

DATA SUMMARY REPORT

70017

**Hudson River Project
Sampling and Analysis Program**

1992 Channel Characterization Program



**General Electric Company
Corporate Environmental Programs
Albany, New York**

May 1993



**O'BRIEN & GERE
ENGINEERS, INC.**

DATA SUMMARY REPORT

**HUDSON RIVER PROJECT
SAMPLING AND ANALYSIS PROGRAM
1992 CHANNEL CHARACTERIZATION PROGRAM**

**GENERAL ELECTRIC COMPANY
CORPORATE ENVIRONMENTAL PROGRAMS
ALBANY, NEW YORK**

MAY 1993

**O'BRIEN & GERE ENGINEERS, INC.
5000 BRITTONFIELD PARKWAY
SYRACUSE, NEW YORK 13221**

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APPENDICES (Separately Bound)

- A Field Documentation
- B OBG Laboratories, Inc. - Laboratory Report
- C Parratt-Wolff, Inc. - Laboratory Report

SECTION 1 - INTRODUCTION

1.01 Background

This report summarizes the results of sampling and analysis efforts conducted by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) as part of the Hudson River Channel Characterization Program. This investigation was initiated to determine PCB levels in sediments within the Champlain Canal. This work was prompted by the PCB Reassessment Remedial Investigation and Feasibility Study (RRI/FS) being performed on the upper Hudson River by the U.S. Environmental Protection Agency (USEPA). The Work being performed by USEPA in conjunction with the Hudson River RRI/FS is described in their Phase 1 Report (USEPA, 1991) and the Final Phase 2 Work Plan and Sampling Plan (USEPA, 1992).

The Champlain Canal extends sixty-two miles from the southern tip of Lake Champlain to the Federal Dam at Troy, New York (NOAA, 1974). Between Lock 12 in Whitehall, New York and Lock 7 in Fort Edward, New York (at the confluence of the Hudson River), the land-cut canal rises forty-four feet in elevation to Dunham Basin then drops twenty-one feet to Fort Edward through a system of five locks (NOAA, 1974). The canal follows the main channel of the Hudson River for another forty miles downstream to Troy, dropping 118 feet in elevation through seven locks. Figure 1 is a map showing the Hudson River portion of the Champlain Canal System.

The New York State Department of Transportation (NYSDOT) is responsible for maintaining the Champlain Canal at a minimum depth of twelve feet to permit unhindered navigation in accordance with Title 17, Chapter II, Section 15.2 of the *Rules and Regulations of the State of New York*. Based on annual investigations,

NYSDOT identifies areas of refill and periodically removes sediment from within the channel. Prior to disposing of material dredged from the channel, NYSDOT must gain regulatory approval in the form of a permit issued from the New York State Department of Environmental Conservation (NYSDEC). The decision by NYSDEC to issue a permit for dredging is based, in part, on the physical and chemical characteristics of the sediment. Sediment quality criteria used by NYSDEC include percent volatile solids, oil & grease content, grain size, concentration of heavy metals, and, in certain cases, the Great Lakes Criteria (NYSDEC, 1990). The last documented dredging operation performed by NYSDOT in the upper Hudson River occurred in 1984 below Lock 4 near Stillwater. NYSDOT has recently specified a number of refill areas potentially needing maintenance dredging including the intersection of the land-cut canal and the Hudson River south of the Northumberland Bridge and the canalized river near the mouth of the Hoosic River (NYSDEC, 1990).

General Electric has evaluated recently collected bathymetric data in an attempt to define areas within the Champlain Canal having less than twelve feet of draft (water depth). A field reconnaissance survey was conducted July 30, 1992 by O'Brien & Gere and General Electric to corroborate the bathymetric data and collect general information on sediment distribution within the canal. During the survey, depth soundings were taken to estimate the extent of refill (material deposited in the channel which could potentially be dredged) and facilitate subsequent field sampling. Figure 2 depicts ten general areas in the upper Hudson River where depth soundings indicated a water depth of less than twelve feet. These areas were the subject of this Channel Characterization Program.

