	0.8	0	6.0	3	4.5	3
ORP (mV)	277.6	0	-15.2	1	41.8	1	-92.3	1	206.1	0	-84.2	1	-173.3	2
Temperature	16.63	0	9.09	0	13.10	0	15.84	0	11.40	0	16.15	0	14.46	0
Dissolved oxygen (mg/L)	0.69	0	1.39	0	0.55	0	0.80	0	0.49	3	0.73	0	0.39	3
pH	6.21		7.04		5.69		5.57		6.93		6.34		6.15	
Turbidity	4.21		11.90		1.92		23.00		14.20		1.62		12.30	
BTEX (mg/L)	ND	2	0.0012	0	ND	2	9.8	2	ND	2	ND	2	ND	2
Hydrogen	NA		NA		NA		NA		NA		NA		NA	
TCE DP of PCE?	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0
DCE DP of TCE?	yes	2	yes	2	yes	2	yes	2	yes	2	yes	2	yes	2
VC DP of DCE?	yes	2	yes	2	yes	2	yes	2	yes	2	yes	2	yes	2
Total Score =	10		13		20		27		13		23		28	

Note: NA - Not available

Table 11-1
Summary of Constituents Detected in Storm Water
Old Erie Canal, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Summary Statistics		Sample ID for Max Detect
			Minimum	Maximum	
1,1,1-Trichloroethane	ug/L	2 / 4	2.0	5.2	MH-3A
1,1-Dichloroethane	ug/L	1 / 4	3.2	3.2	MH-3A
Acetone	ug/L	1 / 4	50	50	CB-3
cis-1,2-Dichloroethene	ug/L	4 / 4	160	920	MH-3B
Methylene chloride	ug/L	3 / 4	1.9	6.0	MH-3B
Tetrachloroethene	ug/L	3 / 4	6.2	69	MH-3B
trans-1,2-Dichloroethene	ug/L	3 / 4	2.1	7.4	MH-3B
Trichloroethene	ug/L	4 / 4	12	83	MH-3A
Vinyl chloride	ug/L	4 / 4	20	65	MH-3B

ug/L = Micrograms per liter.

Table 11-2
Summary of Constituents Detected in Surface Water
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent ¹	Units	Frequency of Detection	Sample ID with Max Detect	Summary Statistics	
				Minimum	Maximum
Aluminum	ug/L	6 / 6	RI SW-04	54	1,950
Antimony	ug/L	1 / 6	RI SW-04	4.3	4.3
Arsenic	ug/L	3 / 6	RI SW-04	7.5	16
Barium	ug/L	6 / 6	RI SW-08	54	395
Beryllium	ug/L	2 / 6	RI SW-05	0.30	0.36
Cadmium	ug/L	3 / 6	RI SW-04	0.41	0.45
Calcium	ug/L	6 / 6	RI SW-04	95,200	126,000
Chromium	ug/L	3 / 6	RI SW-04	1.6	7.4
Cobalt	ug/L	2 / 6	RI SW-04	1.7	2.9
Copper	ug/L	2 / 6	RI SW-04	11	18
Iron	ug/L	6 / 6	RI SW-04	192	39,600
Lead	ug/L	4 / 6	RI SW-04	2.6	53
Magnesium	ug/L	6 / 6	RI SW-09	14,800	23,900
Manganese	ug/L	6 / 6	RI SW-08	40	1,510
Nickel	ug/L	4 / 6	RI SW-04	1.4	6.6
Potassium	ug/L	6 / 6	RI SW-09	2,730	8,590
Vanadium	ug/L	2 / 6	RI SW-04	6	8
Zinc	ug/L	6 / 6	RI SW-04	10	582
Benzo(a)anthracene	ug/L	1 / 6	RI SW-08	1.0	1.0
Benzo(a)pyrene	ug/L	2 / 6	RI SW-04	2.0	4.0
Benzo(b)fluoranthene	ug/L	2 / 6	RI SW-04	3.0	5.0
Benzo(g,h,i)perylene	ug/L	2 / 6	RI SW-04	3.0	5.0
Benzo(k)fluoranthene	ug/L	2 / 6	RI SW-04	2.0	4.0
Chrysene	ug/L	2 / 6	RI SW-04	3.0	5.0
Dibenzo(a,h)anthracene	ug/L	1 / 6	RI SW-08	0.60	0.60
Di-n-octyl phthalate	ug/L	1 / 6	RI SW-03	3.0	3.0
Fluoranthene	ug/L	2 / 6	RI SW-04	6.0	8.0
Indeno(1,2,3-cd)pyrene	ug/L	2 / 6	RI SW-04	2.0	4.0
Pentachlorophenol	ug/L	1 / 6	RI SW-07	2.0	2.0
Phenanthrene	ug/L	1 / 6	RI SW-08	2.0	2.0
Pyrene	ug/L	2 / 6	RI SW-04	4.0	6.0
1,1,1-Trichloroethane	ug/L	1 / 10	RI SW-09	3.3	3.3
1,1-Dichloroethane	ug/L	3 / 10	RI SW-09	0.26	2.2
cis-1,2-Dichloroethene	ug/L	10 / 10	RI SW-09	8.8	530
Tetrachloroethene	ug/L	2 / 10	RI SW-09	3.9	9
trans-1,2-Dichloroethene	ug/L	2 / 10	RI SW-09	2.0	3.9
Trichloroethene	ug/L	10 / 10	RI SW-09	1.0	120
Vinyl chloride	ug/L	9 / 10	RI SW-09	0.84	36
pH (water)	ph unit	6 / 6	RI SW-05	7.4	8.0

1. Data collected on May 21, 2002 by O'Brien & Gere.
ug/L = Micrograms per liter.

Table 11-3
Summary of Constituents Detected in Sediment
Old Erie Canal, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent ¹	Units	Frequency of Detection	Sample ID for Max Detect	Summary Statistics	
				Minimum	Maximum
Aluminum	mg/kg	8 / 8	RI SED 06	2,070	14,400
Antimony	mg/kg	8 / 8	RI SED 06	3.7	33
Arsenic	mg/kg	8 / 8	RI SED 06	9.1	113
Barium	mg/kg	8 / 8	RI SED 04	136	464
Beryllium	mg/kg	8 / 8	RI SED 06	0.14	0.84
Cadmium	mg/kg	8 / 8	RI SED 06	1.2	86
Calcium	mg/kg	8 / 8	RI SED 10	12,500	75,000
Chromium	mg/kg	8 / 8	RI SED 06	8.7	209
Cobalt	mg/kg	8 / 8	RI SED 06	2.8	31
Copper	mg/kg	8 / 8	RI SED 08	32	609
Iron	mg/kg	8 / 8	RI SED 04	17,100	119,000
Lead	mg/kg	8 / 8	RI SED 08	102	331
Magnesium	mg/kg	8 / 8	RI SED 09	2,880	18,700
Manganese	mg/kg	8 / 8	RI SED 09	110	3,230
Mercury	mg/kg	8 / 8	RI SED 06	0.28	0.89
Nickel	mg/kg	8 / 8	RI SED 06	14	79
Potassium	mg/kg	8 / 8	RI SED 06	590	2,600
Selenium	mg/kg	8 / 8	RI SED 07	1.5	7.2
Silver	mg/kg	7 / 8	RI SED 06	0.46	6.3
Sodium	mg/kg	1 / 8	RI SED 10	493	493
Vanadium	mg/kg	8 / 8	RI SED 06	7.6	60
Zinc	mg/kg	8 / 8	RI SED 04	184	1,700
Aroclor-1254	ug/kg	1 / 8	RI SED 10	180	180
Aroclor-1260	ug/kg	6 / 8	RI SED 08	64	540
4,4'DDD	ug/kg	1 / 8	RI SED 03	58	58
4,4'DDE	ug/kg	2 / 8	RI SED 03	32	79
4,4'-DDT	ug/kg	1 / 8	RI SED 03	58	58
Acenaphthene	ug/kg	2 / 8	RI SED 09	1,200	3,100
Anthracene	ug/kg	3 / 8	RI SED 09	1,900	16,000
Benzo(a)anthracene	ug/kg	7 / 8	RI SED 09	270	88,000
Benzo(a)pyrene	ug/kg	8 / 8	RI SED 09	330	97,000
Benzo(b)fluoranthene	ug/kg	8 / 8	RI SED 09	400	130,000
Benzo(g,h,i)perylene	ug/kg	5 / 8	RI SED 09	780	35,000
Benzo(k)fluoranthene	ug/kg	8 / 8	RI SED 09	340	78,000
bis(2-Ethylhexyl)phthalate	ug/kg	8 / 8	RI SED 04	880	8,800
Chrysene	ug/kg	8 / 8	RI SED 09	360	100,000
Dibenzo(a,h)anthracene	ug/kg	3 / 8	RI SED 09	6,000	16,000
Dibenzofuran	ug/kg	2 / 8	RI SED 09	850	1,800
Fluoranthene	ug/kg	8 / 8	RI SED 09	600	230,000
Fluorene	ug/kg	2 / 8	RI SED 09	2,000	4,800
Indeno(1,2,3-cd)pyrene	ug/kg	5 / 8	RI SED 09	670	38,000
Naphthalene	ug/kg	1 / 8	RI SED 10	1,400	1,400
Phenanthrene	ug/kg	5 / 8	RI SED 09	610	120,000
Pyrene	ug/kg	8 / 8	RI SED 09	450	140,000
1,1,1-Trichloroethane	ug/kg	1 / 8	RI SED 08	5.0	5.0
1,1-Dichloroethane	ug/kg	3 / 8	RI SED 08	3.0	5.0
Acetone	ug/kg	1 / 8	RI SED 10	41	41
Carbon disulfide	ug/kg	1 / 8	RI SED 09	4.0	4.0
cis-1,2-Dichloroethene	ug/kg	8 / 8	RI SED 09	4.0	1,000
Methylene chloride	ug/kg	1 / 8	RI SED 10	10	10
Tetrachloroethene	ug/kg	2 / 8	RI SED 08	13	50

Table 11-3
Summary of Constituents Detected in Sediment
Old Erie Canal, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent ¹	Units	Frequency of Detection	Sample ID for Max Detect	Summary Statistics	
				Minimum	Maximum
trans-1,2-Dichloroethene	ug/kg	2 / 8	RI SED 09	5.0	6.0
Trichloroethene	ug/kg	5 / 8	RI SED 08	6.0	230
Vinyl chloride	ug/kg	5 / 8	RI SED 09	3.0	120
Cyanide (total)	mg/kg	2 / 8	RI SED 04	2.8	3.4
pH (soil)	ph units	7 / 7	RI SED 05	7.4	7.7

1. Data collected on May 21, 2002, by O'Brien & Gere.

mg/kg = Milligrams per kilogram.

ug/kg = Micrograms per kilogram.

Table 11-4
Summary of Constituents Detected in Subsurface Soil
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Summary Statistics			Sample ID for Max Detect	Range of Detection Limit
			Minimum	Mean	Maximum		
Aluminum	mg/kg	11 / 11	4,110	6,898	11,100	SS-39	NA - NA
Iron	mg/kg	11 / 11	8,020	13,565	21,300	SS-39	NA - NA
Lead	mg/kg	11 / 11	4.3	143	1,480	SS-GP-25	NA - NA
Magnesium	mg/kg	11 / 11	3,650	14,410	23,800	SS-GD-32	NA - NA
Manganese	mg/kg	11 / 11	183	443	1,070	SS-GD-32	NA - NA
Mercury	mg/kg	3 / 11	0.030	0.029	0.084	SS-GD-7	0.042 - 0.05
Nickel	mg/kg	11 / 11	7.9	12	17	SS-39	NA - NA
Potassium	mg/kg	11 / 11	967	1,311	1,830	SS-GP-20	NA - NA
Arsenic	mg/kg	11 / 11	1.5	3.6	6.5	SS-39	NA - NA
Barium	mg/kg	11 / 11	32	51	84	SS-39	NA - NA
Beryllium	mg/kg	2 / 11	0.64	0.61	0.64	SS-39	1.08 - 1.32
Chromium	mg/kg	11 / 11	6.1	10	15	SS-39	NA - NA
Cobalt	mg/kg	3 / 11	6.5	6.5	8.4	SS-39	10.8 - 13.2
Copper	mg/kg	11 / 11	11	16	23	SS-GD-7	NA - NA
Vanadium	mg/kg	11 / 11	9.30	15	21	SS-39	NA - NA
Zinc	mg/kg	11 / 11	28	38	62	SS-GD-7	NA - NA
Calcium	mg/kg	11 / 11	4,210	50,093	116,000	SS-GD-32	NA - NA
Selenium	mg/kg	5 / 11	0.68	0.70	0.92	SS-GD-7	1.08 - 1.2
4,4'-DDT	ug/kg	1 / 11	34	8.1	34	SS-GD-7	3.6 - 16.8
Chlordane	ug/kg	2 / 11	32	62	48	SS-GP-20	36 - 420
Dieldrin	ug/kg	1 / 11	130	17	130	SS-GD-7	3.6 - 16.8
4,4'DDE	ug/kg	1 / 11	26	7.4	26	SS-GD-7	3.6 - 16.8
4-Methylphenol	ug/kg	1 / 11	31	353	31	SS-GP-25	700 - 840
bis(2-Ethylhexyl)phthalate	ug/kg	6 / 11	37	244	180	SS-GP-16	700 - 840
Di-n-octyl phthalate	ug/kg	2 / 11	21	316	30	SS-X-2	700 - 840
Anthracene	ug/kg	3 / 11	26	321	470	SS-GD-7	700 - 780
Pyrene	ug/kg	4 / 11	33	897	6,800	SS-GD-7	700 - 780
Benzo(g,h,i)perylene	ug/kg	3 / 11	61	493	2,300	SS-GD-7	700 - 780
Indeno(1,2,3-cd)pyrene	ug/kg	3 / 11	57	483	2,200	SS-GD-7	700 - 780
Benzo(b)fluoranthene	ug/kg	3 / 11	82	616	3,600	SS-GD-7	700 - 780
Fluoranthene	ug/kg	4 / 11	43	1,111	9,100	SS-GD-7	700 - 780
Benzo(k)fluoranthene	ug/kg	3 / 11	84	607	3,500	SS-GD-7	700 - 780
Chrysene	ug/kg	3 / 11	110	703	4,500	SS-GD-7	700 - 780
Benzo(a)pyrene	ug/kg	3 / 11	96	636	3,800	SS-GD-7	700 - 780

Table 11-4
Summary of Constituents Detected in Subsurface Soil
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Summary Statistics			Sample ID for Max Detect	Range of Detection Limit
			Minimum	Mean	Maximum		
Dibenzo(a,h)anthracene	ug/kg	3 / 11	25	301	260	SS-GD-7	700 - 780
Benzo(a)anthracene	ug/kg	3 / 11	98	628	3,700	SS-GD-7	700 - 780
Di-n-butylphthalate	ug/kg	1 / 11	49	352	49	SS-X-2	700 - 840
Phenanthrene	ug/kg	3 / 11	140	656	3,900	SS-GD-7	700 - 780
Fluorene	ug/kg	2 / 11	22	315	28	SS-GP-20	700 - 840
Naphthalene	ug/kg	2 / 11	54	321	56	SS-GP-20	700 - 840
Ethylbenzene	ug/kg	2 / 11	2.0	550	190	SS-X-2	24 - 3200
4-Methyl-2-pentanone	ug/kg	1 / 11	1,400	666	1,400	SS-GP-25	22 - 3200
Toluene	ug/kg	2 / 11	4,300	1,306	5,800	SS-X-2	24 - 2800
cis-1,2-Dichloroethene	ug/kg	8 / 11	14	2,541	14,000	SS-X-2	24 - 30
Vinyl chloride	ug/kg	6 / 11	25	436	1,200	SS-X-2	24 - 2800
Methylene chloride	ug/kg	5 / 11	30	602	200	SS-GP-33	24 - 3200
Trichloroethene	ug/kg	6 / 11	6.0	946	4,700	SS-GP-25	24 - 3200
pH (soil)	ph units	11 / 11	7.1	7.7	8.3	SS-GD-32	NA - NA

Table 11-5
Summary of Constituents Detected in Surface Soil
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent ¹	Units	Frequency of Detection	Detected Concentration	Sample ID
Aluminum	mg/kg	1 / 1	7,530	RI SS-01
Antimony	mg/kg	1 / 1	1.2	RI SS-01
Arsenic	mg/kg	1 / 1	7.5	RI SS-01
Barium	mg/kg	1 / 1	32	RI SS-01
Beryllium	mg/kg	1 / 1	0.24	RI SS-01
Cadmium	mg/kg	1 / 1	0.39	RI SS-01
Calcium	mg/kg	1 / 1	2,560	RI SS-01
Chromium	mg/kg	1 / 1	6.3	RI SS-01
Cobalt	mg/kg	1 / 1	2.5	RI SS-01
Copper	mg/kg	1 / 1	13	RI SS-01
Iron	mg/kg	1 / 1	7,830	RI SS-01
Lead	mg/kg	1 / 1	47	RI SS-01
Magnesium	mg/kg	1 / 1	1,040	RI SS-01
Manganese	mg/kg	1 / 1	97	RI SS-01
Mercury	mg/kg	1 / 1	0.098	RI SS-01
Nickel	mg/kg	1 / 1	5.1	RI SS-01
Potassium	mg/kg	1 / 1	549	RI SS-01
Silver	mg/kg	1 / 1	0.18	RI SS-01
Vanadium	mg/kg	1 / 1	12	RI SS-01
Zinc	mg/kg	1 / 1	54	RI SS-01
4,4'-DDE	mg/kg	1 / 1	2.1	RI SS-01
4,4'-DDT	mg/kg	1 / 1	0.37	RI SS-01
Benzo(a)pyrene	mg/kg	1 / 1	0.070	RI SS-01
Benzo(b)fluoranthene	mg/kg	1 / 1	0.080	RI SS-01
Benzo(g,h,i)perylene	mg/kg	1 / 1	0.045	RI SS-01
Benzo(k)fluoranthene	mg/kg	1 / 1	0.060	RI SS-01
bis(2-Ethylhexyl)phthalate	mg/kg	1 / 1	0.13	RI SS-01
Chrysene	mg/kg	1 / 1	0.080	RI SS-01
Di-n-butylphthalate	mg/kg	1 / 1	0.028	RI SS-01
Di-n-octyl phthalate	mg/kg	1 / 1	0.041	RI SS-01
Fluoranthene	mg/kg	1 / 1	0.11	RI SS-01
Indeno(1,2,3-cd)pyrene	mg/kg	1 / 1	0.043	RI SS-01
Phenanthrene	mg/kg	1 / 1	0.038	RI SS-01
Pyrene	mg/kg	1 / 1	0.086	RI SS-01
pH (soil)	ph units	1 / 1	6.6	RI SS-01

1. Data from surface soil sample collected on May 21, 2002, by O'Brien & Gere.

2. Screening values presented in *Ecological Screening Values for Surface Water, Sediment*

mg/kg = Milligrams per kilogram.

NAP = Not applicable.

NV = No screening value.

Table 11-6
Summary of Constituents Detected in Ground Water
Old Erie Canal, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Summary Statistics			Sample ID for Max Detect	Range of Detection Limit
			Minimum	Mean	Maximum		
Aluminum	ug/L	21 / 25	31	216	1,300	MW-9S	42.6 - 42.6
Iron	ug/L	25 / 25	20	6,290	59,500	MW-6S	NA - NA
Lead	ug/L	4 / 25	2.0	2.0	2.5	MW-5S	3.8 - 3.8
Magnesium	ug/L	25 / 25	8,300	36,244	110,000	MW-7B	NA - NA
Manganese	ug/L	25 / 25	32	951	3,970	MW-5S	NA - NA
Nickel	ug/L	10 / 25	1.1	1.9	11	MW-6S	1.8 - 1.8
Potassium	ug/L	25 / 25	1,440	7,264	76,800	MW-2B	NA - NA
Sodium	ug/L	25 / 25	1,310	69,645	215,000	MW-8S	NA - NA
Antimony	ug/L	10 / 25	2.3	2.5	3.6	MW-8S	4.6 - 4.6
Arsenic	ug/L	10 / 25	2.4	4.1	17	MW-6S	4.8 - 4.8
Barium	ug/L	25 / 25	14	126	342	EMW-4	NA - NA
Beryllium	ug/L	10 / 25	0.40	0.39	0.77	MW-2B	0.6 - 0.6
Cadmium	ug/L	1 / 25	0.61	0.41	0.61	MW-7B	0.8 - 0.8
Chromium	ug/L	7 / 25	0.89	0.90	2.30	MW-9S	1.4 - 1.4
Cobalt	ug/L	12 / 25	0.84	1.3	4.7	EMW-3	1.4 - 1.4
Copper	ug/L	6 / 25	1.1	1.3	4.2	MW-9S	1.8 - 1.8
Vanadium	ug/L	15 / 25	0.64	1.1	3.4	MW-9S	1.2 - 1.2
Zinc	ug/L	25 / 25	2.9	6.4	17	EMW-3	NA - NA
Calcium	ug/L	25 / 25	45,100	248,364	614,000	X-1	NA - NA
2,4-Dimethylphenol	ug/L	3 / 25	0.90	9.0	3.0	MW-6S	20 - 20
4-Methylphenol	ug/L	1 / 25	66	12	66	MW-6S	20 - 20
Phenol	ug/L	1 / 25	5.0	9.8	5.0	MW-6S	20 - 20
bis(2-Ethylhexyl)phthalate	ug/L	2 / 25	9.0	9.9	9.0	MW-9S	20 - 20
Di-n-octyl phthalate	ug/L	1 / 25	4.0	9.8	4.0	MW-1	20 - 20
Di-n-butylphthalate	ug/L	8 / 25	0.50	7.94	15	EMW-2	20 - 20
Phenanthrene	ug/L	1 / 25	1.0	9.6	1.0	MW-6S	20 - 20
Butyl benzylphthalate	ug/L	1 / 25	1.0	9.6	1.0	MW-1	20 - 20
Naphthalene	ug/L	19 / 101	0.66	21	30	GP-56	2 - 400
Ethylbenzene	ug/L	9 / 101	0.33	148	360	GW-GP-6-042602-0810	2 - 4000
4-Methyl-2-pentanone	ug/L	1 / 39	1,000	1,589	1,000	MW-6S	10 - 20000
Toluene	ug/L	51 / 101	0.23	535	9,800	MW-6S	2 - 10000
Chlorobenzene	ug/L	5 / 101	0.21	145	0.33	GP-54	2 - 4000
Tetrachloroethene	ug/L	8 / 101	0.28	144	14	GP-56	2 - 4000
Xylene (total)	ug/L	3 / 39	0.70	806	0.71	EMW-2-121902	2 - 12000

Table 11-6
Summary of Constituents Detected in Ground Water
Old Erie Canal, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Summary Statistics			Sample ID for Max Detect	Range of Detection Limit
			Minimum	Mean	Maximum		
cis-1,2-Dichloroethene	ug/L	82 / 101	0.27	13,665	200,000	GW-X-3-050202 DL	2 - 10
trans-1,2-Dichloroethene	ug/L	30 / 101	0.23	251	420	GW-X-3-050202	2 - 10000
Acetone	ug/L	10 / 39	0.75	1,703	510	MW-12S121802	10 - 20000
Chloroform	ug/L	2 / 101	14	145	14	GW-GP-25-043002	2 - 4000
Benzene	ug/L	20 / 101	0.21	144	23	GW-GP-20-050202	2 - 4000
1,1,1-Trichloroethane	ug/L	1 / 101	0.20	145	0.20	GW-GP-17-042502-0815	2 - 4000
Chloromethane	ug/L	4 / 101	0.48	145	7.7	MW-12S121802	2 - 4000
Chloroethane	ug/L	2 / 101	0.61	145	0.64	EMW-4	2 - 4000
Vinyl chloride	ug/L	68 / 101	0.42	4,653	51,000	GW-GP-16-042502 DL	2 - 10
Methylene chloride	ug/L	12 / 101	0.30	164	1,200	MW-4B	2 - 8000
1,1-Dichloroethane	ug/L	12 / 101	0.21	145	28	GW-GP-28-050102	2 - 4000
1,1-Dichloroethene	ug/L	19 / 101	0.21	150	220	GW-X-1-043002	2 - 4000
1,1,2-Trichloroethane	ug/L	2 / 101	6.5	145	7.6	GW-X-1-043002	2 - 4000
Trichloroethene	ug/L	65 / 101	0.24	1,654	71,000	GW-GP-25-043002 DL	2 - 400
Cyanide (total)	ug/L	50 / 50	3.1	9.7	10	MW-9S	NA - NA
pH (water)	ph units	29 / 29	6.5	7.3	12	MW-12B121802	NA - NA