1.02 Program Scope and Objectives

The principal objective of this investigation was to characterize sediment in the Champlain Canal for PCB. Specific tasks included:

- collecting and compositing sediment samples from 13 targeted areas,
- analyzing sediment samples for total PCBs, TCLP metals, oil & grease, percent volatile solids, percent moisture, bulk density, and grain size distribution, and
- generating a report summarizing the sampling and analysis results.

SECTION 2 - METHODS

2.01 Sediment Sampling Locations

The Channel Characterization Program involved the collection and processing of seventy-one sediment cores and grab samples from thirteen sites in the upper Hudson River and Champlain Canal from Rogers Island, near Fort Edward, to the Route 4 Bridge in Waterford. The thirteen sites were selected based on bathymetric data, site reconnaissance, and discussions with General Electric. The general sampling areas are depicted in Figure 2. The thirteen sites are described below and are depicted in Figures 3 through 11.

Site Name	River Mile	Description
A	194.1	Fort Edward Terminal; Rogers Island (north)
B	193.9	Fort Edward Terminal; Rogers Island (south)
CN	192.5	Town of Moreau near H-7 site (north)
CS	192.3	Town of Moreau near H-7 site (south)
DG	191	1000 ft downstream of Snook Kill
DC	191	1000 ft downstream of Snook Kill
E	183.5	Reach 6 north of Northumberland Dam
F1	180.1	Reach 5 north of Schuylerville (north)
F2	180	Reach 5 north of Schuylerville (south)
G	167.5	Reach 4 near confluence with Hoosic River
H	164	Reach 3 south of Mechanicville
I	160.9	Reach 2
J	158.5	Reach 1 north of Waterford

2.02 Sample Collection Procedures

The vessel employed for sampling was a 24-foot pontoon boat powered by a 50 hp outboard motor and equipped with front and rear anchoring spuds. Deployment of the boat to each sampling site was accomplished using landmarks and NYSDOT buoy markers as visual references.

Sediment core collection and grab sampling were as discussed below. An Ogeechee River corer and a petite Eckman dredge sampler were used to collect sediment cores and grab samples, respectively. A total of twelve core samples were obtained from two sites (B and DC), ranging in depth from two to ten inches. Field sampling notes were recorded on field logsheets and are presented in Appendix A. Core collection generally consisted of the following procedure:

- 1) anchor the boat at the desired sampling location,
- 2) record the water depth and approximate location in the field logsheet,
- 3) insert a clean, 1½-inch Lexan® core liner into the PVC core tube assembly and lower the sampler into the water making sure the valve on the core head is in the open position,
- 4) advance the Ogeechee River core sampler into the sediment as far as possible, but no more than twelve feet below water level, using the extension T-handle and drive hammer apparatus,
- 5) close the valve on the sampler head and retrieve the corer, and
- 6) cap the top and bottom of the core liner containing the sample and place vertically in a holding rack until the appropriate number of cores from each site have been collected.

Where cores could not be obtained due to sediment characteristics, grab sampling procedures were employed to collect sediment. A total of fifty-nine grab samples were collected. Grab sampling procedures were as follows:

- 1) lower a decontaminated petite Eckman dredge sampler into the water until it settles on the river bottom,
- 2) disengage the crossbar latch and retrieve the sample, and
- 3) empty the contents of the grab sampler into a clean, plastic tub.

2.03 Sediment Sample Processing Procedure

Sample processing involved compositing sediment samples collected from the same site and depth in a decontaminated aluminum bowl and mixing the sediment using a dedicated metal spoon. Decontamination procedures are specified in the Quality Assurance Project Plan (QAPP) developed for the Hudson River Sampling and Analysis Program (O'Brien & Gere, 1993).