Table 11-7
Summary of Constituents Detected in Surface Soil Compared to Site-Specific Background Concentrations
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	On-Site Detected Concentration	Sample ID	Background (Sample SS-GD-7)	Detected Conc. Exceed Background?
Aluminum	mg/kg	1 / 1	7,530	RI SS-01	9,790	No
Antimony	mg/kg	1 / 1	1.2	RI SS-01	ND	No
Arsenic	mg/kg	1 / 1	7.5	RI SS-01	5.8	Exceed
Barium	mg/kg	1 / 1	32	RI SS-01	72	No
Beryllium	mg/kg	1 / 1	0.24	RI SS-01	ND	No
Cadmium	mg/kg	1 / 1	0.39	RI SS-01	ND	No
Calcium	mg/kg	1 / 1	2,560	RI SS-01	24,400	No
Chromium	mg/kg	1 / 1	6.3	RI SS-01	15	No
Cobalt	mg/kg	1 / 1	2.5	RI SS-01	ND	No
Copper	mg/kg	1 / 1	13	RI SS-01	23	No
Iron	mg/kg	1 / 1	7,830	RI SS-01	16,000	No
Lead	mg/kg	1 / 1	47	RI SS-01	29	Exceed
Magnesium	mg/kg	1 / 1	1,040	RI SS-01	4,970	No
Manganese	mg/kg	1 / 1	97	RI SS-01	277	No
Mercury	mg/kg	1 / 1	0.098	RI SS-01	0.084	Exceed
Nickel	mg/kg	1 / 1	5.1	RI SS-01	13	No
Potassium	mg/kg	1 / 1	549	RI SS-01	1,260	No
Silver	mg/kg	1 / 1	0.18	RI SS-01	ND	No
Vanadium	mg/kg	1 / 1	12	RI SS-01	20	No
Zinc	mg/kg	1 / 1	54	RI SS-01	62	No
4,4'DDD	ug/kg	1 / 1	480	RI SS-01	ND	No
4,4'DDE	ug/kg	1 / 1	2,100	RI SS-01	26	Exceed
4,4'DDT	ug/kg	1 / 1	370	RI SS-01	34	Exceed
Dieldrin	ug/kg	1 / 1	ND	RI SS-01	130	No
Anthracene	ug/kg	1 / 1	ND	RI SS-01	470	No
Benzo(a)anthracene	ug/kg	1 / 1	53	RI SS-01	3,700	No
Benzo(a)pyrene	ug/kg	1 / 1	70	RI SS-01	3,800	No
Benzo(b)fluoranthene	ug/kg	1 / 1	80	RI SS-01	3,600	No
Benzo(g,h,i)perylene	ug/kg	1 / 1	45	RI SS-01	2,300	No
Benzo(k)fluoranthene	ug/kg	1 / 1	60	RI SS-01	3,500	No
bis(2-Ethylhexyl)phthalate	ug/kg	1 / 1	130	RI SS-01	ND	No
Chrysene	ug/kg	1 / 1	80	RI SS-01	4,500	No
Dibenzo(a,h)anthracene	ug/kg	1 / 1	ND	RI SS-01	260	No
Di-n-butylphthalate	ug/kg	1 / 1	28	RI SS-01	ND	No
Di-n-octyl phthalate	ug/kg	1 / 1	41	RI SS-01	ND	No
Fluoranthene	ug/kg	1 / 1	110	RI SS-01	9,100	No
Indeno(1,2,3-cd)pyrene	ug/kg	1 / 1	43	RI SS-01	2,200	No
Phenanthrene	ug/kg	1 / 1	38	RI SS-01	3,900	No
Pyrene	ug/kg	1 / 1	86	RI SS-01	6,800	No
pH (soil)	ph units	1 / 1	6.6	RI SS-01	8.0	No

Friday 1998.

mg/kg = Milligrams per kilogram.

NAP = Not applicable.

NV = No screening value.

Table 11-8
Summary of Constituents Detected in Surface Water Compared to Site-Specific Background Concentrations
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Sample ID with Max Detect	Minimum Concentration		Maximum Concentration	
				Background	Site	Background	Site
Aluminum	ug/L	6 / 6	RI SW-04	120	54	240	1,950
Antimony	ug/L	1 / 6	RI SW-04	ND	4.3	ND	4.3
Arsenic	ug/L	3 / 6	RI SW-04	ND	8	ND	16
Barium	ug/L	6 / 6	RI SW-08	87	54	92	395
Beryllium	ug/L	2 / 6	RI SW-05	ND	0.30	ND	0.36
Cadmium	ug/L	3 / 6	RI SW-04	ND	0.41	ND	0.45
Calcium	ug/L	6 / 6	RI SW-04	109,000	95,200	127,000	126,000
Chromium	ug/L	3 / 6	RI SW-04	ND (0.9)	1.6	1.2	7.4
Cobalt	ug/L	2 / 6	RI SW-04	ND	1.7	ND	2.9
Copper	ug/L	2 / 6	RI SW-04	ND	11	ND	18
Iron	ug/L	6 / 6	RI SW-04	798	192	951	39,600
Lead	ug/L	4 / 6	RI SW-04	4.0	2.6	5.7	53
Magnesium	ug/L	6 / 6	RI SW-09	21,500	14,800	22,100	23,900
Manganese	ug/L	6 / 6	RI SW-08	87	40	110	1,510
Nickel	ug/L	4 / 6	RI SW-04	ND	1.4	1.6	6.6
Potassium	ug/L	6 / 6	RI SW-09	6,270	2,730	7,430	8,590
Vanadium	ug/L	2 / 6	RI SW-04	ND	6	ND	8
Zinc	ug/L	6 / 6	RI SW-04	17	10	25	582
Benzo(a)anthracene	ug/L	1 / 6	RI SW-08	ND	1.0	ND	1.0
Benzo(a)pyrene	ug/L	2 / 6	RI SW-04	ND	2.0	0.70	4.0
Benzo(b)fluoranthene	ug/L	2 / 6	RI SW-04	ND	3.0	ND	5.0
Benzo(g,h,i)perylene	ug/L	2 / 6	RI SW-04	ND	3.0	0.80	5.0
Benzo(k)fluoranthene	ug/L	2 / 6	RI SW-04	ND	2.0	0.70	4.0
Chrysene	ug/L	2 / 6	RI SW-04	ND	3.0	1.0	5.0
Dibenzo(a,h)anthracene	ug/L	1 / 6	RI SW-08	ND	0.60	ND	0.60
Di-n-octyl phthalate	ug/L	1 / 6	RI SW-03	ND	3.0	ND	3.0
Fluoranthene	ug/L	2 / 6	RI SW-04	ND	6.0	2.0	8.0
Indeno(1,2,3-cd)pyrene	ug/L	2 / 6	RI SW-04	ND	2.0	0.70	4.0
Pentachlorophenol	ug/L	1 / 6	RI SW-07	ND	2.0	ND	2.0
Phenanthrene	ug/L	1 / 6	RI SW-08	ND	2.0	ND	2.0
Pyrene	ug/L	2 / 6	RI SW-04	ND	4.0	1.0	6.0
1,1,1-Trichloroethane	ug/L	1 / 10	RI SW-09	ND	3.3	ND	3.3
1,1-Dichloroethane	ug/L	3 / 10	RI SW-09	ND	0.3	ND	2.2
cis-1,2-Dichloroethene	ug/L	10 / 10	RI SW-09	ND	9	0.27	530

Table 11-8
Summary of Constituents Detected in Surface Water Compared to Site-Specific Background Concentrations
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Sample ID with Max Detect	Minimum Concentration		Maximum Concentration	
				Background	Site	Background	Site
Tetrachloroethene	ug/L	2 / 10	RI SW-09	ND	4	ND	9
trans-1,2-Dichloroethene	ug/L	2 / 10	RI SW-09	ND	2.0	ND	3.9
Trichloroethene	ug/L	10 / 10	RI SW-09	ND	1	0.27	120
Vinyl chloride	ug/L	9 / 10	RI SW-09	ND	1	ND	36
pH (water)	ph units	6 / 6	RI SW-05	7.8	7.4	7.9	8.0

NYSDEC 1998. New York State Class C Criteria.

USEPA 1999. National Recommended Water Quality Criteria- Freshwater CCC µg/L

ug/L = Micrograms per liter.

NAP = Not applicable; no screening value was available.

Table 11-9
Summary of Constituents Detected in Sediment Compared to Background Concentrations
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Sample ID for Max Detect	Minimum Concentration		Maximum Concentration	
				Background	Site	Background	Site
Aluminum	mg/kg	8 / 8	RI SED 06	1,610	2,070	6,940	14,400
Antimony	mg/kg	8 / 8	RI SED 06	ND	3.7	1.8	33
Arsenic	mg/kg	8 / 8	RI SED 06	6.5	9.1	7.9	113
Barium	mg/kg	8 / 8	RI SED 04	58	136	154	464
Beryllium	mg/kg	8 / 8	RI SED 06	0.11	0.14	0.39	0.84
Cadmium	mg/kg	8 / 8	RI SED 06	1.5	1.2	4.5	86
Calcium	mg/kg	8 / 8	RI SED 10	26,900	12,500	43,300	75,000
Chromium	mg/kg	8 / 8	RI SED 06	22	8.7	23	209
Cobalt	mg/kg	8 / 8	RI SED 06	2.3	2.8	5.6	31
Copper	mg/kg	8 / 8	RI SED 08	39	32	66	609
Iron	mg/kg	8 / 8	RI SED 04	12,200	17,100	19,600	119,000
Lead	mg/kg	8 / 8	RI SED 08	142	102	289	331
Magnesium	mg/kg	8 / 8	RI SED 09	5,310	2,880	11,200	18,700
Manganese	mg/kg	8 / 8	RI SED 09	155	110	329	3,230
Mercury	mg/kg	8 / 8	RI SED 06	0.22	0.28	0.35	0.89
Nickel	mg/kg	8 / 8	RI SED 06	11	14	16	79
Potassium	mg/kg	8 / 8	RI SED 06	585	590	1,780	2,600
Selenium	mg/kg	8 / 8	RI SED 07	2.3	1.5	2.6	7.2
Silver	mg/kg	7 / 8	RI SED 06	ND	0.46	ND	6.3
Sodium	mg/kg	1 / 8	RI SED 10	ND	493	ND	493
Vanadium	mg/kg	8 / 8	RI SED 06	11	7.6	21	60
Zinc	mg/kg	8 / 8	RI SED 04	615	184	878	1,700
Aroclor-1254	ug/kg	1 / 8	RI SED 10	ND	180	ND	180
Aroclor-1260	ug/kg	6 / 8	RI SED 08	ND	64	ND	540
4,4'DDD	ug/kg	1 / 8	RI SED 03	ND	58	ND	58
4,4'DDE	ug/kg	2 / 8	RI SED 03	ND	32	ND	79
4,4'-DDT	ug/kg	1 / 8	RI SED 03	ND	58	ND	58
Acenaphthene	ug/kg	2 / 8	RI SED 09	ND	1,200	ND	3,100
Anthracene	ug/kg	3 / 8	RI SED 09	ND	1,900	640	16,000
Benzo(a)anthracene	ug/kg	7 / 8	RI SED 09	2,100	270	9,500	88,000
Benzo(a)pyrene	ug/kg	8 / 8	RI SED 09	3,400	330	17,000	97,000
Benzo(b)fluoranthene	ug/kg	8 / 8	RI SED 09	5,800	400	27,000	130,000
Benzo(g,h,i)perylene	ug/kg	5 / 8	RI SED 09	1,300	780	6,800	35,000
Benzo(k)fluoranthene	ug/kg	8 / 8	RI SED 09	3,500	340	22,000	78,000

Table 11-9
Summary of Constituents Detected in Sediment Compared to Background Concentrations
Old Erie Canal Site, Clyde, New York
Qualitative Human Health Risk Assessment

Constituent	Units	Frequency of Detection	Sample ID for Max Detect	Minimum Concentration		Maximum Concentration	
				Background	Site	Background	Site
bis(2-Ethylhexyl)phthalate	ug/kg	8 / 8	RI SED 04	3,300	880	5,600	8,800
Chrysene	ug/kg	8 / 8	RI SED 09	3,500	360	20,000	100,000
Dibenzo(a,h)anthracene	ug/kg	3 / 8	RI SED 09	ND	6,000	2,800	16,000
Dibenzofuran	ug/kg	2 / 8	RI SED 09	ND	850	ND	1,800
Fluoranthene	ug/kg	8 / 8	RI SED 09	5,600	600	35,000	230,000
Fluorene	ug/kg	2 / 8	RI SED 09	ND	2,000	ND	4,800
Indeno(1,2,3-cd)pyrene	ug/kg	5 / 8	RI SED 09	1,300	670	7,500	38,000
Naphthalene	ug/kg	1 / 8	RI SED 10	ND	1,400	ND	1,400
Phenanthrene	ug/kg	5 / 8	RI SED 09	1,400	610	8,700	120,000
Pyrene	ug/kg	8 / 8	RI SED 09	3,400	450	21,000	140,000
1,1,1-Trichloroethane	ug/kg	1 / 8	RI SED 08	ND	5.0	ND	5.0
1,1-Dichloroethane	ug/kg	3 / 8	RI SED 08	ND	3.0	ND	5.0
Acetone	ug/kg	1 / 8	RI SED 10	ND	41	ND	41
Carbon disulfide	ug/kg	1 / 8	RI SED 09	ND	4.0	ND	4.0
cis-1,2-Dichloroethene	ug/kg	8 / 8	RI SED 09	ND	4.0	ND	1,000
Methylene chloride	ug/kg	1 / 8	RI SED 10	ND	10	ND	10
Tetrachloroethene	ug/kg	2 / 8	RI SED 08	ND	13	ND	50
trans-1,2-Dichloroethene	ug/kg	2 / 8	RI SED 09	ND	5.0	ND	6.0
Trichloroethene	ug/kg	5 / 8	RI SED 08	ND	6.0	ND	230
Vinyl chloride	ug/kg	5 / 8	RI SED 09	ND	3.0	ND	120
Cyanide (total)	mg/kg	2 / 8	RI SED 04	1.1	2.8	3.2	3.4
pH (soil)	ph units	7 / 7	RI SED 05	7.3	7.4	7.3	7.7

Figures

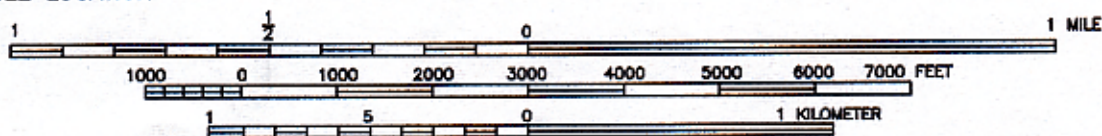


ADAPTED FROM: USGS 7.5 MIN. quad., LYONS AND SAVANNAH, NEW YORK

OLD ERIE CANAL SITE
CLYDE, NEW YORK



QUADRANGLE LOCATION



FILE NO. 31117
MAY 2003

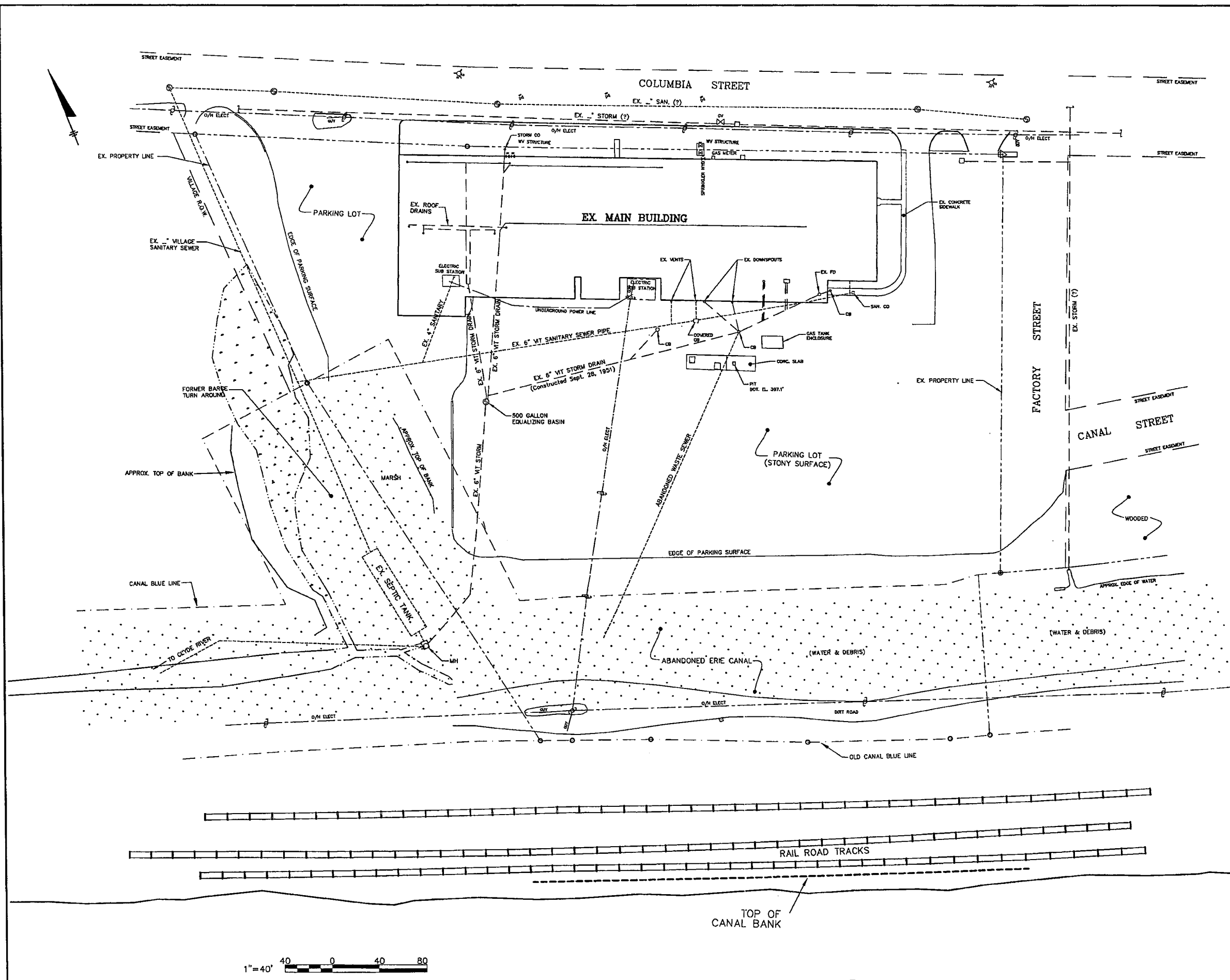
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FIGURE 2-2

LEGEND

- PROPERTY BOUNDARY
- - - CANAL BLUE LINE



OLD ERIE CANAL SITE
CLYDE, NEW YORK

OLD ERIE CANAL SITE
-1952-



SCALE IN FEET

AUGUST 2003

FILE NO.



O'BRIEN & GERE
ENGINEERS INC.

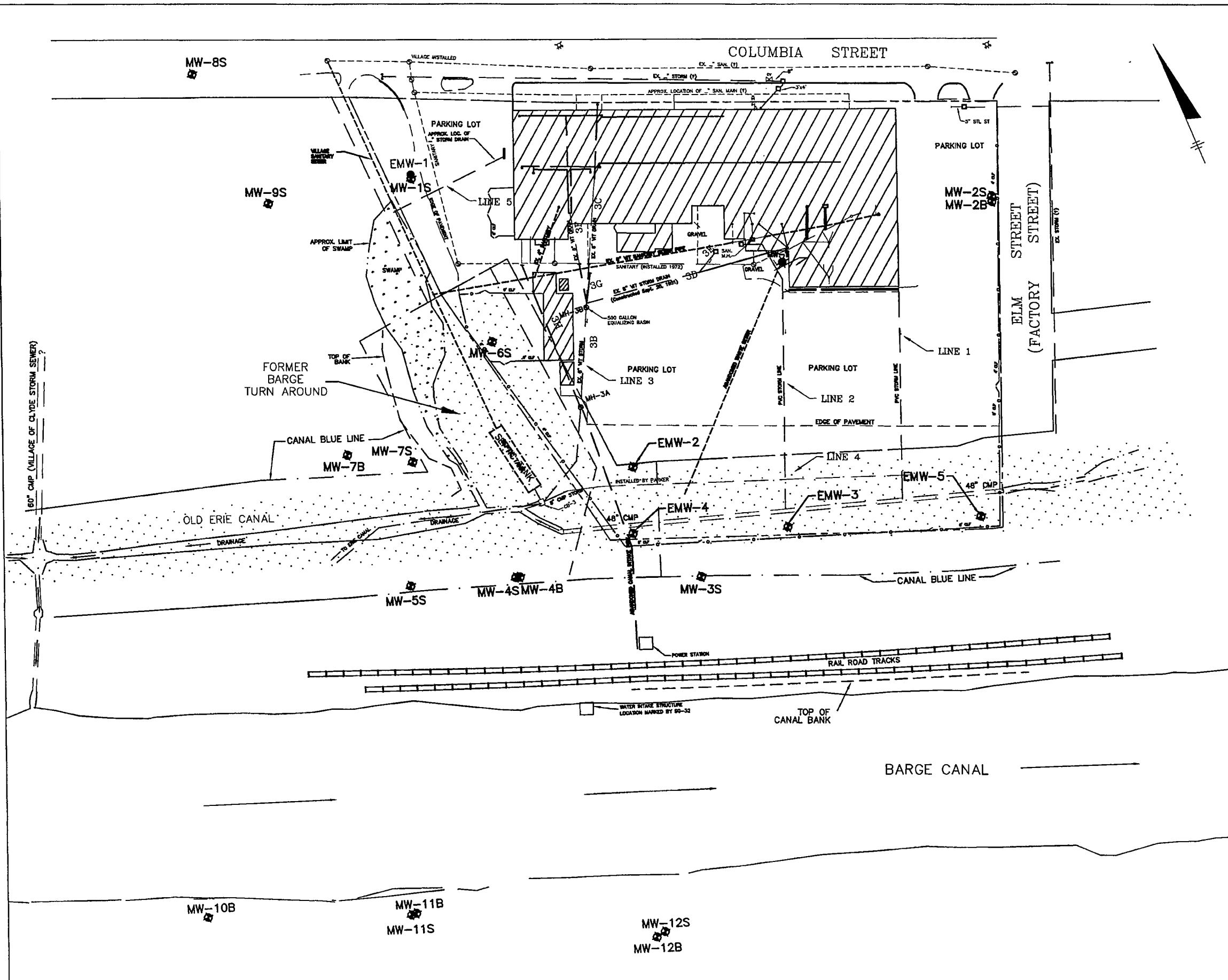


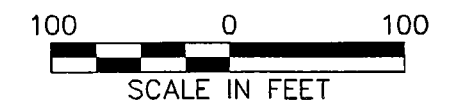
FIGURE 2-3

LEGEND

- PROPERTY BOUNDARY
- - - - CANAL BLUE LINE
- STORM SEWER
- == 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SURFACE WATER/SEDIMENT SAMPLE LOCATION
- MW-1 ● TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