Vertically stratified composite samples on one-foot intervals were desired. However, since no sediment deeper than one foot below the sediment/water interface was collected, composite samples represent only the top layer of sediment.

2.04 Sample Handling and Custody

Subsamples of each composite sample were transferred to pre-cleaned, 500-ml glass jars with Teflon® lids, labeled, and placed in laboratory coolers. At the end of each day, the sample coolers were sent, via overnight carrier, to OBG Laboratories, Inc. in Syracuse, New York for analysis. Container specifications, preservation

requirements, and holding times followed specifications described in the QAPP (O'Brien & Gere, 1993).

2.05 Laboratory Analysis

Sediment samples collected during the Channel Characterization Program were analyzed by OBG Laboratories, Inc. for total PCB, TCLP metals, oil & grease, volatile solids, bulk density, and percent moisture. Total PCB, bulk density, and percent moisture were analyzed in accordance with the QAPP (O'Brien & Gere, 1993). Grain size analyses were performed by Parratt-Wolff, Inc. under subcontract to OBG Laboratories, Inc. Analytical methods are specified in Section 3.

2.06 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) samples were collected in accordance with the QAPP (O'Brien & Gere, 1993). These samples included matrix spike, blind duplicate, and equipment blank samples.

SECTION 3 - DATA PRODUCTION AND REPORTING

3.01 OBG Laboratories, Inc.

OBG Laboratories, Inc. was responsible for the analysis of fifteen sediment and four equipment rinse samples (blanks) collected during the Channel Characterization Program. Analytical methods employed for sample analyses are presented in the following table:

PARAMETER	MATRIX	METHOD NUMBER AND REFERENCE
Bulk Density	Sed	(Page, 1982)
Total PCBs	Sed	EPA 8080 (USEPA, 1986)
TCLP Extraction	Sed	EPA 1311 (CFR, 1990)
Metals		
Arsenic	Sed	EPA 206.2 (USEPA, 1986)
Barium	Sed	EPA 208.2 (USEPA, 1986)
Cadmium	Sed	EPA 213.2 (USEPA, 1986)
Chromium	Sed	EPA 218.2 (USEPA, 1986)
Lead	Sed	EPA 239.2 (USEPA, 1986)
Mercury	Sed	EPA 245.5 (USEPA, 1986)
Selenium	Sed	EPA 270.2 (USEPA, 1986)
Silver	Sed	EPA 272.2 (USEPA, 1986)
Oil & Grease	Sed	EPA 413.1 (USEPA, 1986)
Volatile Solids	Sed	EPA 160.4 (USEPA, 1986)

Analytical data packages were provided for each sample analyzed documenting sample preparation, extraction, and analysis procedures. *NYSDEC Analytical Services Protocol (ASP) Category B* deliverables were provided for PCB and TCLP

metals analyses. The data reports are presented in Appendix B and include the following:

- case narrative,
- physical description of samples,
- summaries of calibration and QA/QC data,
- copies of completed chain of custody forms,
- analytical results of environmental,
- trip blank, field blank, and method blank samples, and
- appropriate raw instrument outputs.

3.02 Parratt-Wolff, Inc.

Parratt-Wolff, Inc. was responsible for conducting sieve analyses and hydrometer testing on nine sediment samples under subcontract to OBG Laboratories, Inc. The analytical method employed for grain size analysis was ASTM Method D422. The data generated by Parratt-Wolff, Inc. is presented in Appendix C and includes a summary table of sieve testing results and grain size distribution graphs for each sample.

SECTION 4 - SAMPLING AND ANALYSIS RESULTS

4.01 PCB, TCLP Metals, Oil & Grease, and Conventional Parameter Testing

Analytical results for the Hudson River Channel Characterization Program are summarized in Table 1. A total of nineteen samples were analyzed, including two blind duplicates and four equipment blanks. PCB, TCLP metals, and oil & grease concentrations are presented on a dry weight basis in mg/kg (gravimetric). TCLP metals concentrations are calculated from volumetric values (mg/l) based on an extraction volume of 2,000 ml and a sample weight of 100 grams. Bulk density is presented in grams/cubic centimeter (g/cc) on a wet weight basis.