OLD ERIE CANAL SITE
-2002-



MAY 2003
31117



DATE: 10-30-03 50 RDN

3117 RPTS V1.00 3-1 Res Well DWG-1-00

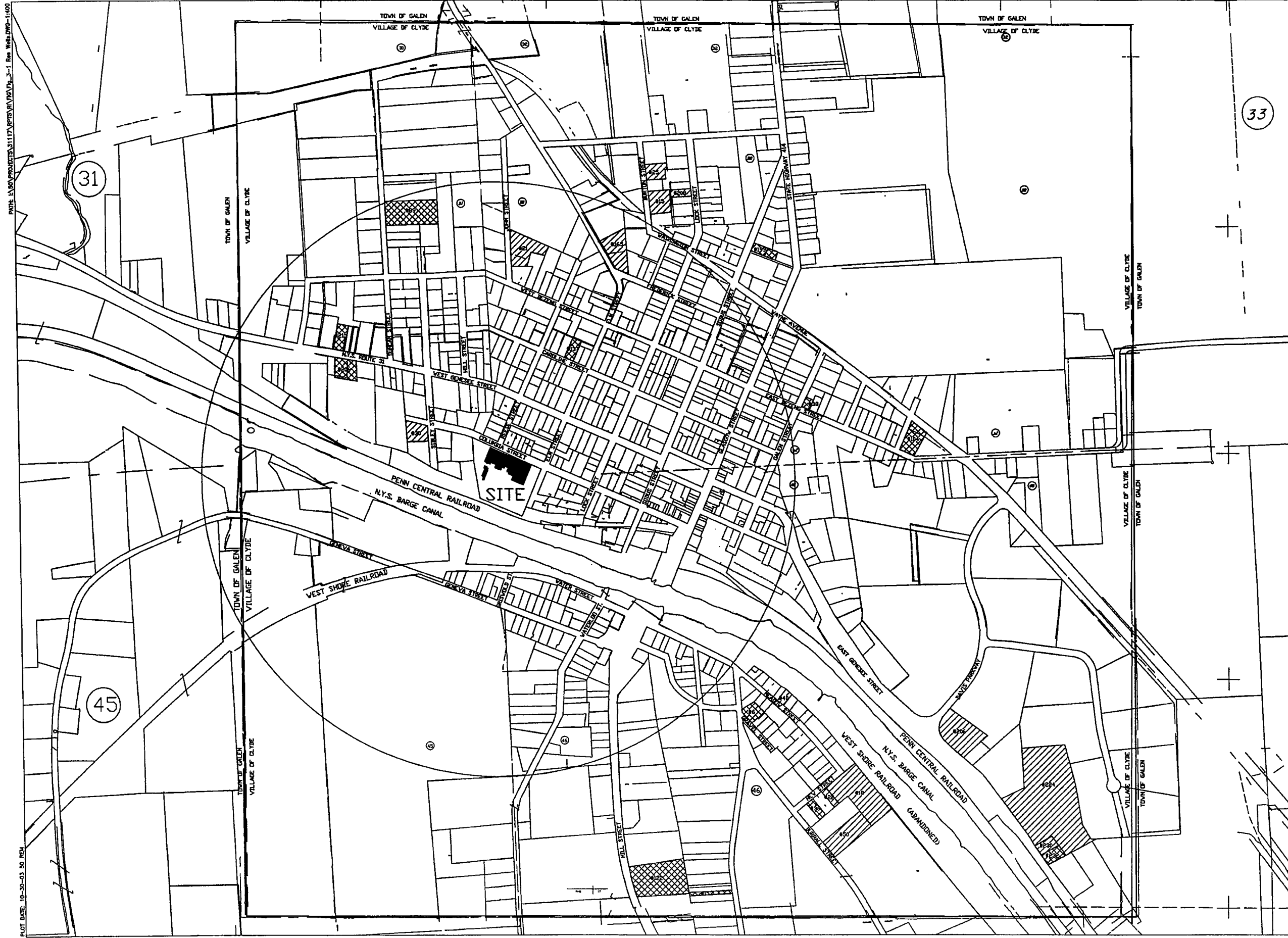


FIGURE 3-1

- PROPERTY BOUNDARY
- #30 RESIDENCE NOT CONNECTED TO PUBLIC WATER
- #122 RESIDENCE CONNECTED TO PUBLIC WATER BUT ALSO HAVE PRIVATE WELL ON PROPERTY
- REPRESENTS ONE-HALF MILE RADIUS AROUND SITE

OLD ERIE CANAL SITE
CLYDE, NEW YORK

RESIDENTIAL WELL
LOCATION MAP

1"=800' 800 0 800

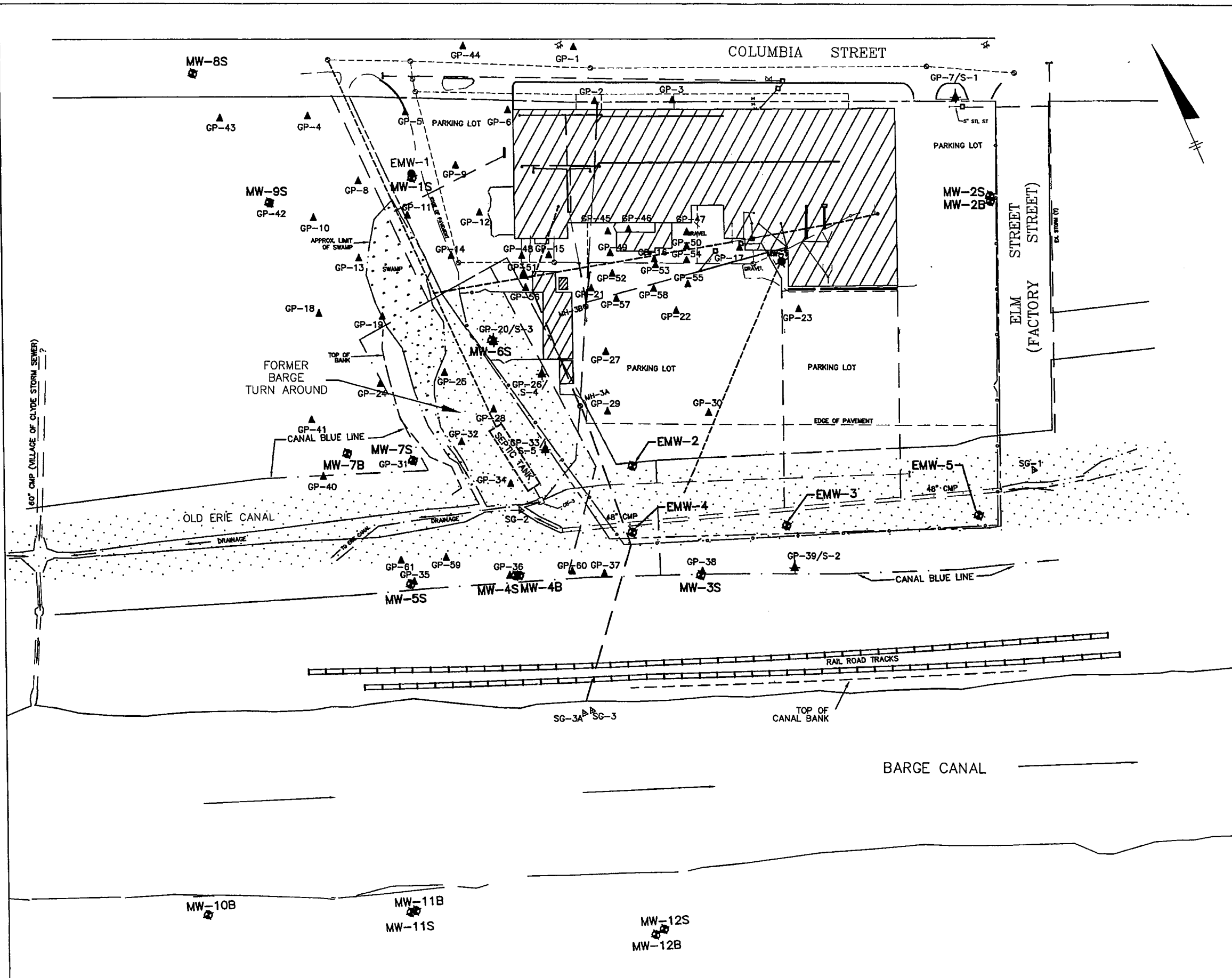


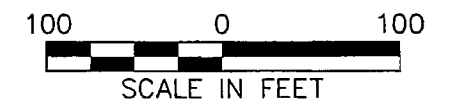
FIGURE 3-2

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- GP-39 DIRECT PUSH SAMPLE LOCATION
- GP-7/S-1 DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

DIRECT PUSH SAMPLE
LOCATION MAP



MAY 2003
31117



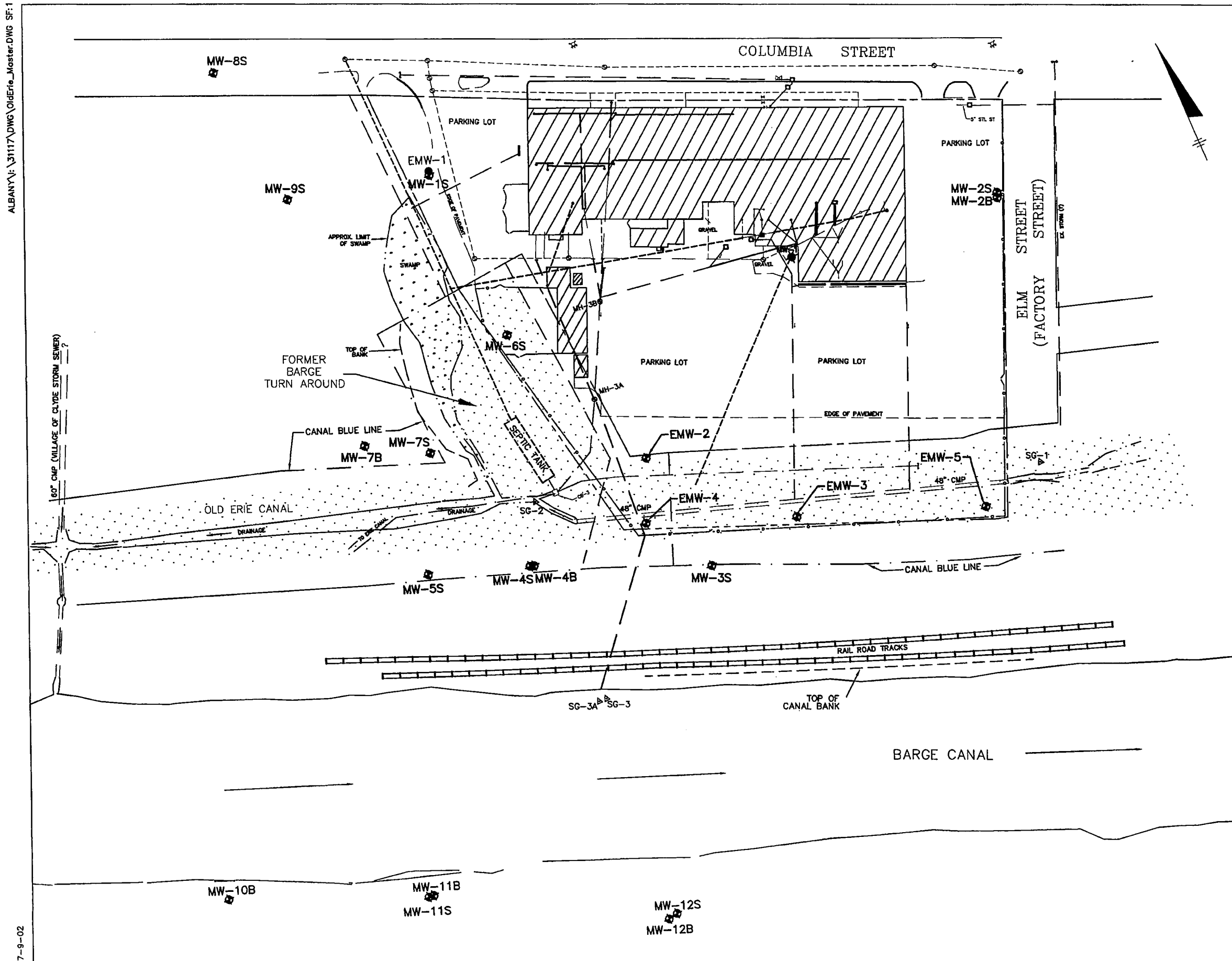


FIGURE 3-3

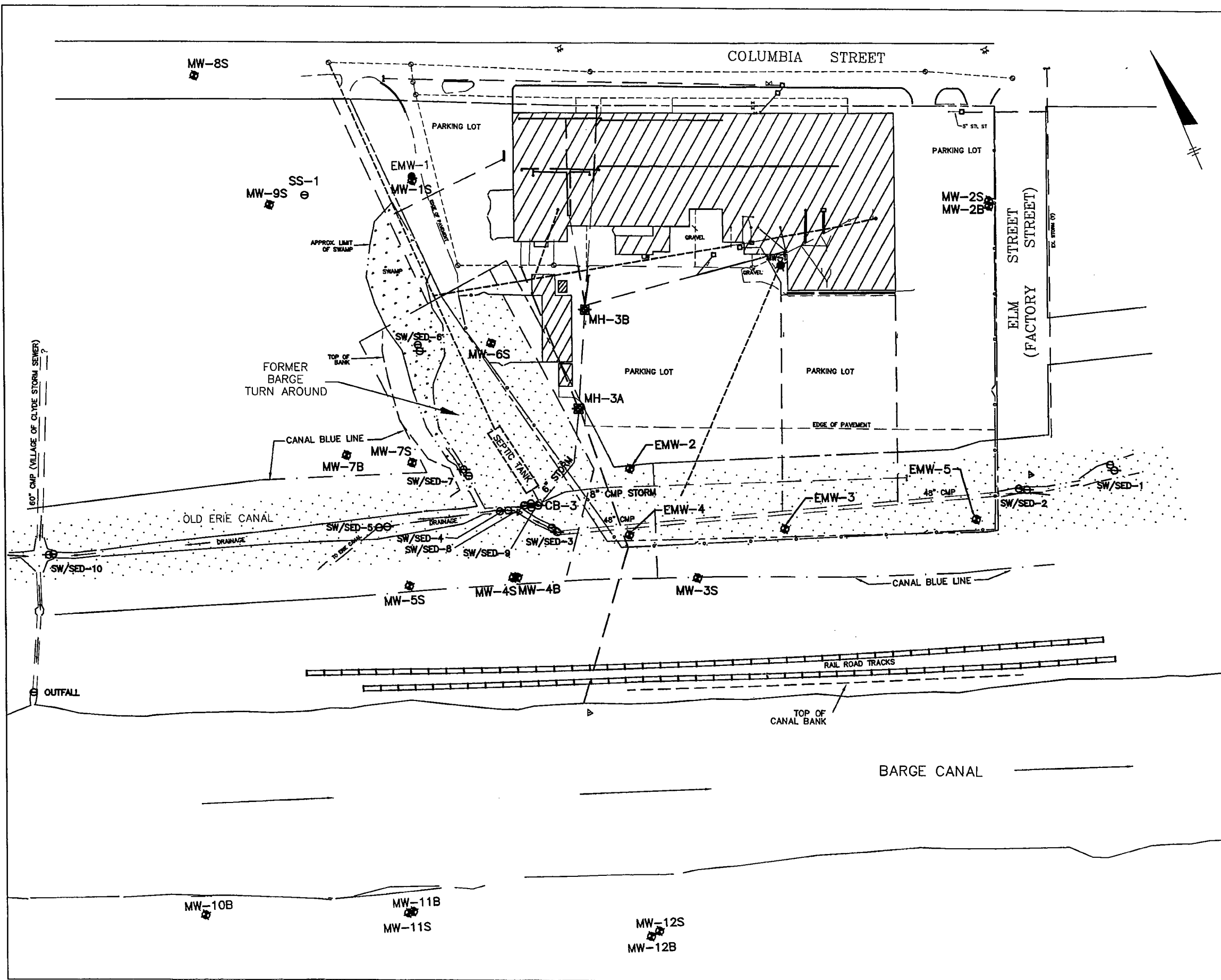


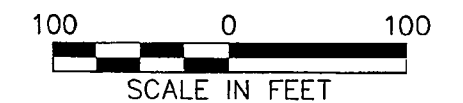
FIGURE 3-4

LEGEND

- PROPERTY BOUNDARY
- - - - - CANAL BLUE LINE
- STORM SEWER
- == 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SW/SED-1 SURFACE WATER/SEDIMENT SAMPLE LOCATION
- SS-1 SURFACE SOIL SAMPLE LOCATION
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

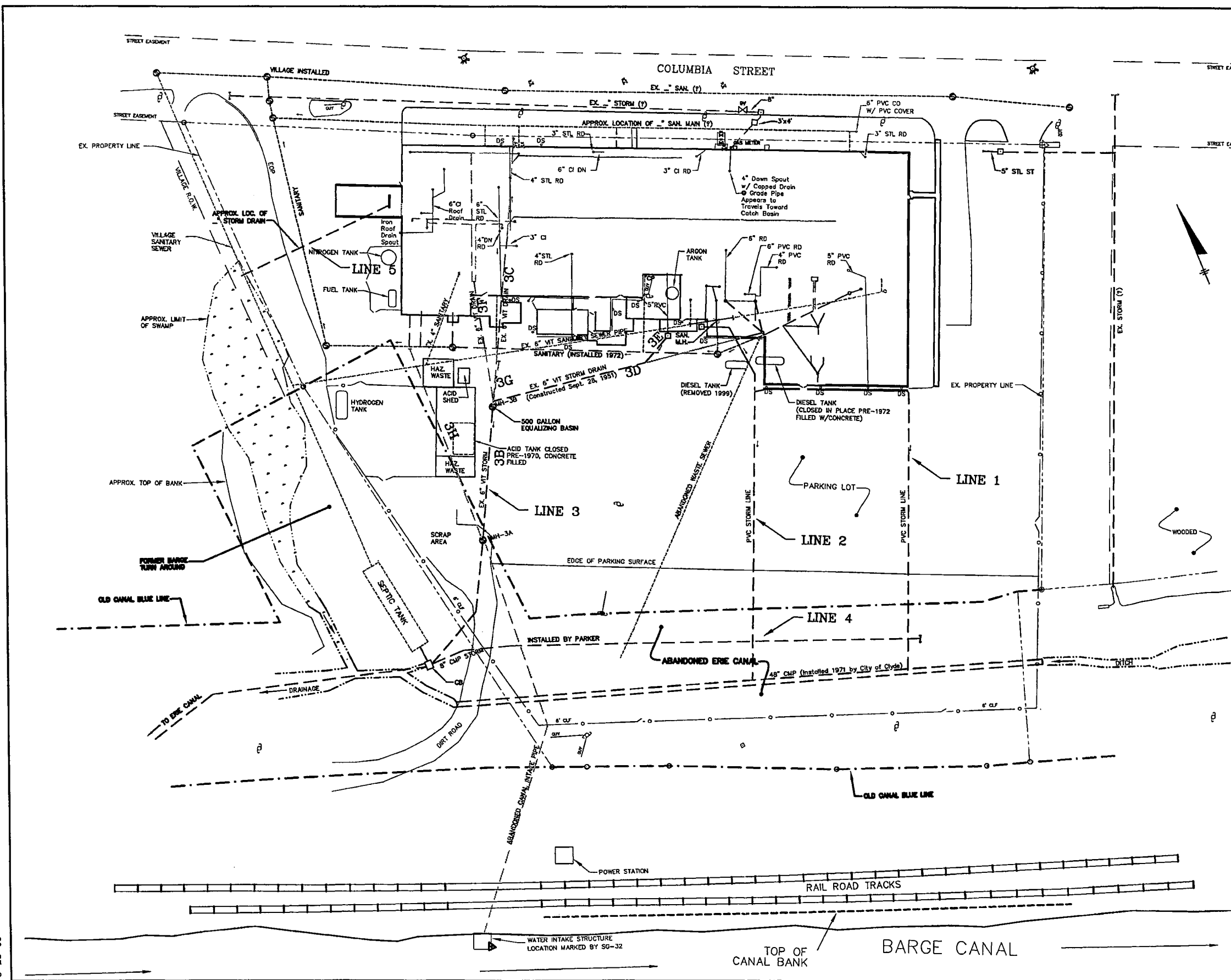
SURFACE WATER, SURFACE
SOIL/SEDIMENT & STORM
WATER SAMPLE
LOCATION MAP



MAY 2003
31117



FIGURE 3-5

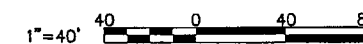


LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- 48-INCH CMP

OLD ERIE CANAL SITE
CLYDE, NEW YORK

SITE UTILITY MAP



MAY 2003
31117



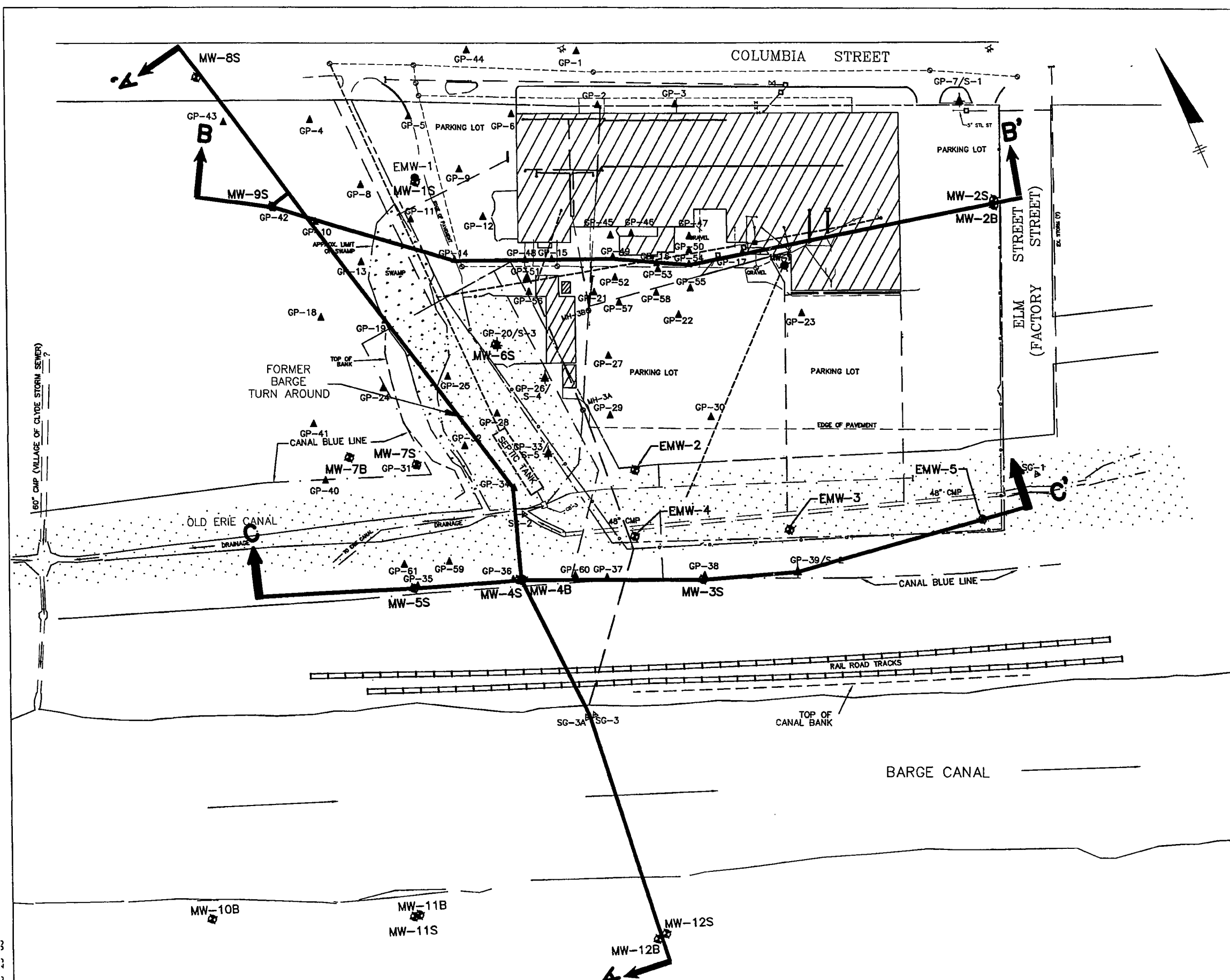





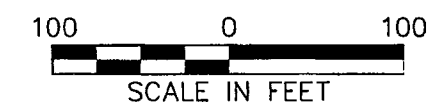


FIGURE 4-1

LEGEND

- - - - - PROPERTY BOUNDARY
 - · - · - CANAL BLUE LINE
 - - - - - STORM SEWER
 = = = 48-INCH CMP
 MW-3S  OVERBURDEN
 MONITORING WELL
 MW-3B  BEDROCK
 MONITORING WELL
 GP-39  DIRECT PUSH
 SAMPLE LOCATION
 GP-7/
 S-1  DIRECT PUSH AND
 SUBSURFACE SOIL
 SAMPLE LOCATION
 MW-1  TEMPORARY MONITORING
 WELL INSTALLED DURING
 REMOVAL OF AN UNDER-
 GROUND DIESEL TANK

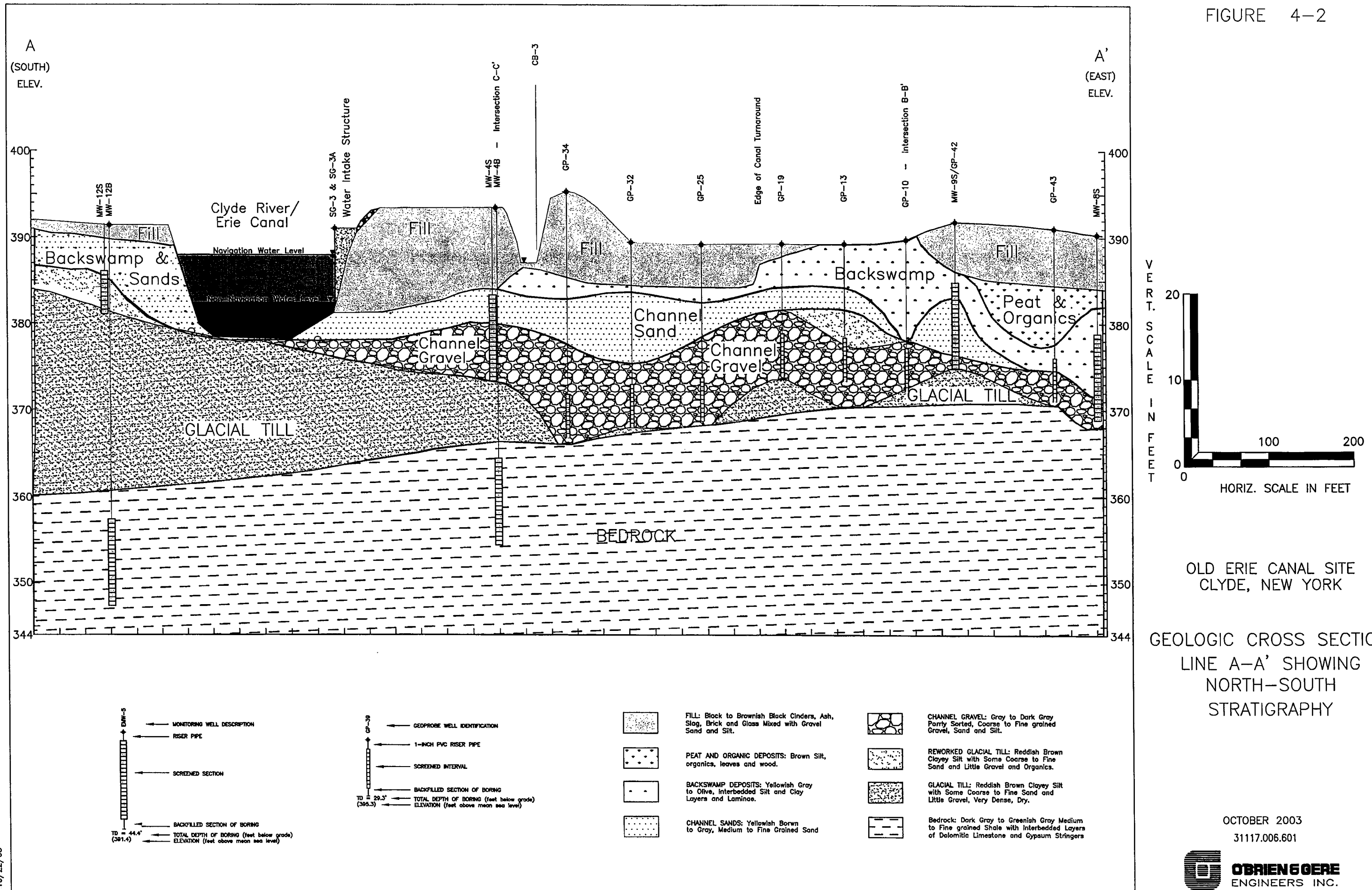
OLD ERIE CANAL SITE
CLYDE, NEW YORK

CROSS-SECTION
LOCATION MAP

SEPTEMBER 2003
3117



FIGURE 4-2



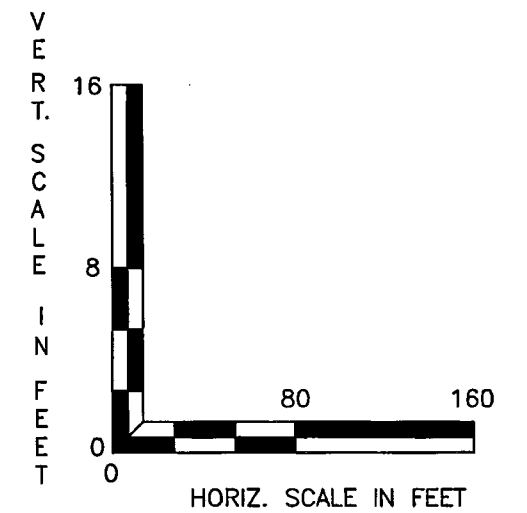
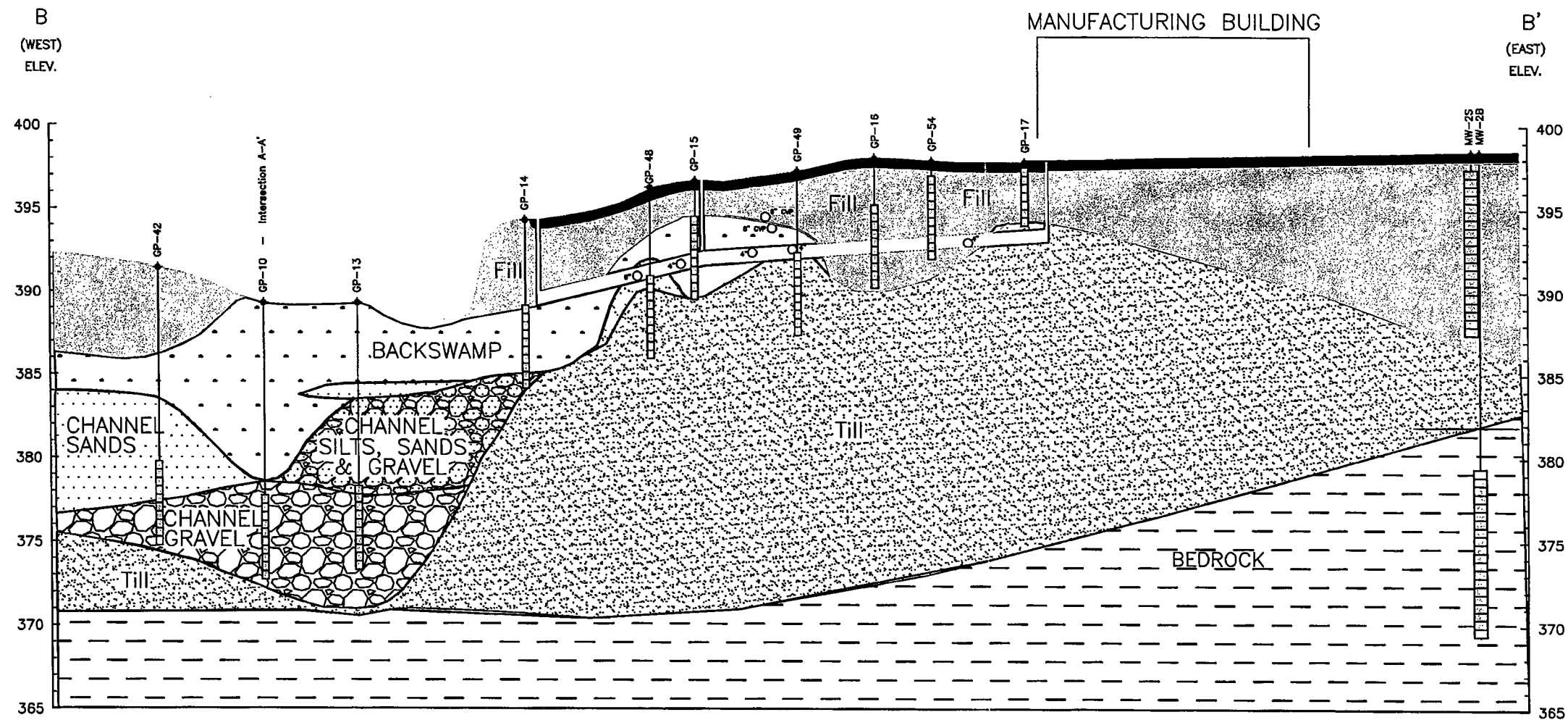
OLD ERIE CANAL SITE
CLYDE, NEW YORK

GEOLOGIC CROSS SECTION
LINE A-A' SHOWING
NORTH-SOUTH
STRATIGRAPHY

OCTOBER 2003

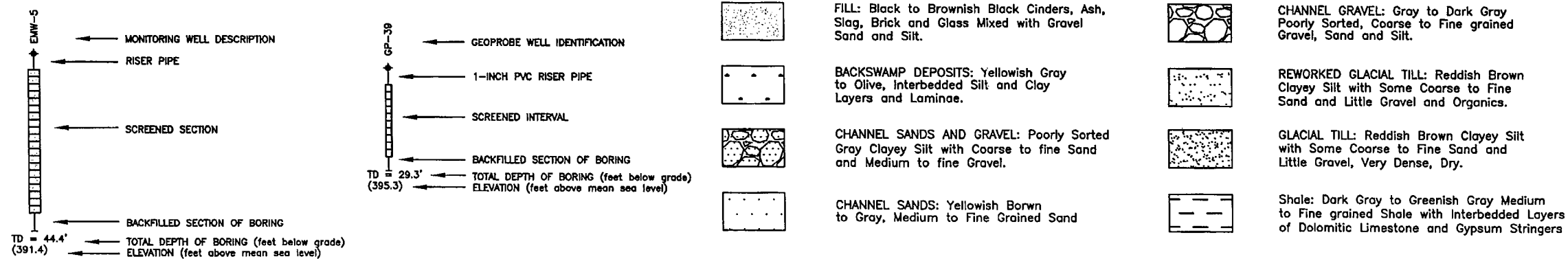
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FIGURE 4-3



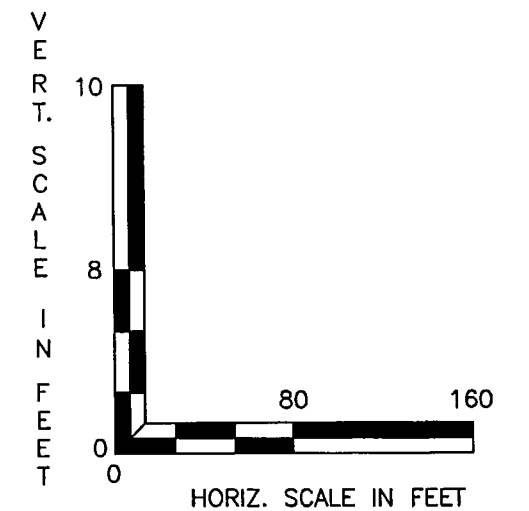
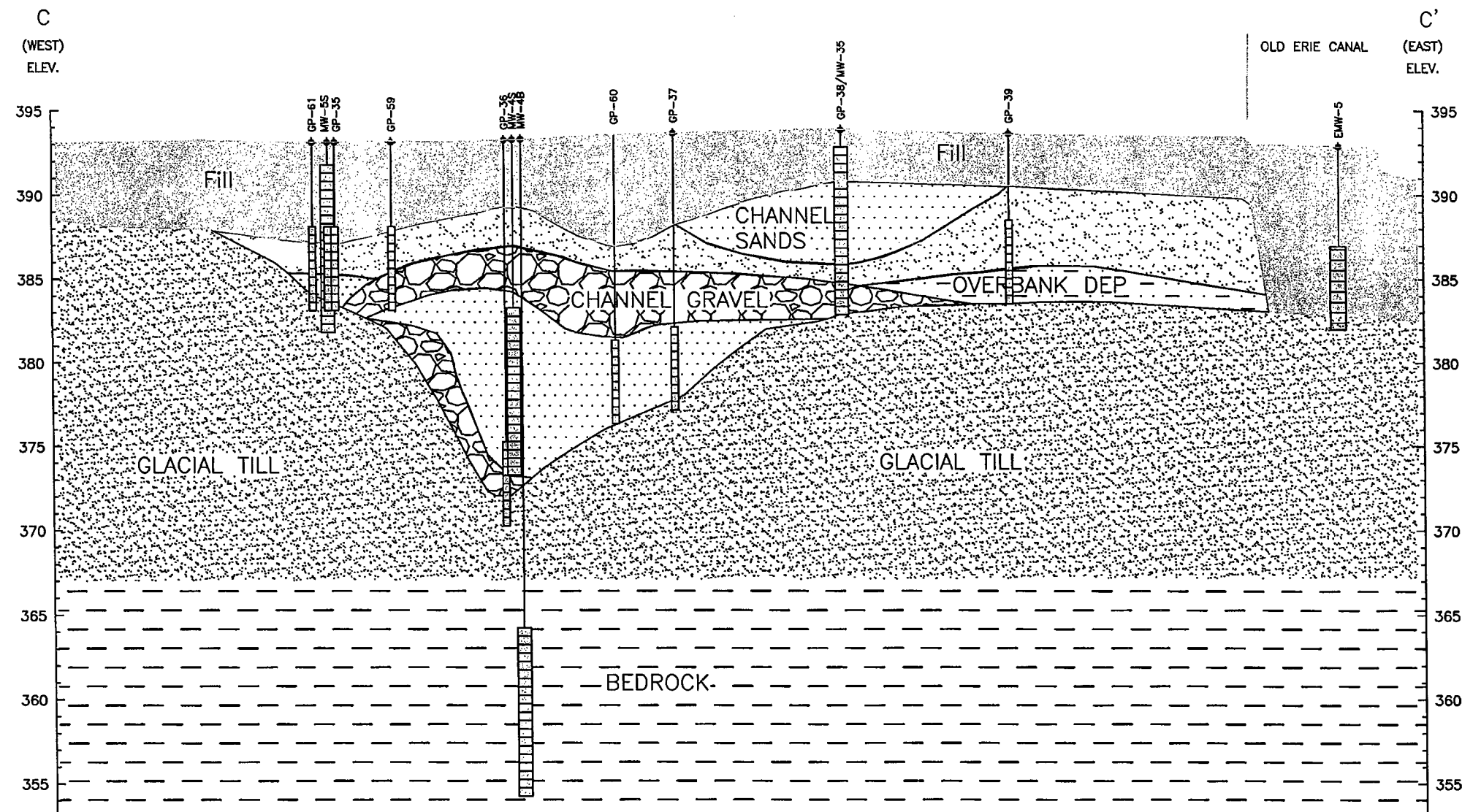
OLD ERIE CANAL SITE
CLYDE NEW YORK

GEOLOGIC CROSS SECTION
LINE B-B' SHOWING
EAST-WEST STRATIGRAPHY
MANUFACTURING BUILDING



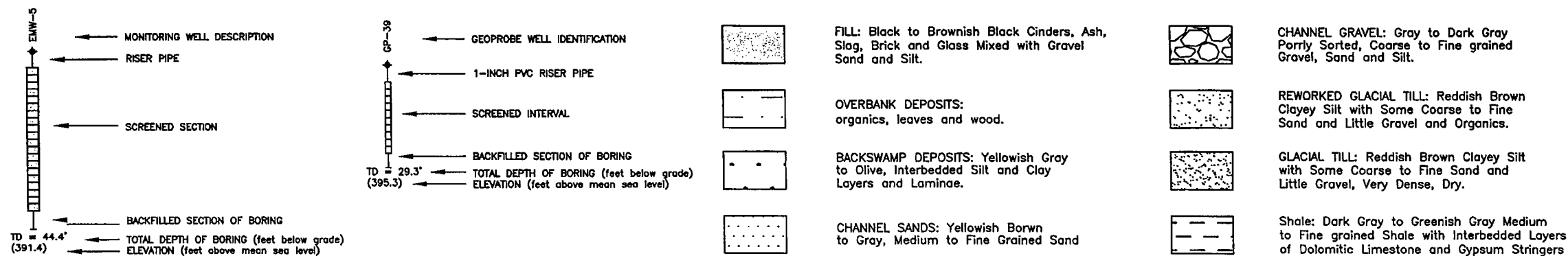
OCTOBER 2003
31117.006.601

FIGURE 4-4



OLD ERIE CANAL SITE
CLYDE, NEW YORK

GEOLOGIC CROSS SECTION
LINE C-C' SHOWING
EAST-WEST STRATIGRAPHY



OCTOBER 2003

31117.006.601

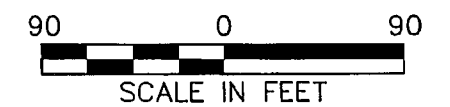
FIGURE 4-5

LEGEND

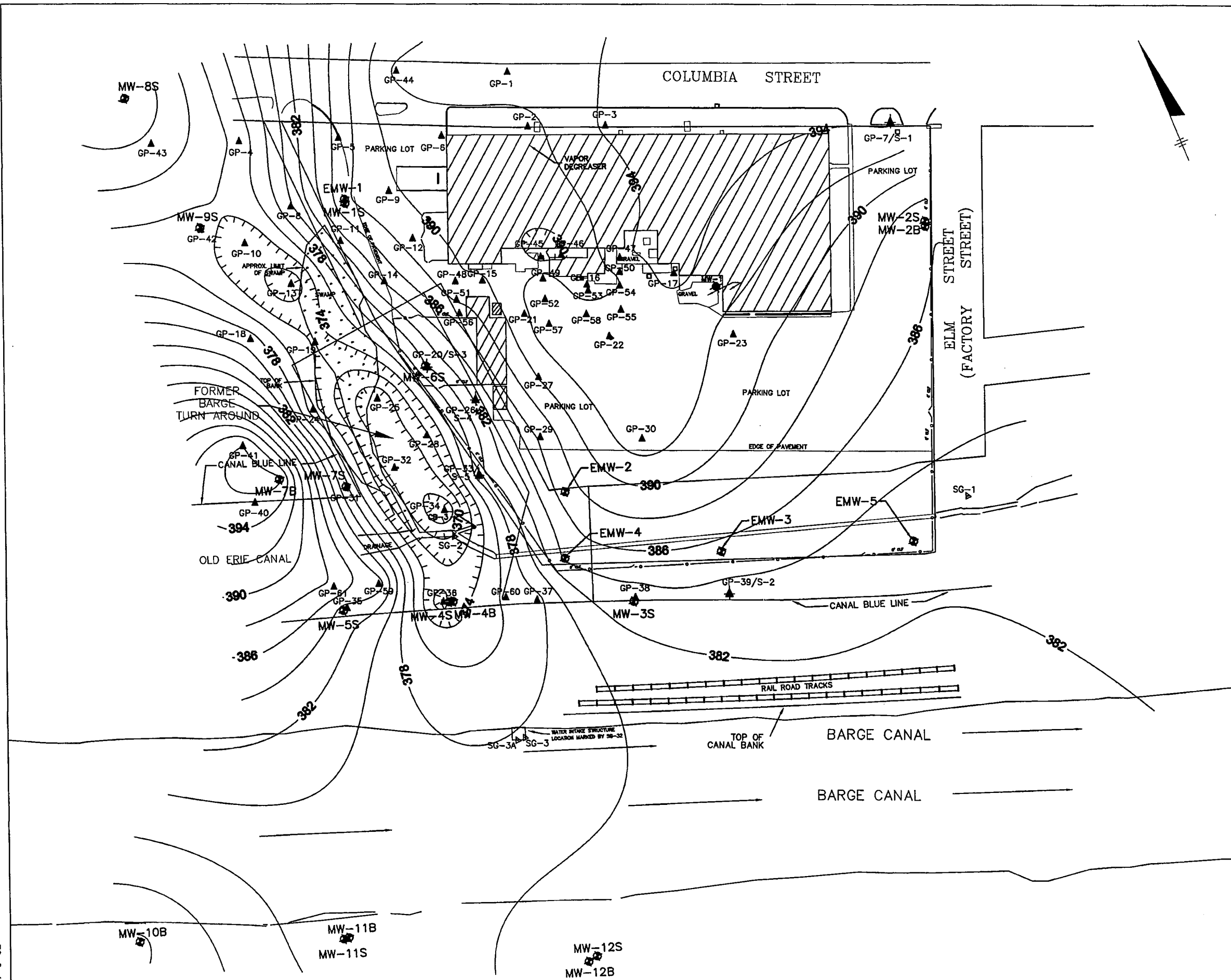
- PROPERTY BOUNDARY
- CANAL BLUE LINE
- 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SG-1 STAFF GAUGE
- ▲ DIRECT PUSH SAMPLE LOCATION
- ▲ GP-26/S-4 DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- ★ TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