PCB concentrations ranged from 0.42 mg/kg to 18.0 mg/kg on a dry weight basis with a mean concentration of 4.4 mg/kg and standard deviation of 4.3. The highest level was quantified in a composite sediment sample collected from Site B near Rogers Island in Fort Edward (see Figure 3). The composite sample consisted of seven discrete cores collected from the top four inches of sediment. The sediment type at Site B was described by field personnel as a mixture of sand and silt with some gravel. There was also visible evidence of wood debris in some of the core samples.

Concentrations of most metals quantified in sediment samples collected during this study were below instrument detection limits with the exception of barium and mercury. Concentrations of barium ranged from 9.8 mg/kg to 29.0 mg/kg (Site H) on a dry weight basis. Mercury was quantified at concentrations above the instrument detection limit in four out of fifteen composite sediment samples analyzed and ranged in concentration from 0.012 mg/kg to 0.026 mg/kg on a dry weight basis.

The limited amount of sample available to the analytical laboratory for oil & grease analysis raised the detection limit above the instrument detection limit of 500 mg/kg. The concentrations of oil & grease reported by the laboratory, and summarized in Table 1, are below the detection limit in each case. None of the samples showed oil & grease concentrations greater than 1000 mg/kg-dry weight, the level above which further testing for other pollutants, including PCBs, might be required by NYSDEC during the permitting process (NYSDEC, 1990).

4.02 Grain Size Analysis

Grain size testing results for nine of the fifteen sediment samples collected are summarized in Table 2. Submitted sample amounts for six samples was insufficient to allow grain size testing by ASTM Method D422. Raw data and grain size distribution plots are included in Appendix C.

The percent of sample material passing through a 200 mesh sieve is one of several flag test criteria used by NYSDEC in deciding whether to issue permits for the disposal of material dredged as a result of canal maintenance (NYSDEC, 1990). The samples analyzed during this study contained between 1.1 percent and 10.6 percent material passing a 200 mesh sieve. None of the values exceeded the flag test criteria of 30 percent set by NYSDEC.

The results of Hudson River Channel Characterization Program suggest that sediments within the channel of the Champlain Canal in areas potentially subject to dredging do not exceed the flag test criteria set by NYSDEC, which include percent volatile solids, oil & grease content, and grain size analyses. In addition, none of the metals quantified in sediment samples exceeded TCLP regulatory levels (CFR, 1990)

and PCB concentrations quantified in all but one sample were less than 10 mg/kg-dry weight.

REFERENCES

- CFR Part 261 Appendix II - Method 1311 Toxicity Characteristic Leaching Procedure (TCLP), as amended 55 CFR 11863. March 29, 1990.
- New York State Department of Environmental Conservation. 1990. *NYS Barge Canal 1990-93 Water Quality Certification*. Letter to John R. Jermano (NYSDOT). June 1, 1990.
- National Oceanic and Atmospheric Administration. 1974. Lake Sung Center. New York. State Barge Canal System - Chart No. 180.
- O'Brien & Gere Engineers, Inc. 1993. *Quality Assurance Project Plan*. Hudson River Project; 1991-1992 Sampling and Analysis Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY. May 1993.
- Page, A.L. 1982. *Methods of Soil Analysis*. American Society of Agronomy. Madison, WI.
- U.S. Environmental Protection Agency. 1986. *Test Methods for Evaluating Solid Waste*. SW-846, 3rd edition. November, 1986.
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Tables



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Table 1

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Hudson River Channel Characterization Program
Analytical Results Summary