TOP OF LOW
PERMEABILITY UNIT
CONTOUR MAP



SEPTEMBER 2003
31117



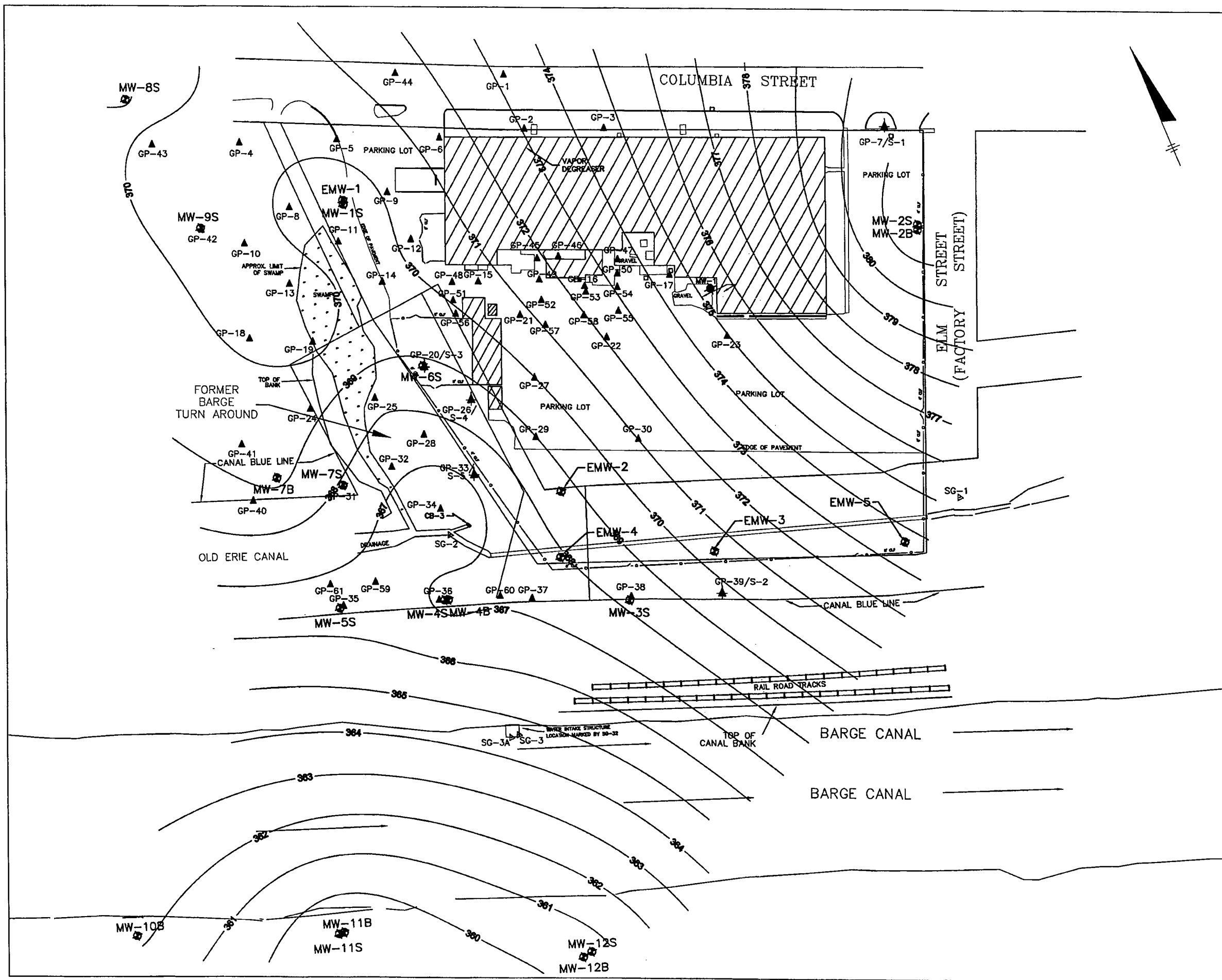


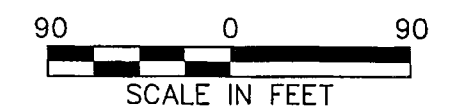
FIGURE 4-6

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- == 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SG-1 STAFF GAUGE
- ▲ GP-23 DIRECT PUSH SAMPLE LOCATION
- ▲ GP-26/S-4 DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

TOP OF BEDROCK
CONTOUR MAP



SEPTEMBER 2003
31117



FIGURE 5-1
MONTHLY PRECIPITATION and TEMPERATURE
January 1 - December 31, 2002
Old Erie Canal Site
Clyde, New York

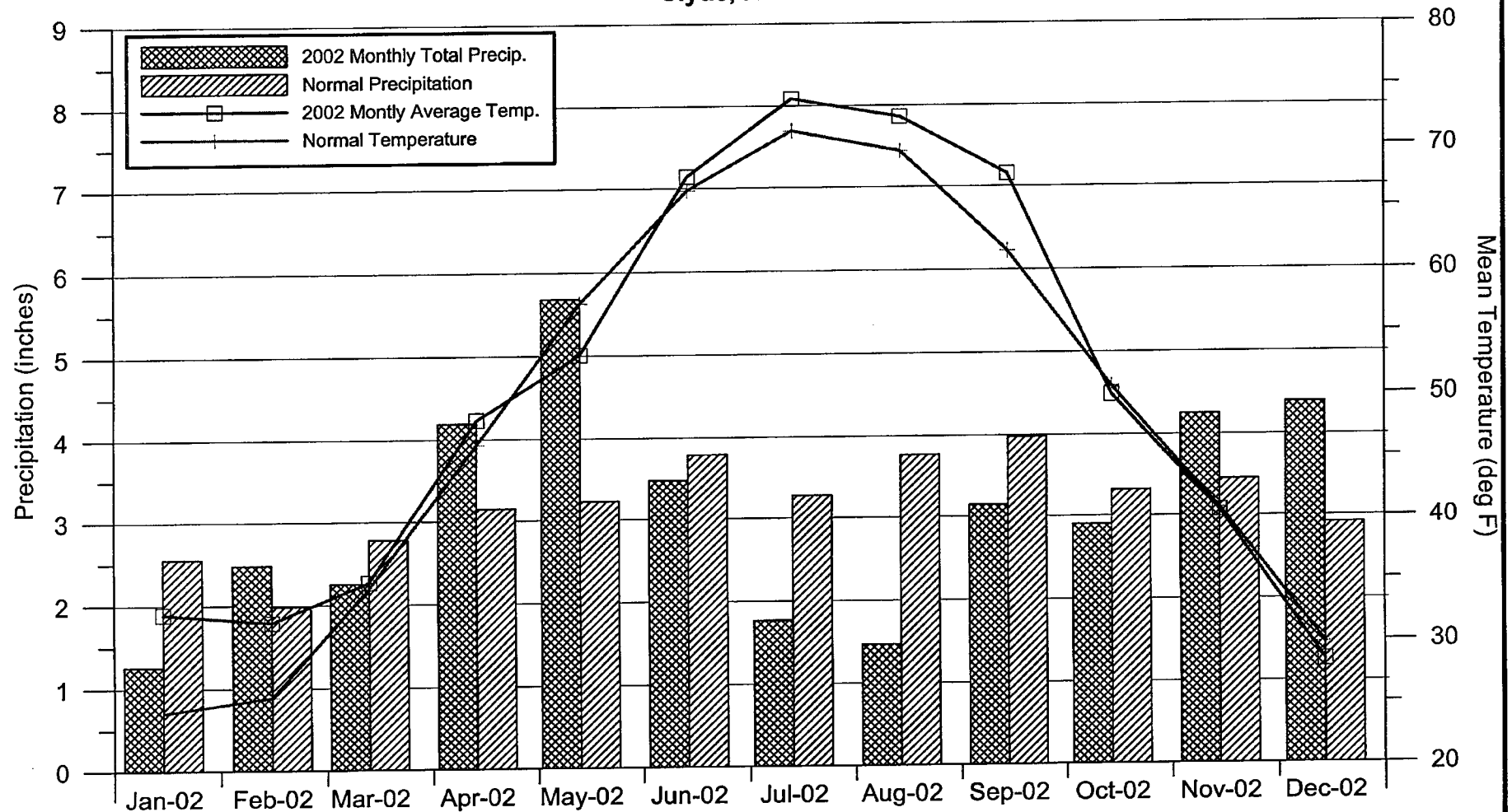
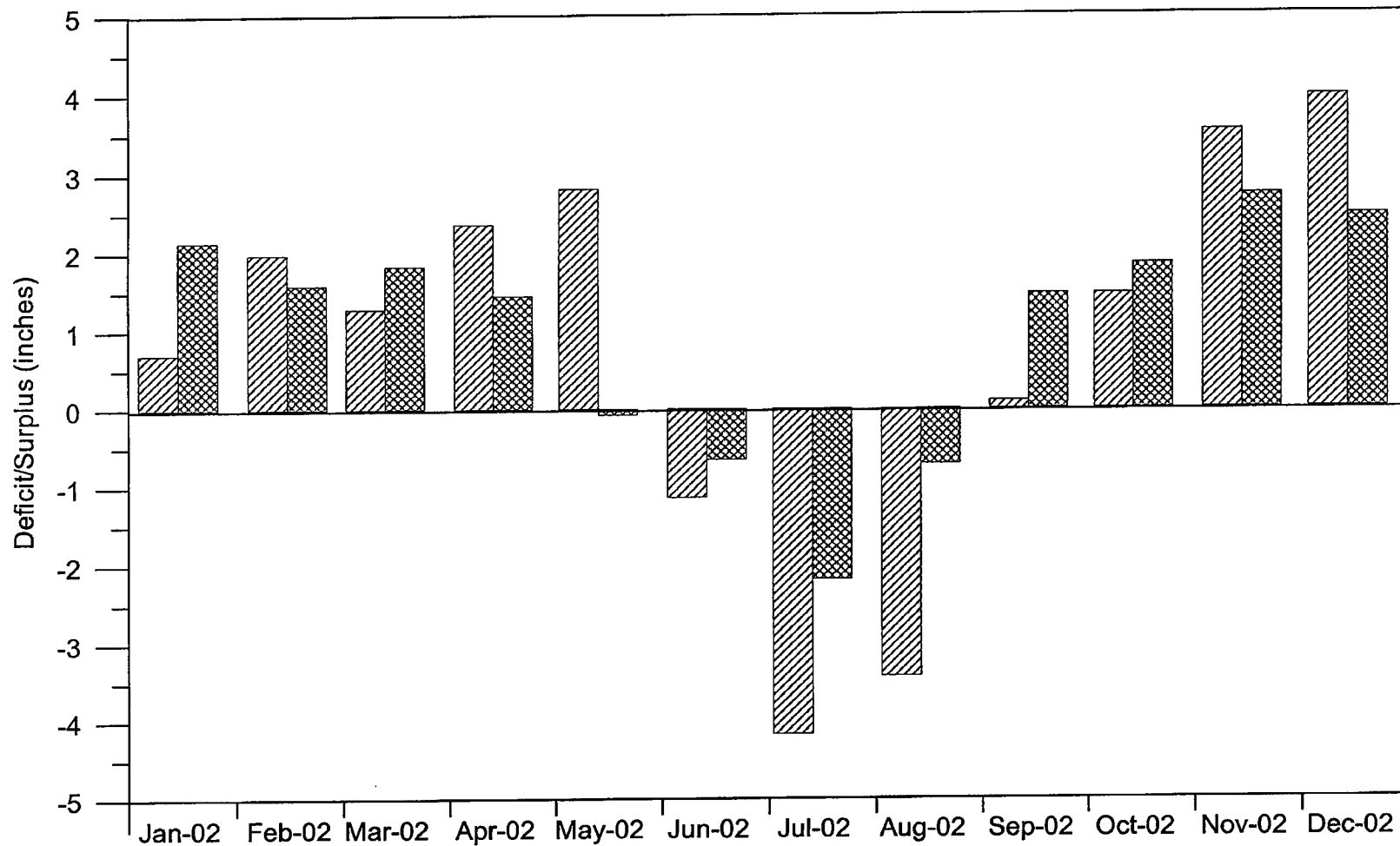


FIGURE 5-2
PRECIPITATION LESS POTENTIAL EVAPOTRANSPIRATION
January 1 - December 31, 2002
Old Erie Canal Site
Clyde, New York



2002 Monthly PET
Normal PET

FIGURE 5-3 HYDROGRAPH FOR WELL PAIRS MW-2 AND MW-4

Old Erie Canal Site
Clyde, New York

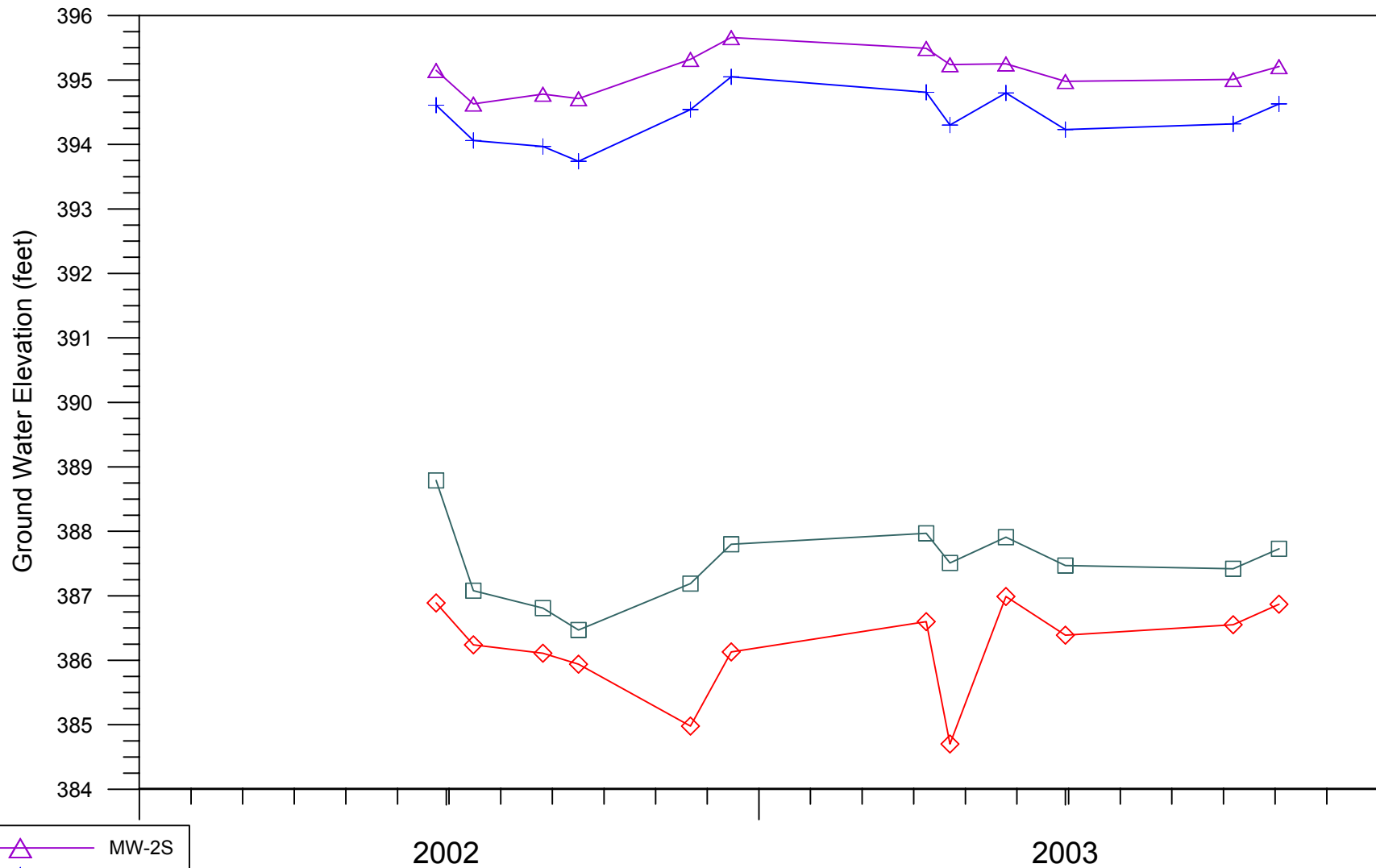


FIGURE 5-4 HYDROGRAPH FOR WELLS LOCATED IN THE NORTHERN PORTION OF THE SITE

Old Erie Canal Site
Clyde, New York

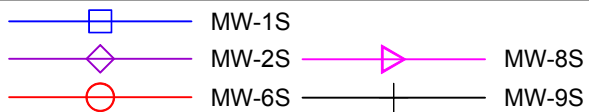
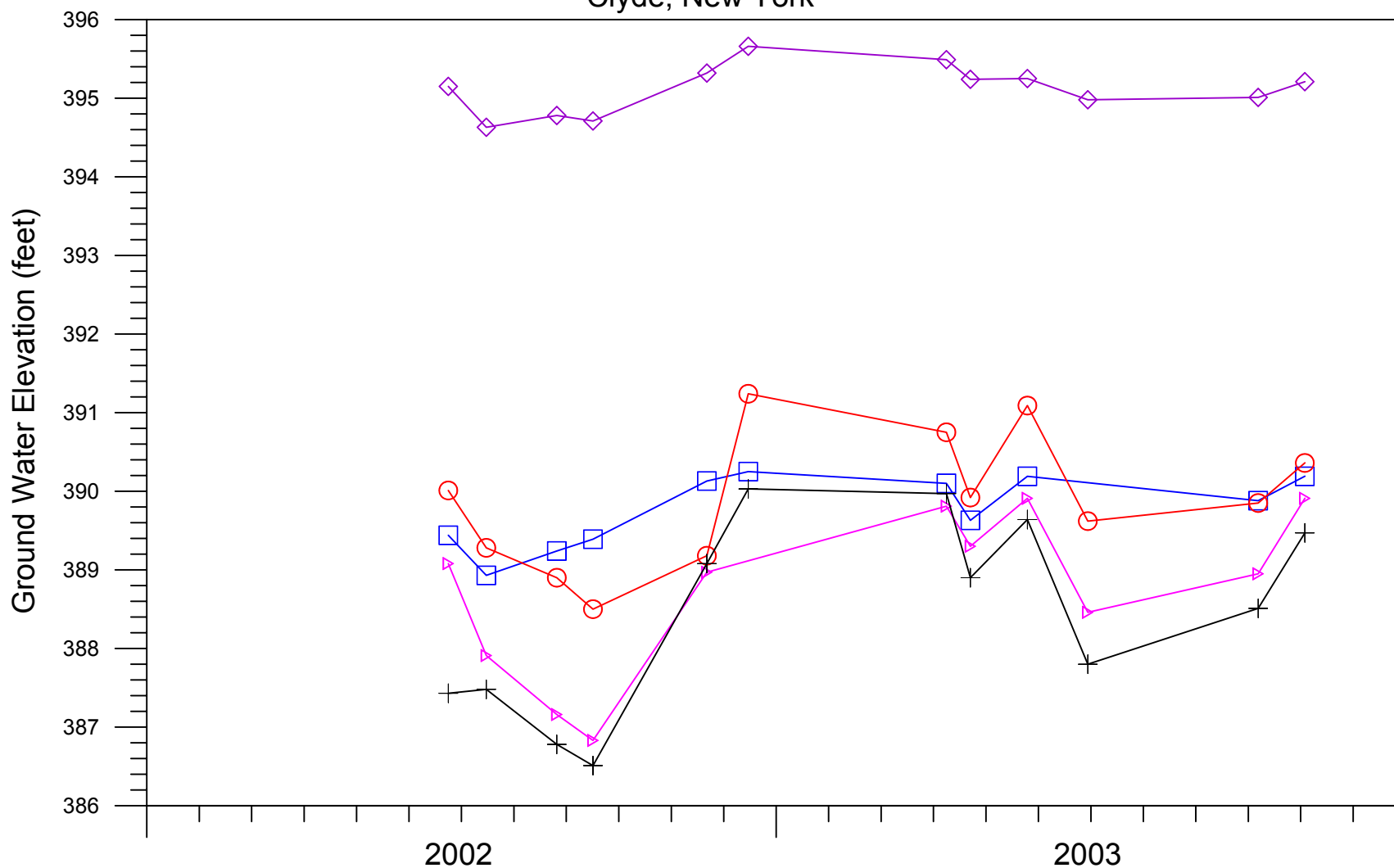


FIGURE 5-5 HYDROGRAPH FOR WELLS LOCATED IN THE WESTERN PORTION OF THE SITE

Old Erie Canal Site
Clyde, New York

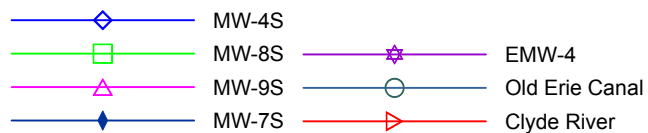
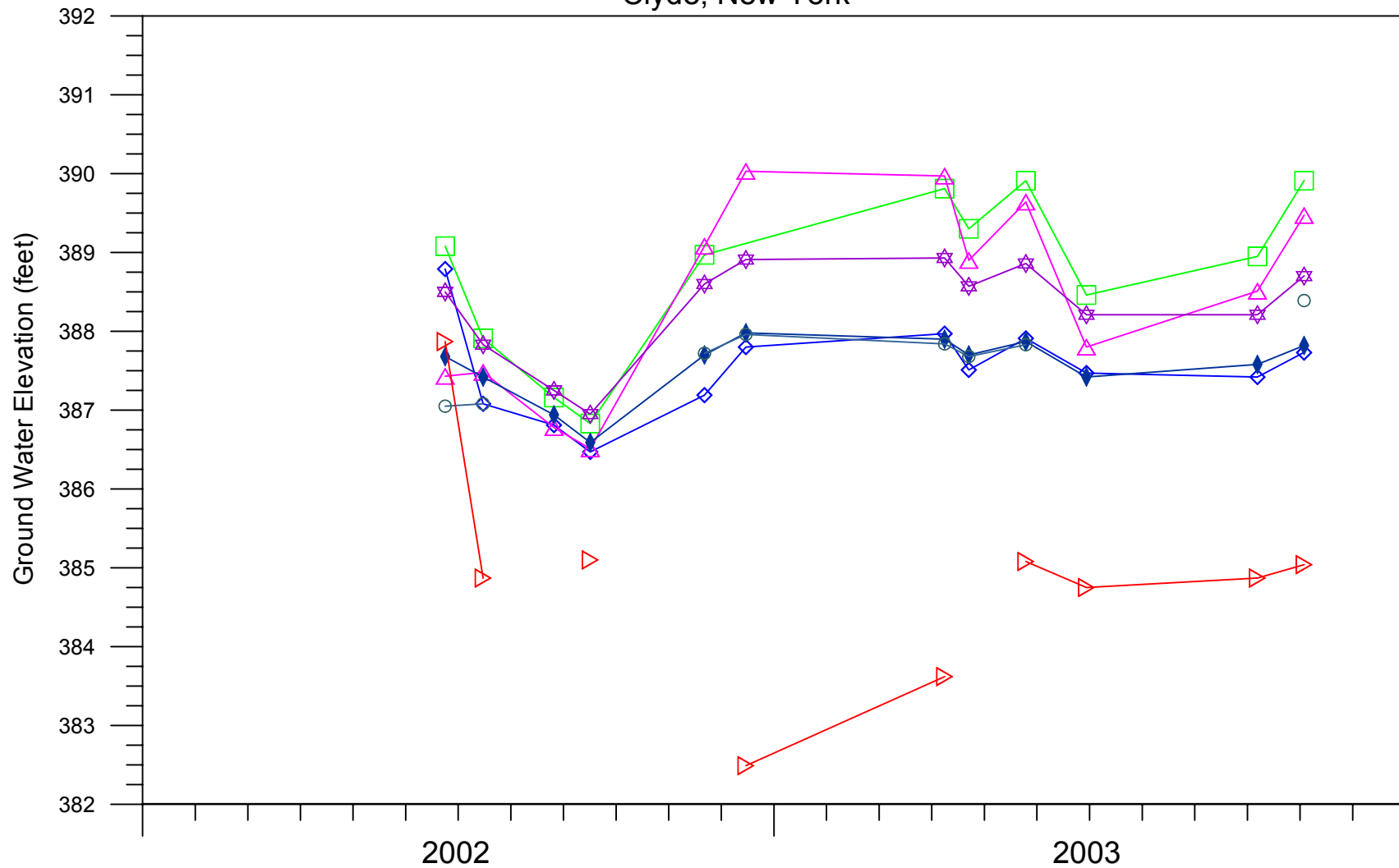


FIGURE 5-6 HYDROGRAPH FOR WELLS LOCATED ALONG THE SOUTHERN PORTION OF THE SITE

Old Erie Canal Site
Clyde, New York

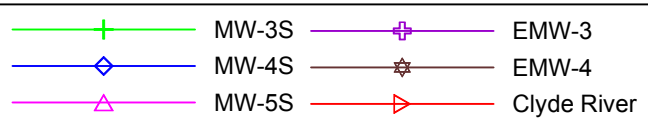
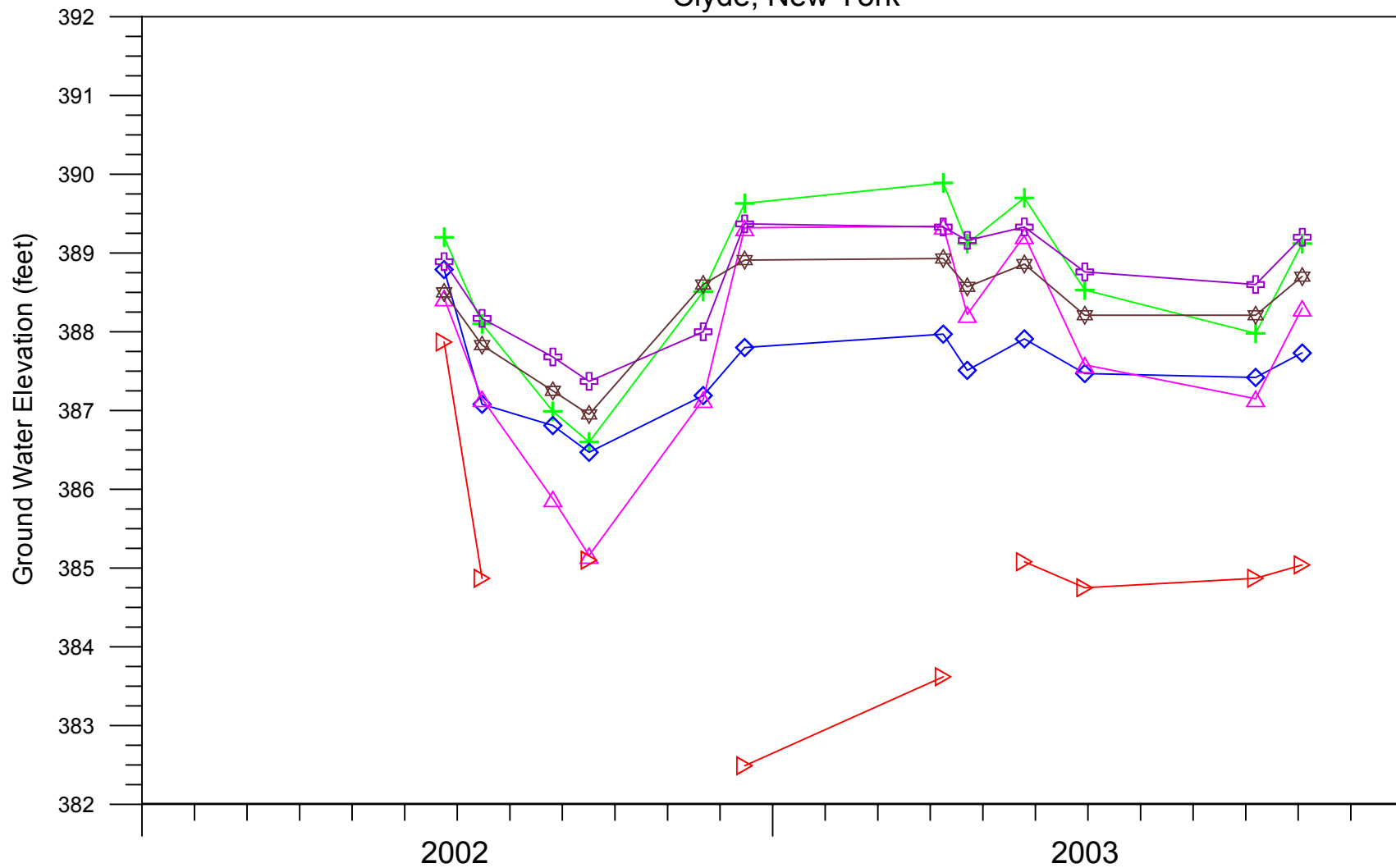


FIGURE 5-7 HYDROGRAPH FOR BEDROCK WELLS

Old Erie Canal Site
Clyde, New York

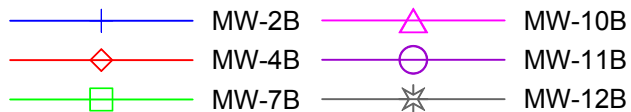
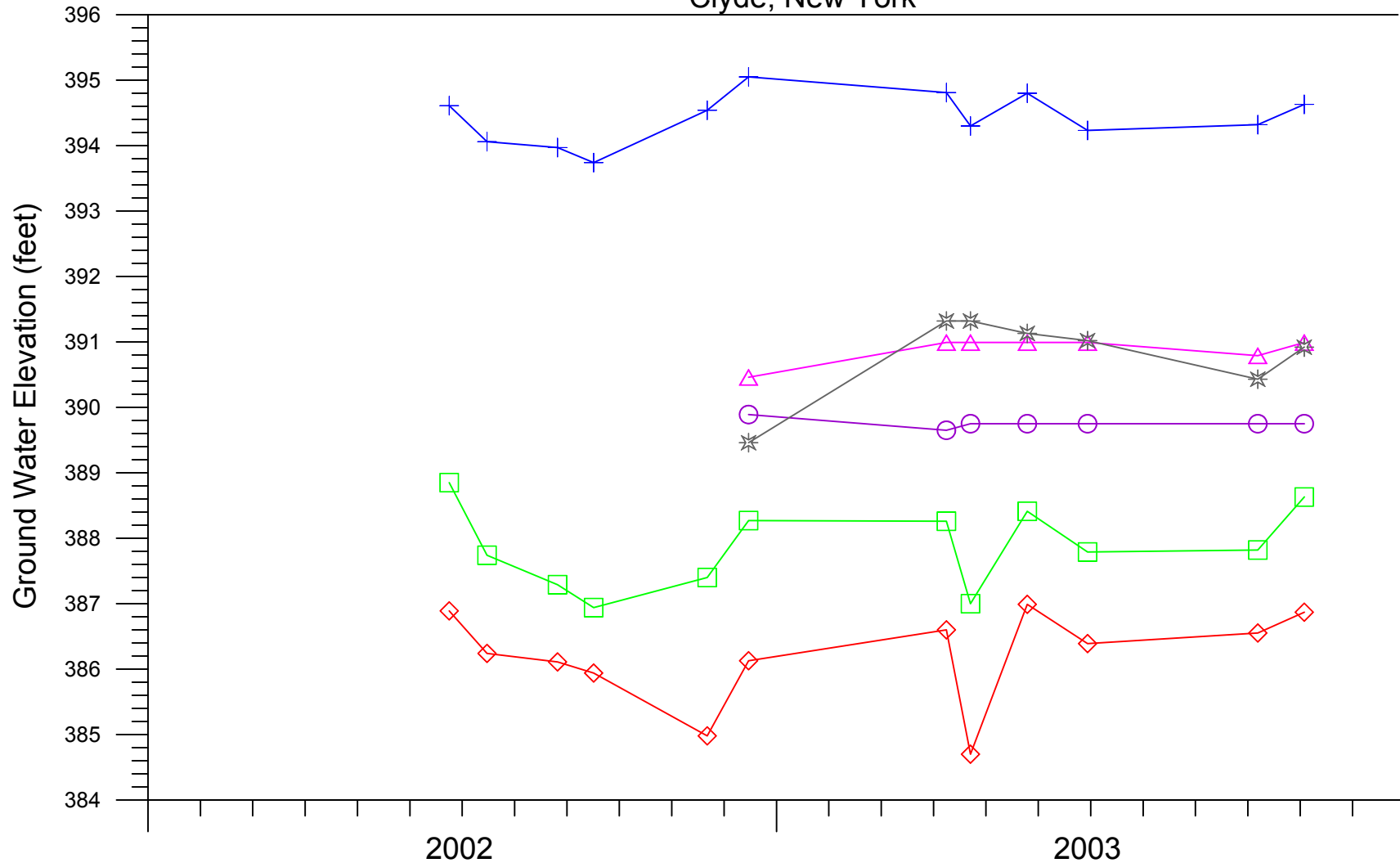


FIGURE 5-8 HYDROGRAPH FOR WELLS LOCATED SOUTH OF CLYDE RIVER

Old Erie Canal Site
Clyde, New York

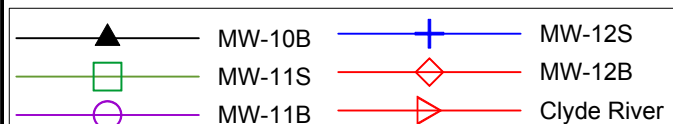
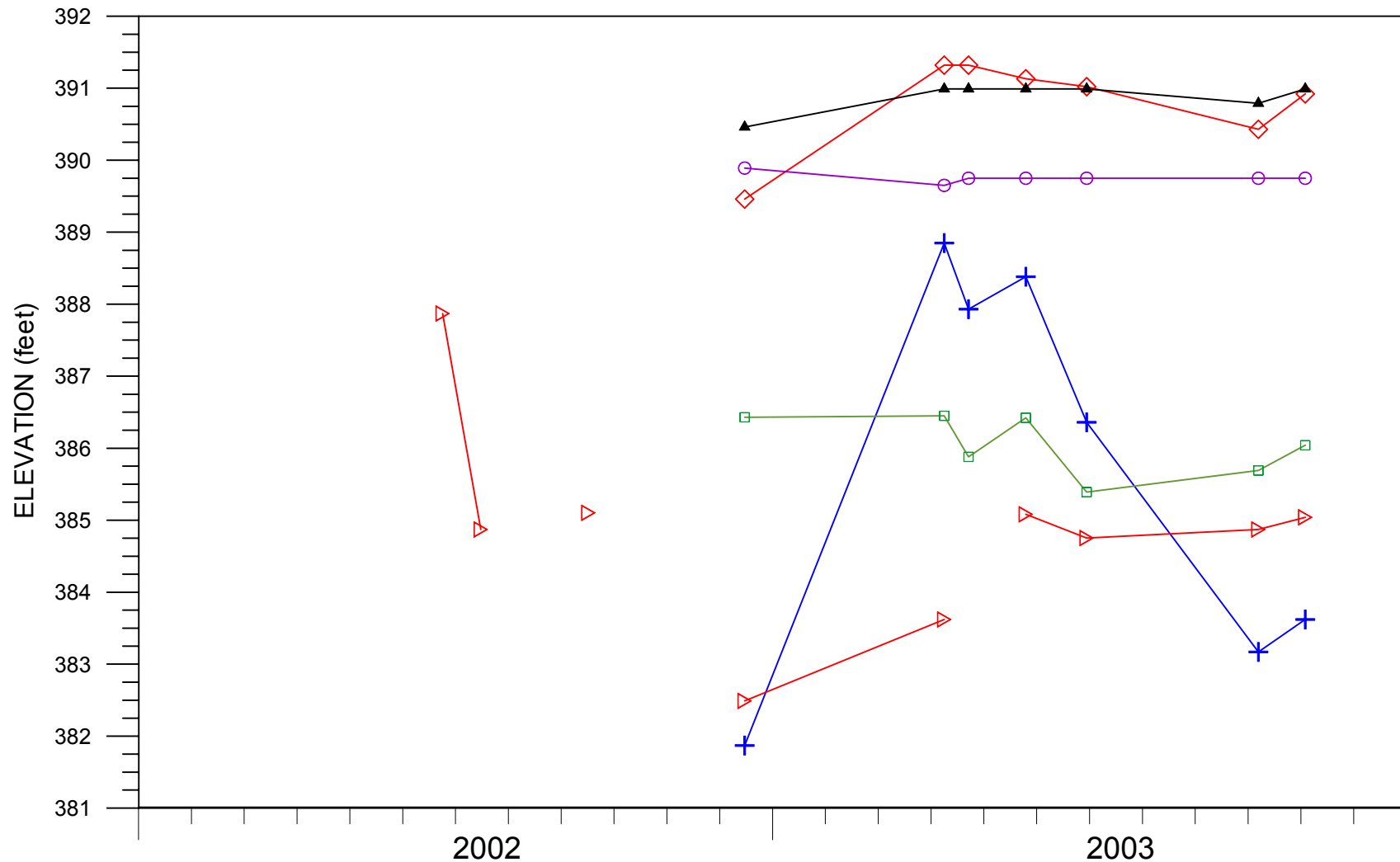


FIGURE 5-9
HYDROGRAPHS FOR DATALOGGERS AT WELL PAIR MW-4

Old Erie Canal Site
 Clyde, New York

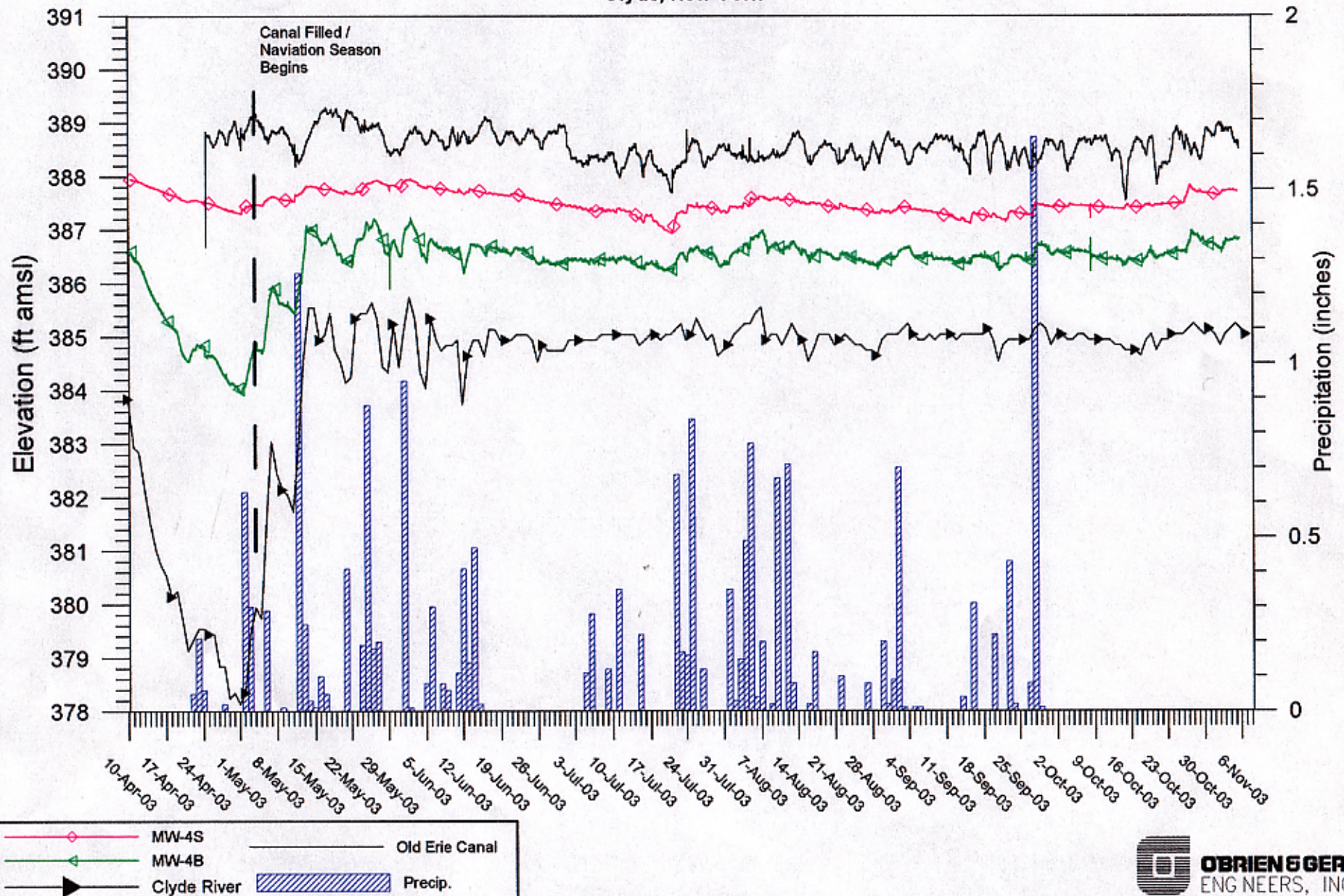


FIGURE 5-10
HYDROGRAPHS FOR WELLS ALONG CROSS-SECTION A-A'

Old Erie Canal Site
 Clyde, New York

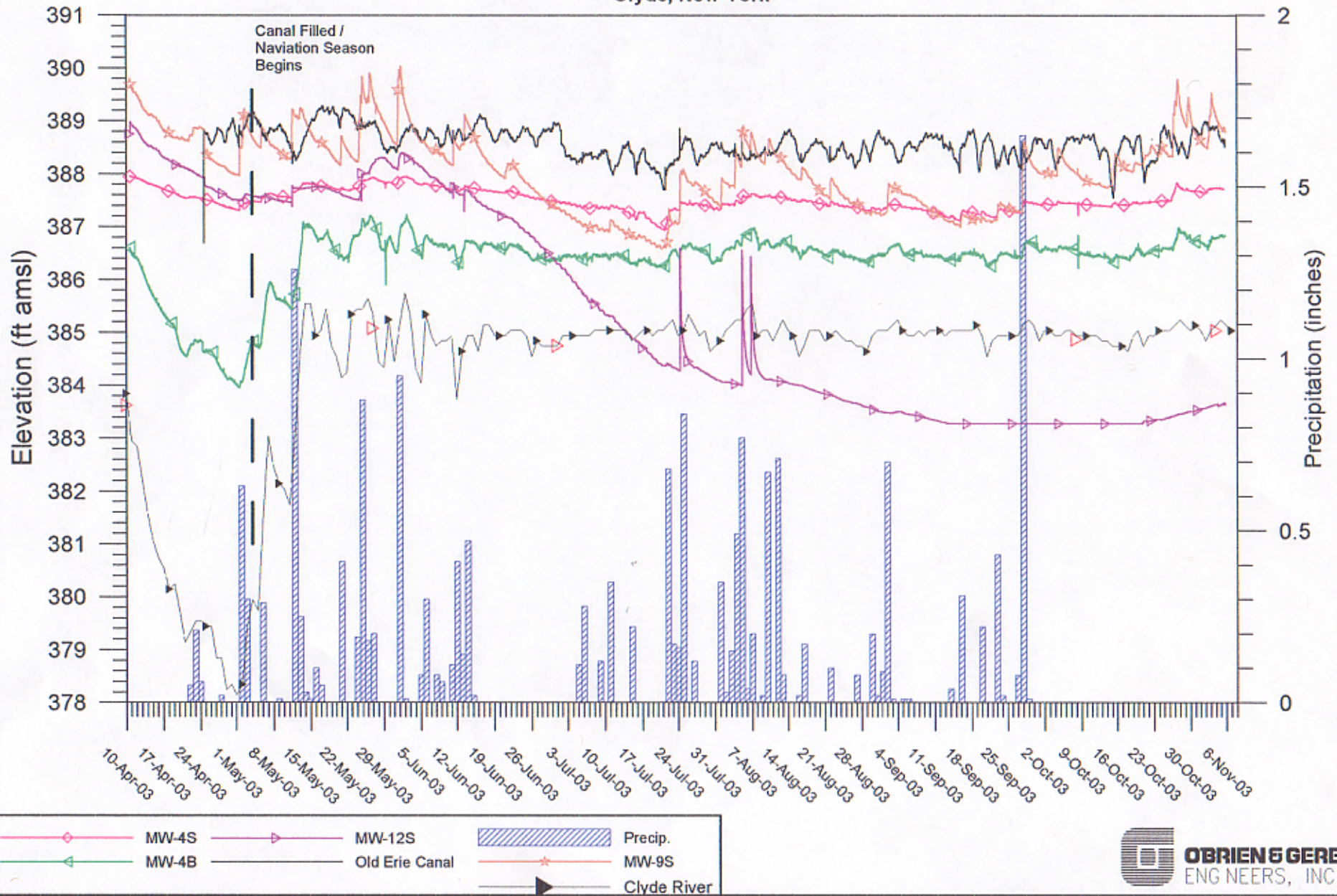
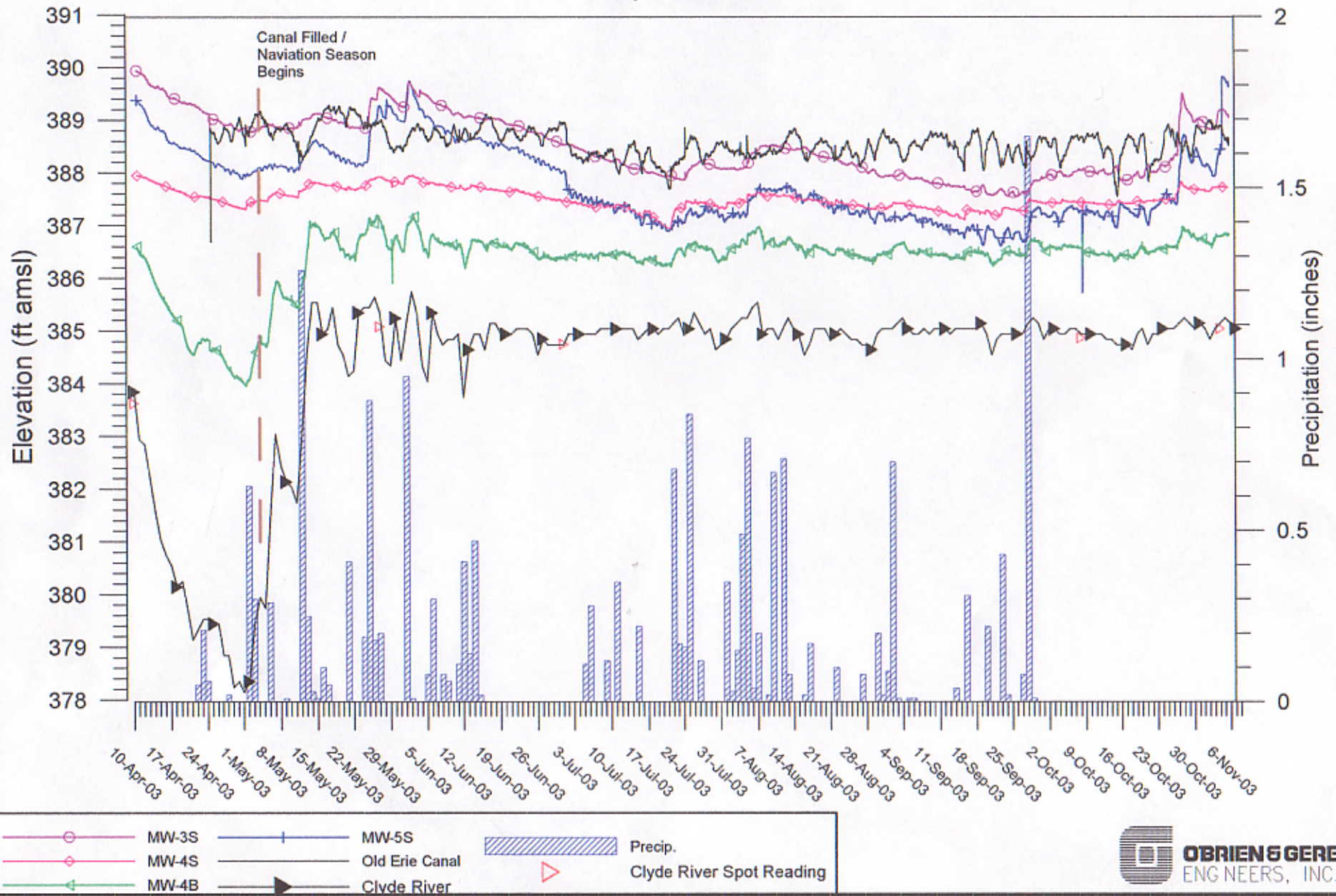


FIGURE 5-11
HYDROGRAPHS FOR DATALOGGERS ADJACENT TO RIVER

Old Erie Canal Site
 Clyde, New York



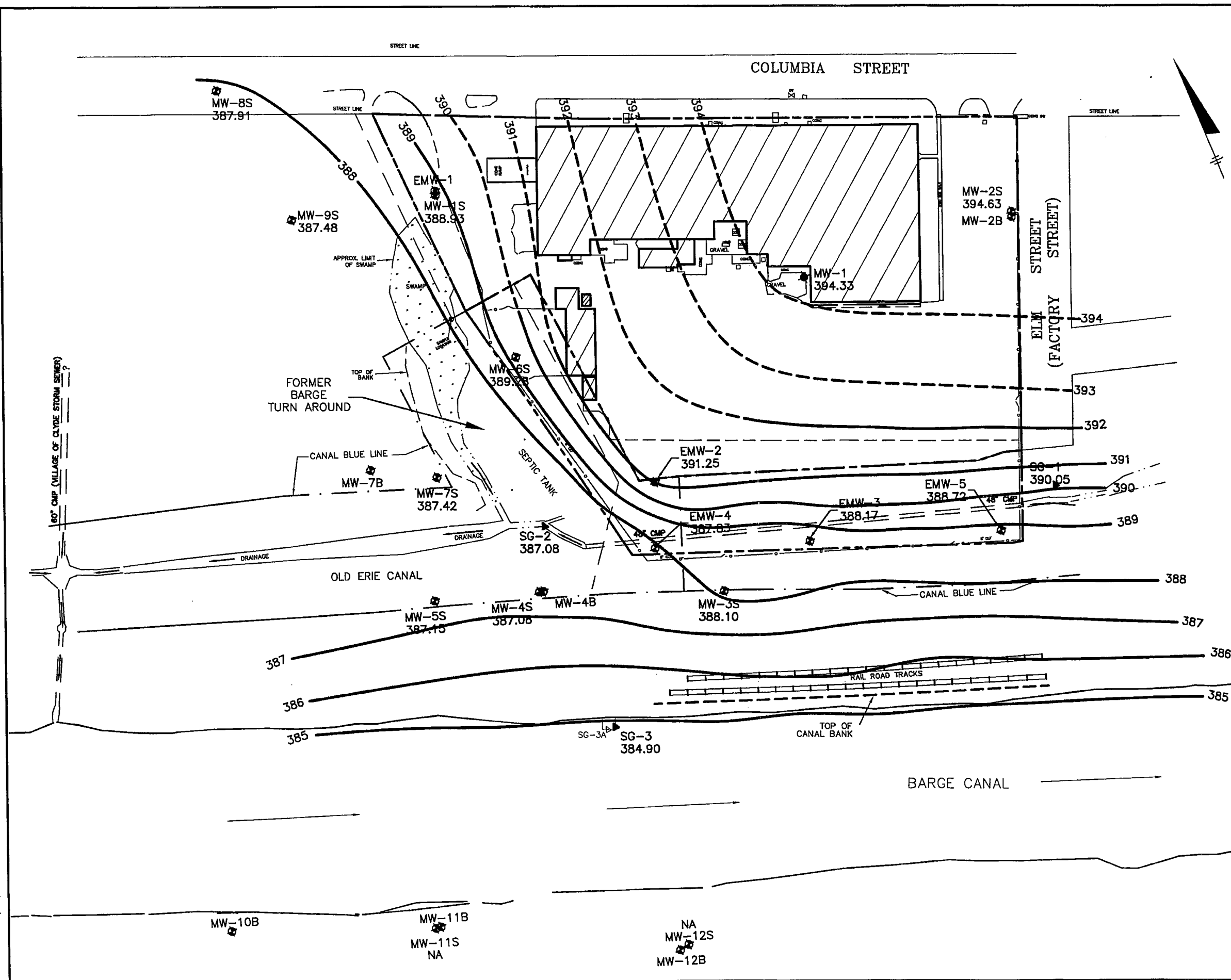


FIGURE 5-12

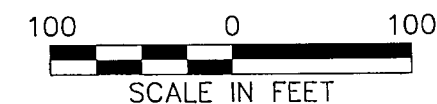
LEGEND

- PROPERTY BOUNDARY
- - - CANAL BLUE LINE
- - - STORM SEWER
- === 48-INCH CMP
- MW-2S OVERBURDEN MONITORING WELL
- MW-2B BEDROCK MONITORING WELL
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

NOTE:
"NA" DESIGNATES WATER LEVEL ELEVATION NOT AVAILABLE.

OLD ERIE CANAL SITE
CLYDE, NEW YORK

**POTENTIOMETRIC
SURFACE MAP FOR
OVERBURDEN GROUNDWATER
ON JULY 17, 2002**



OCTOBER 2003
31117



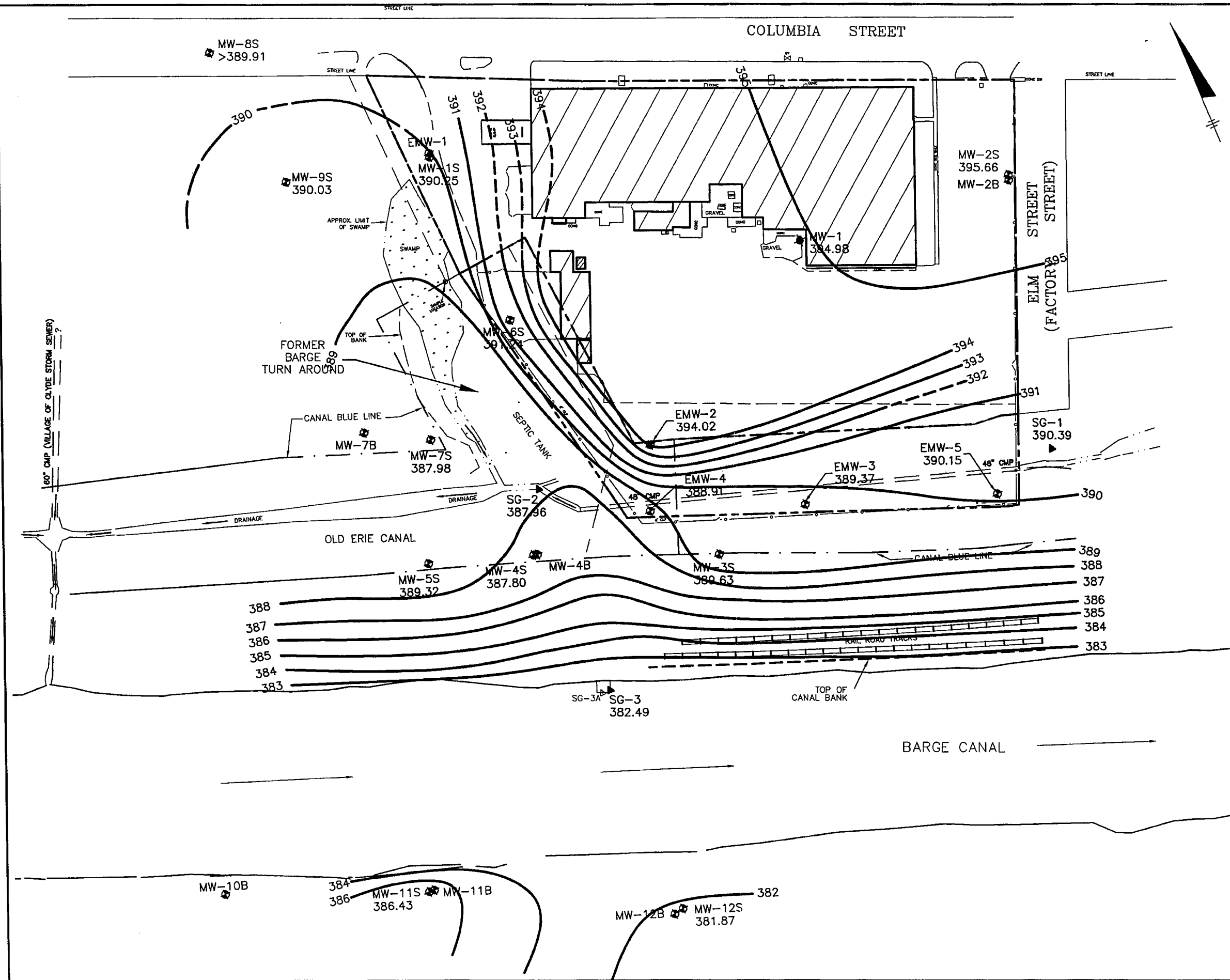


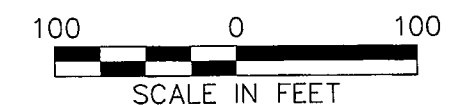
FIGURE 5-13

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP
- MW-2S OVERBURDEN MONITORING WELL
- MW-2B BEDROCK MONITORING WELL
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

POTENTIOMETRIC
SURFACE MAP FOR
OVERBURDEN GROUNDWATER
ON DECEMBER 16, 2002



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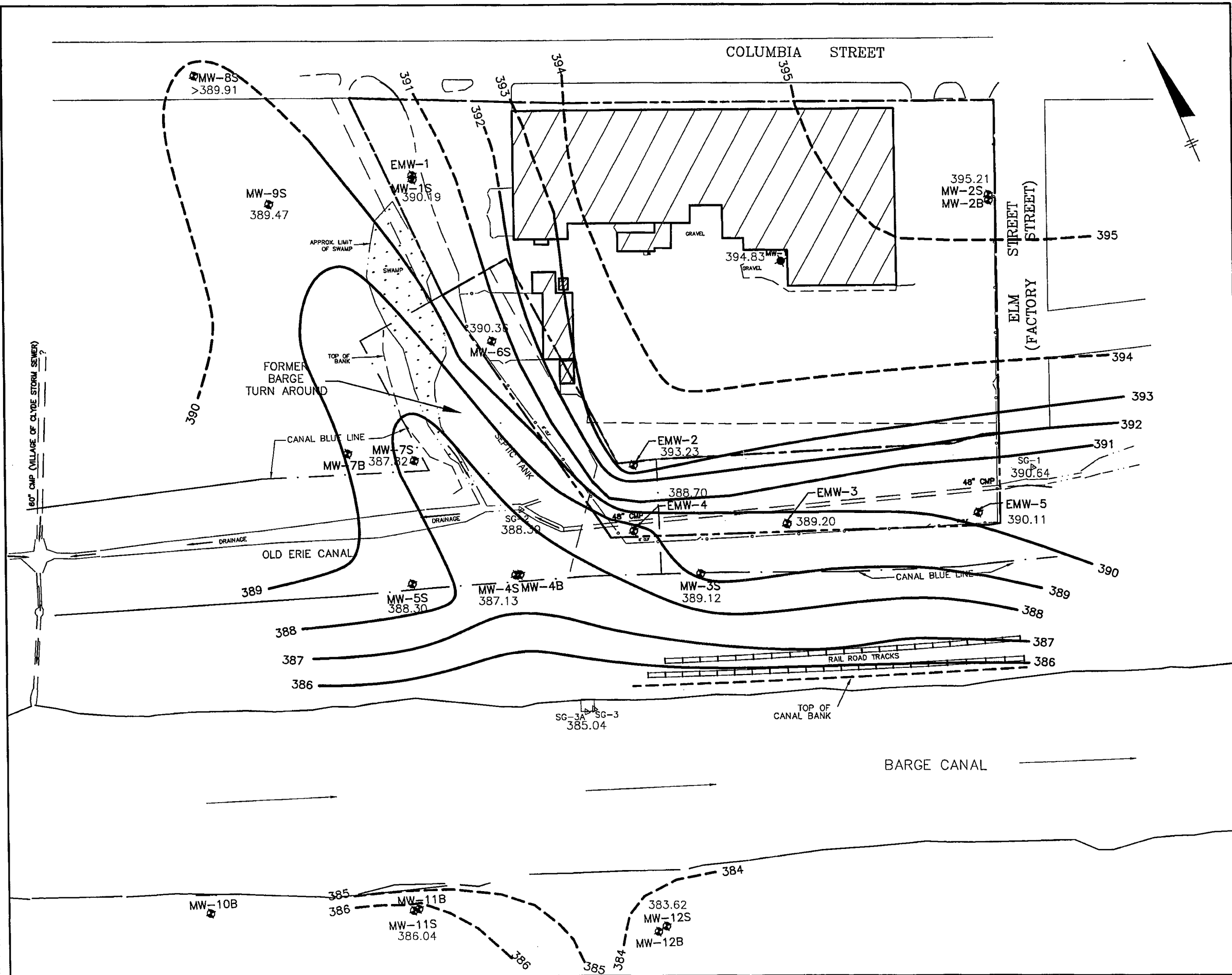


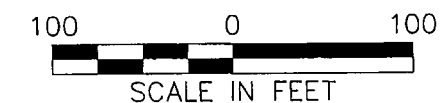
FIGURE 5-14

LEGEND

- PROPERTY BOUNDARY
- - - - - CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

POTENTIOMETRIC MAP
FOR THE OVERBURDEN
GROUND WATER ON
NOVEMBER 4, 2003



NOVEMBER 2003

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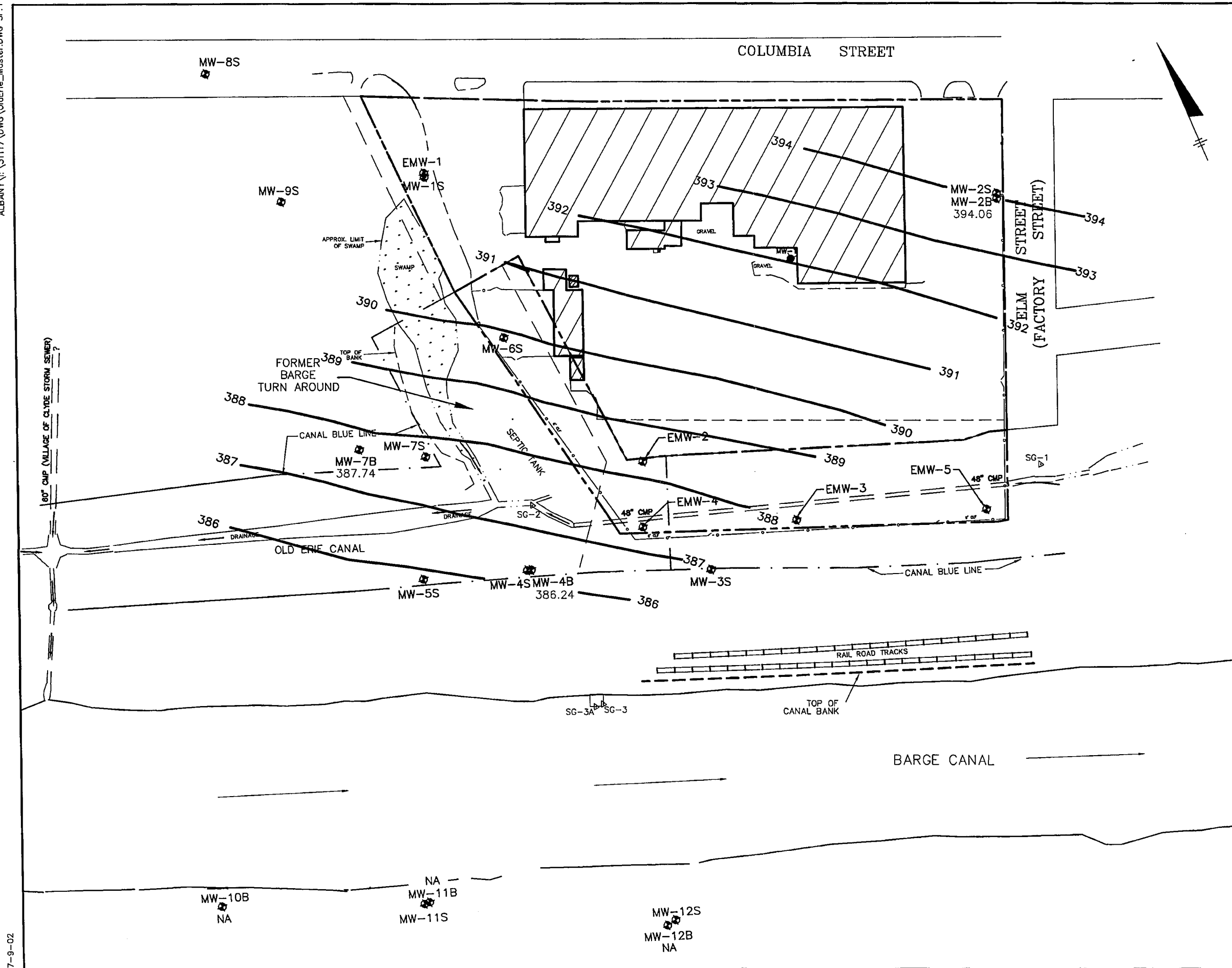


FIGURE 5-15

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP

MW-3S OVERBURDEN MONITORING WELL

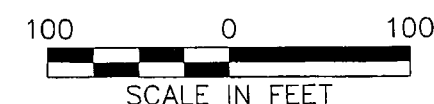
MW-3B BEDROCK MONITORING WELL

MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

NOTE:
"NA" DESIGNATES WATER LEVEL ELEVATION NOT AVAILABLE.

OLD ERIE CANAL SITE
CLYDE, NEW YORK

**POTENTIOMETRIC MAP
FOR THE BEDROCK
GROUND WATER ON
JULY 17, 2002**



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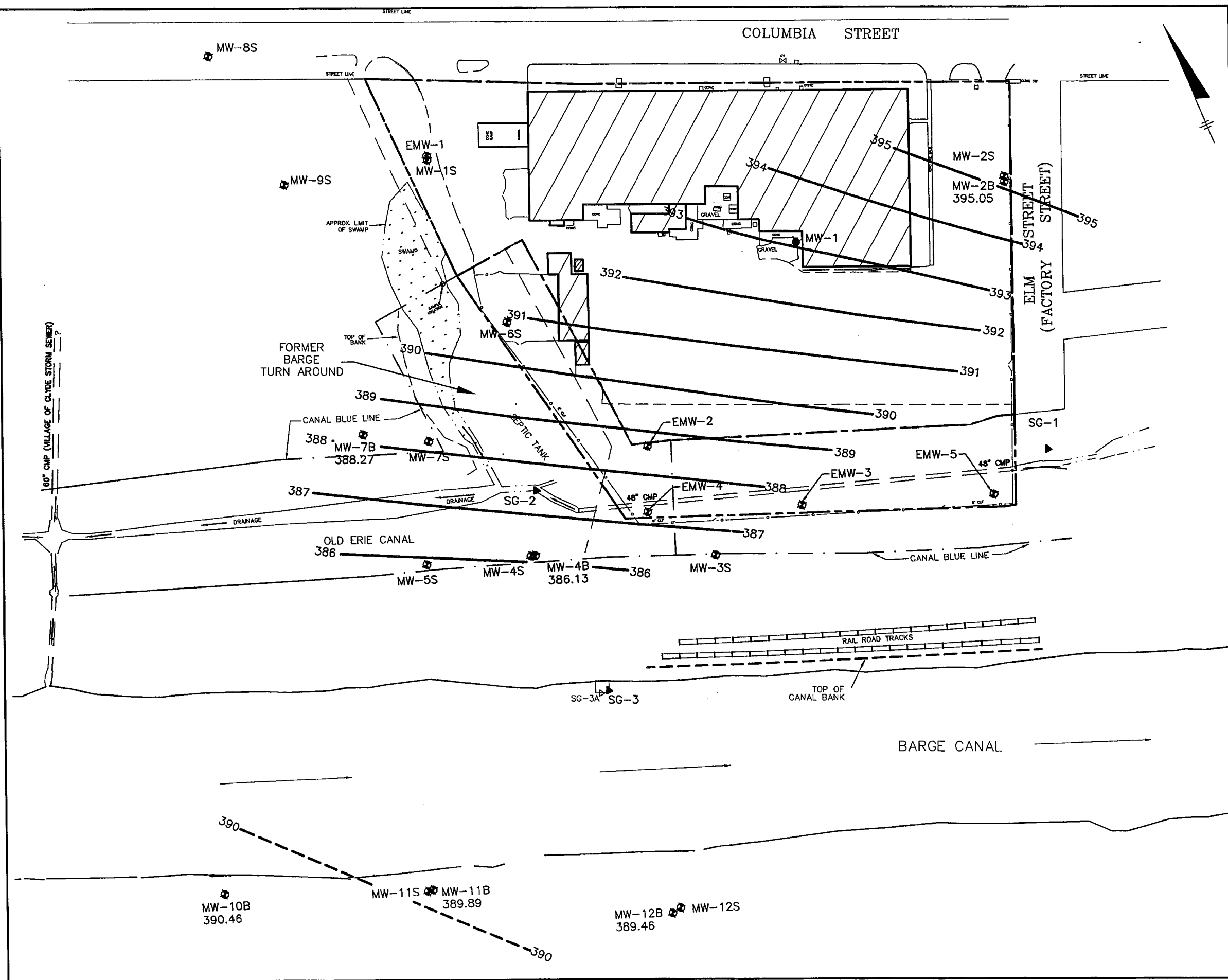


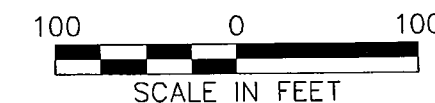
FIGURE 5-16

LEGEND

- PROPERTY BOUNDARY
- - - CANAL BLUE LINE
- STORM SEWER
- == 48-INCH CMP
- MW-2S OVERBURDEN MONITORING WELL
- MW-2B BEDROCK MONITORING WELL
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

POTENTIOMETRIC
SURFACE MAP FOR
BEDROCK GROUNDWATER
ON DECEMBER 16, 2002



OCTOBER 2003
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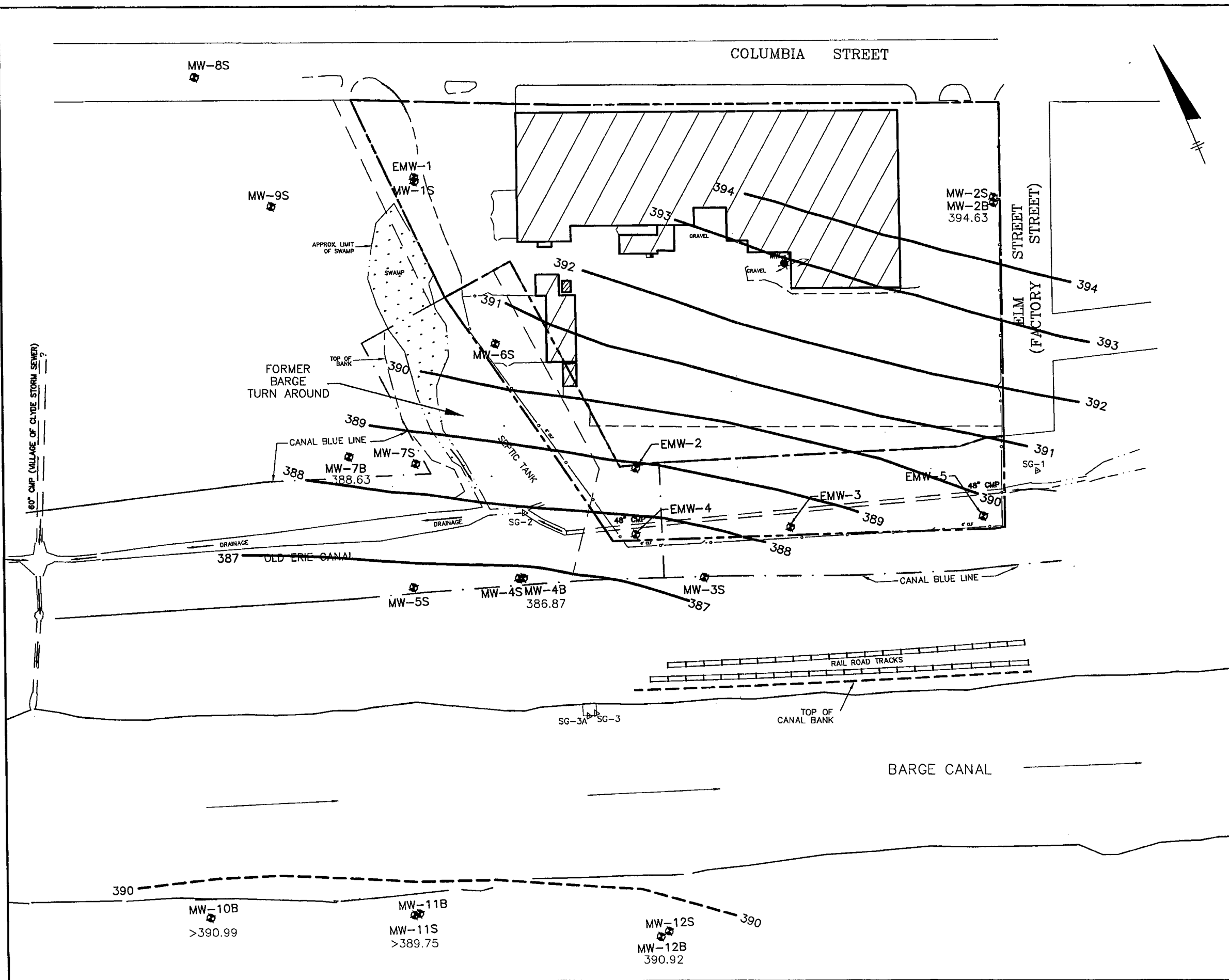


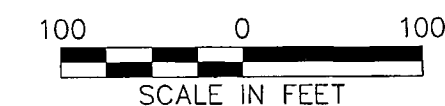
FIGURE 5-17

LEGEND

- PROPERTY BOUNDARY
- - - - CANAL BLUE LINE
- STORM SEWER
- === 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

POTENTIOMETRIC MAP
FOR THE BEDROCK
GROUND WATER ON
NOVEMBER 4, 2003



NOVEMBER 2003
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180" CMP (VILLAGE OF CLYDE STORM SEWER)

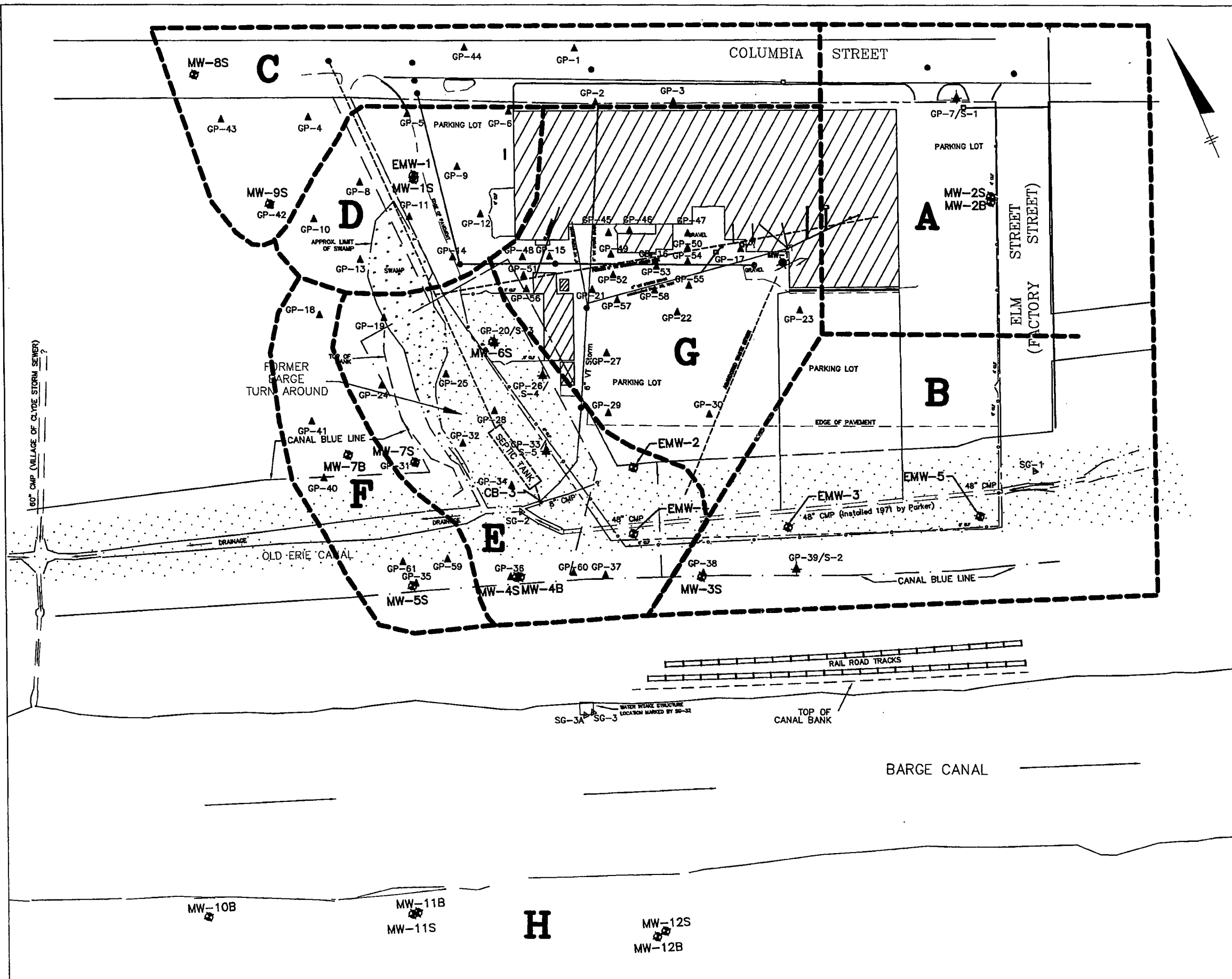


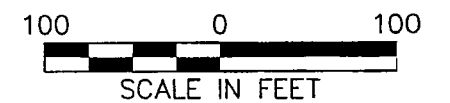
FIGURE 6-1

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- GP-39 ▲ DIRECT PUSH SAMPLE LOCATION
- GP-7/S-1 ▲ DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- MW-1 ▲ TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

SOIL BORING AND
MONITORING WELL
LOCATION MAP



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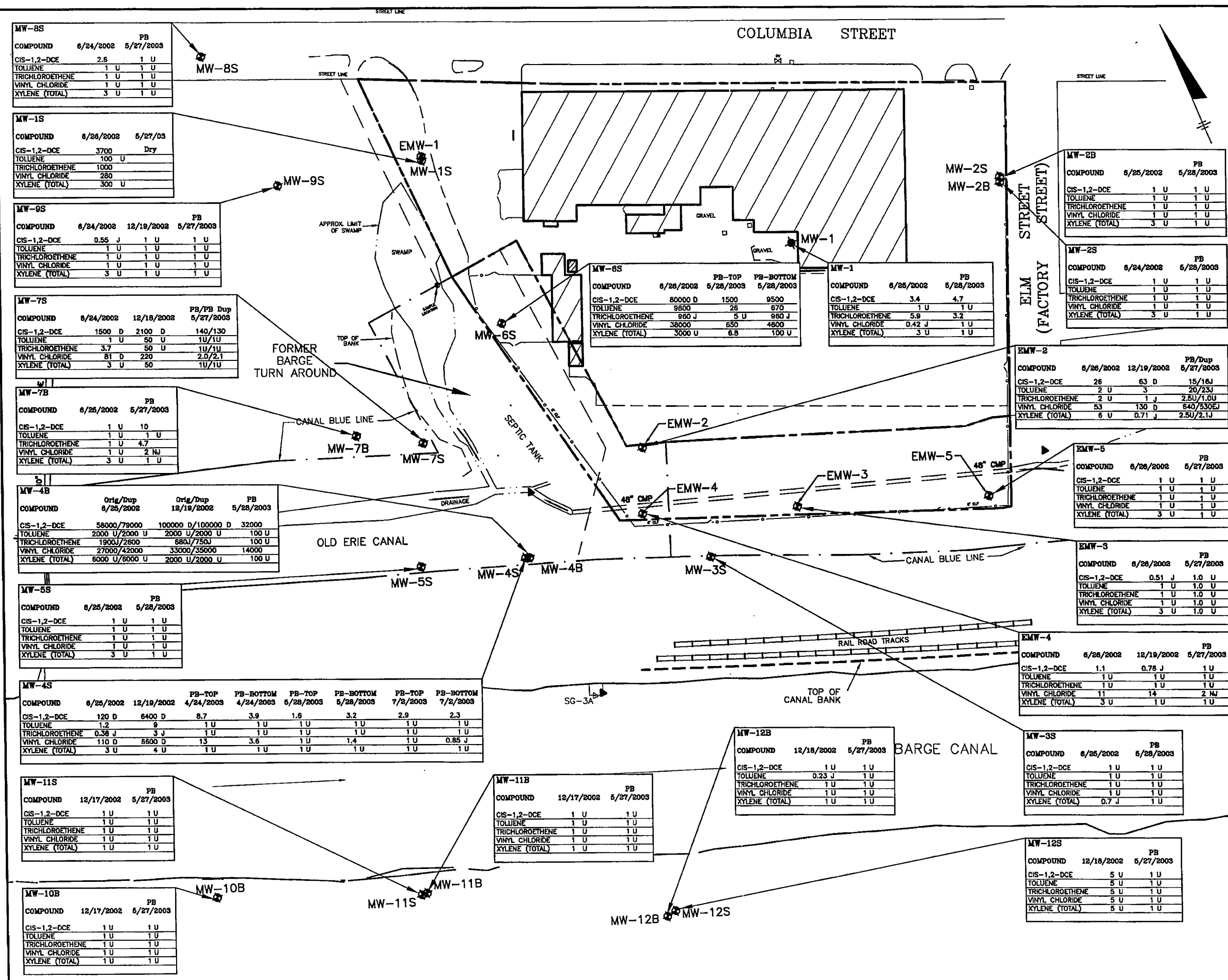


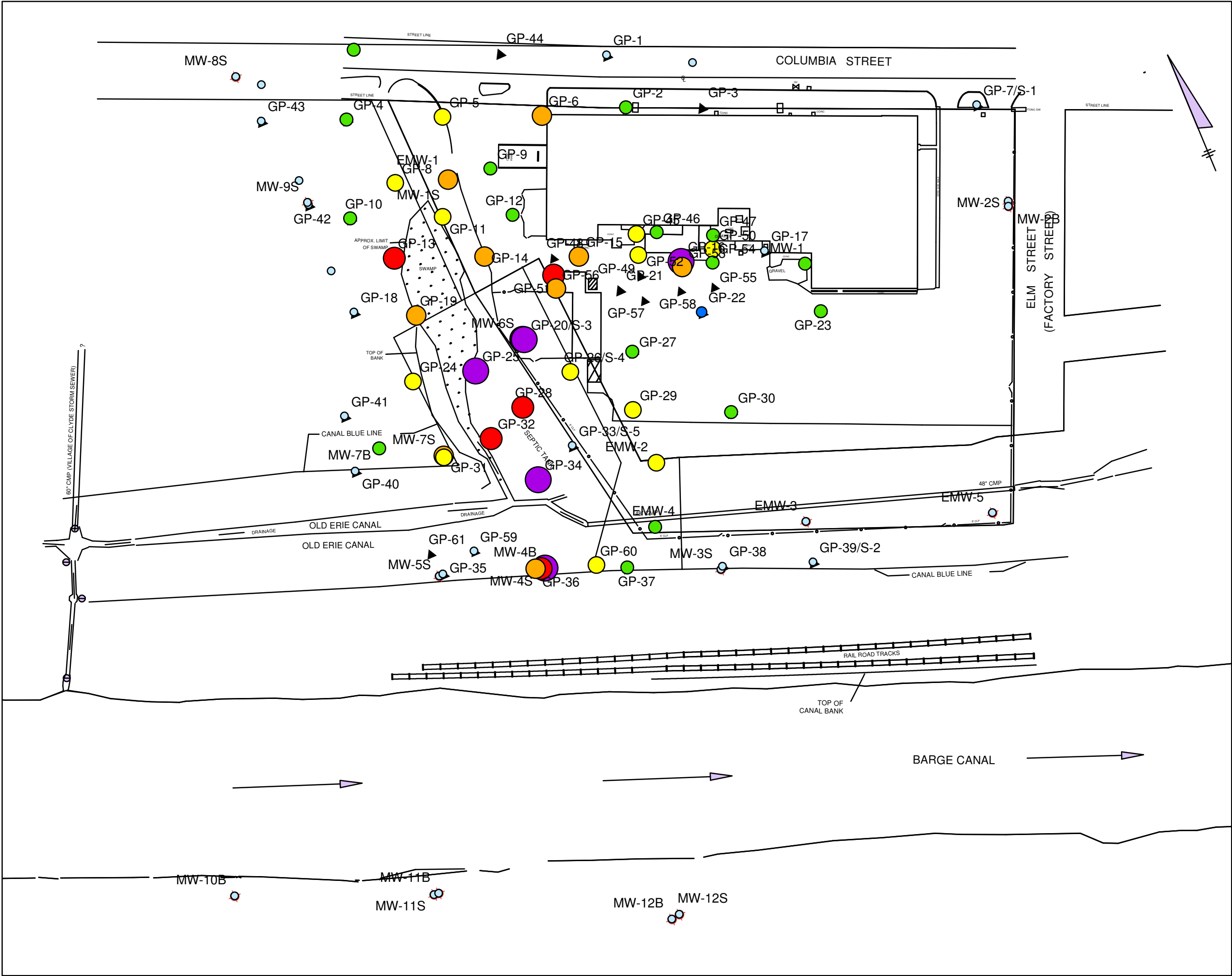
FIGURE 6-2

OLD ERIE CANAL SITE
CLYDE, NEW YORK100 0 100
SCALE IN FEET

OCTOBER 2003

31117

FIGURE 6-3



Legend

Ground Water
TOTAL_VOCS

- 0 - 5
- 6 - 10
- 11 - 100
- 101 - 1000
- 1001 - 10000
- 10001 - 50000
- 50001 - 300000
- ▲ Geoprobe Location
- ⊕ Monitoring Wells

NOTE:
A detailed summary of the ground water data is provided in Appendices F and G-1.

OLD ERIE CANAL SITE
CLYDE, NEW YORK

**TOTAL CONCENTRATION OF
VOCS IN GROUND WATER**



9-23-03
Site_base-Map.mxd



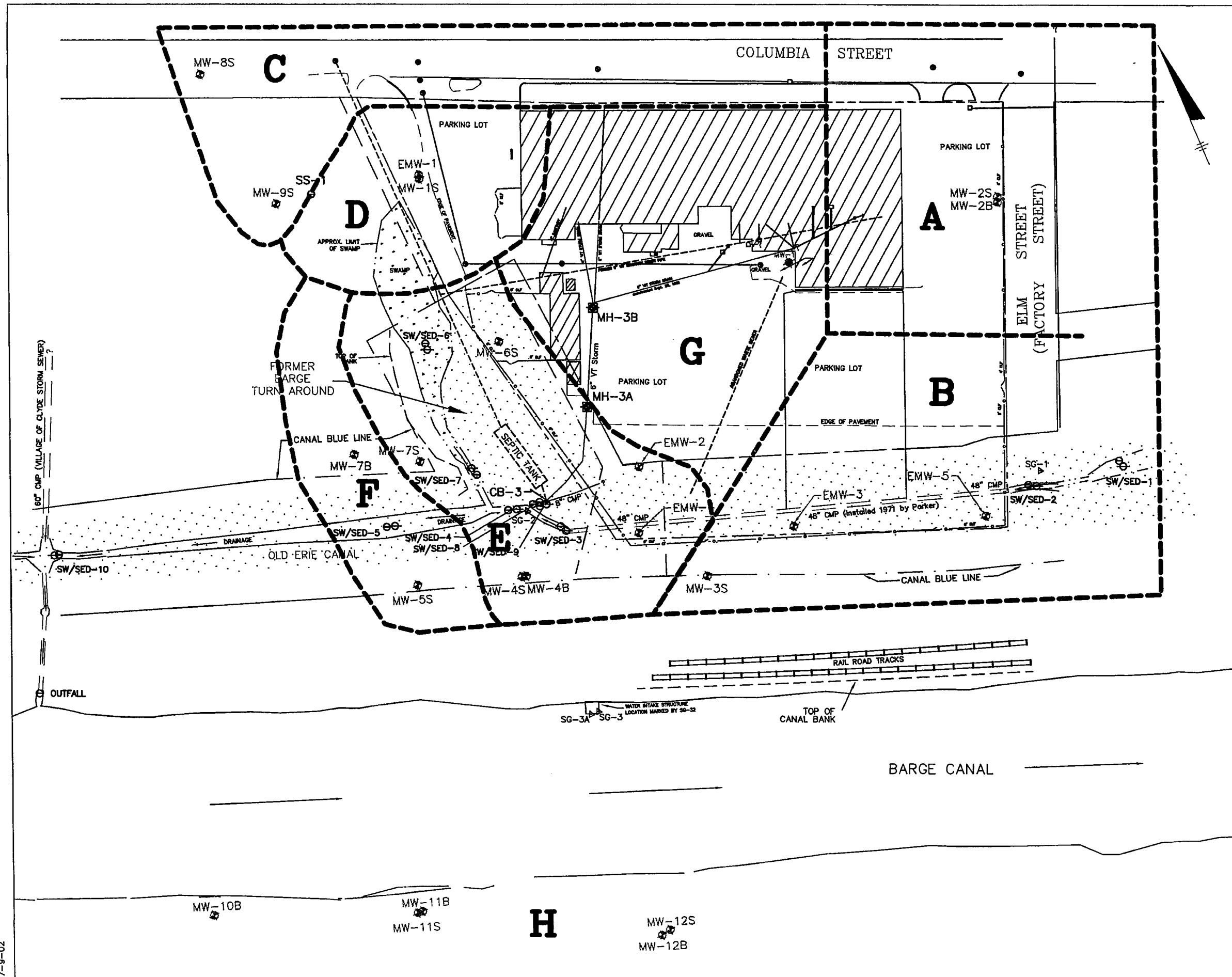


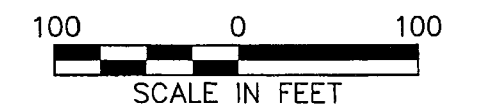
FIGURE 7-1

LEGEND

- PROPERTY BOUNDARY
- CANAL BLUE LINE
- STORM SEWER
- ==== 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SW/SED-1 SURFACE WATER/SEDIMENT SAMPLE LOCATION
- SS-1 SURFACE WATER/SEDIMENT SAMPLE LOCATION
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDERGROUND DIESEL TANK

OLD ERIE CANAL SITE
CLYDE, NEW YORK

SURFACE SOIL/SEDIMENT
SAMPLE LOCATION MAP



FEBRUARY 2003
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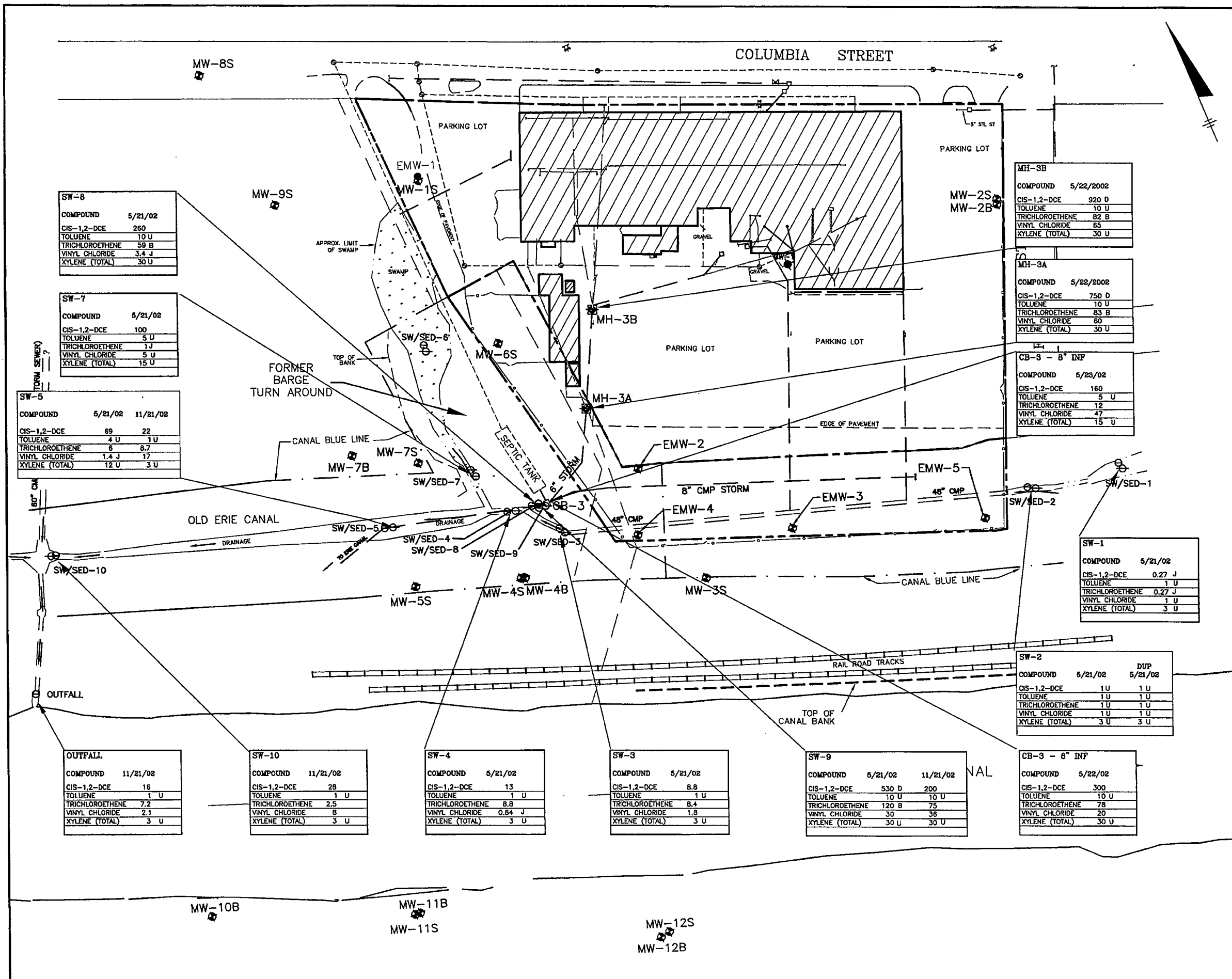


FIGURE 7-2

LEGEND

- PROPERTY BOUNDARY
- - - CANAL BLUE LINE
- - - STORM SEWER
- = = = 48-INCH CMP
- MW-3S OVERBURDEN MONITORING WELL
- MW-3B BEDROCK MONITORING WELL
- SW/SED-1 SURFACE WATER/SEDIMENT SAMPLE LOCATION
- MW-1 TEMPORARY MONITORING WELL INSTALLED DURING REMOVAL OF AN UNDER-GROUND DIESEL TANK

Notes:

- All units in ug/L (ppb).
- All analyses performed by Severn Trent Laboratories, Inc. of Buffalo, N.Y.
- Volatile organic compounds quantitated by EPA SW-846 Method 8260B.
- "U" designates that the compound was not detected at or above the quantitation limit shown.
- "J" designates that the detected concentration should be considered estimated because associated QC criteria was exceeded.
- "D" designates compounds identified in an analysis at the secondary dilution factor.
- "E" designates that the reported value is outside the calibration range of the instrument.
- "B" designates that the compound was also detected in the associated blank.

OLD ERIE CANAL SITE
CLYDE, NEW YORK

SURFACE WATER AND STORM WATER SAMPLING DATA

100 0 100
SCALE IN FEET

OCTOBER 2003
31117

O'BRIEN & GERE
ENGINEERS INC.