Site	Date Collected	Total PCB (mg/kg)	TCLP Metals								Oil & Grease (mg/kg)	Bulk Density (g/cc)	Volatile Solids (%)	Moisture Content (%)	Solids Content (%)
			As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)					
A	9/2/92	5.9	U	23.8	U	U	U	U	U	U	<680	1.236	3.4	26.4	73.6
B	9/2/92	18.0	U	18.9	U	U	U	U	U	U	<690	1.191	4.3	28.0	72.0
C (north)	9/1/92	7.3	U	13.9	U	U	U	0.026	U	U	<690	1.296	3.3	27.6	72.4
C (south)	9/1/92	6.8	U	14.2	U	U	U	0.012	U	U	<690	1.21	2.8	27.5	72.5
DC	9/1/92	5.1	U	14.1	U	U	U	0.014	U	U	<670	1.368	2.7	24.9	75.1
DC (dup)	9/1/92	3.8	U	9.76	U	U	U	U	U	U	<650	1.286	3	23.6	76.4
DG	9/1/92	3.2	U	12.0	U	U	U	0.016	U	U	<650	1.44	2.7	23.2	76.8
DG (dup)	9/1/92	3.7	U	22.6	U	U	U	U	U	U	<650	1.402	5.8	23.6	76.4
E	8/31/92	5.0	U	22.4	U	U	U	U	U	U	<670	1.419	5.4	25.7	74.3
F (north)	8/31/92	1.6	U	23.0	U	U	U	U	U	U	<740	1.253	3.1	32.6	67.4
F (south)	8/31/92	1.4	U	20.2	U	U	U	U	U	U	<630	1.472	2.7	20.5	79.5
G	8/27/92	0.42	U	24.4	U	U	U	U	U	U	<820	1.358	4.9	39.3	60.7
H	8/27/92	1.9	U	29.0	U	U	U	U	U	U	<680	1.404	3	26.6	73.4
I	8/26/92	0.81	U	26.6	U	U	U	U	U	U	<640	1.584	2.3	22.2	77.8
J	8/26/92	1.5	U	24.2	U	U	U	U	U	U	<1000	1.323	4.8	50.9	49.1
EB-B	9/2/92	0.12	U	9.70	U	U	U	U	U	U	-	-	-	-	-
EB-C	9/1/92	<.065	U	8.90	U	U	U	U	U	U	-	-	-	-	-
EB-E	8/31/92	0.13	U	5.76	U	U	U	U	U	U	-	-	-	-	-
EB-F	9/1/92	0.09	U	9.92	U	U	U	U	U	U	-	-	-	-	-
Detection Limit (Approx.)		0.1	5	2	2	10	10	0.010	2	2	NA	NA	NA	NA	NA

- Notes:
- 1) U = below instrument detection limit
 - 2) - = Not analyzed
 - 3) Concentrations presented on a dry weight basis
 - 4) EB-"x" = equipment rinse; concentration in units of ug/L for water sample
 - 5) TCLP metals concentrations based on 2 liter extraction volume and 100 gram sample weight

Table 2

General Electric Company
Hudson River Channel Characterization Program
Sieve Analysis Results

Site	Sieve Size - Percent Passing Sieve											
	1"	3/4"	1/2"	3/8"	1/4"	#4	#10	#30	#40	#60	#100	#200
A	100	96.5	96.5	95.8	93.1	91.2	83.9	59.3	40.3	12	3.5	1.4
B	-	100	97.3	96.6	93.2	90.7	80.1	56.4	42.9	18.4	5.5	2.3
C (south)	-	100	98.8	98.4	97.8	97.4	94.9	87.8	85.1	56.9	11	2
DG	-	100	95.7	91.7	81.7	75.2	57.1	40.7	36.7	26.2	10.2	4
E	-	100	97	97	95.5	94.3	79.8	37	27.2	16.9	6.8	1.9
F (south)	-	100	95.3	92.4	83.6	79.5	70.6	58.1	49	15.4	3.4	1.1
G	-	100	96.2	93.1	90.5	87	77.6	58.3	46.2	27.4	17.2	10.6
H	100	98.6	90.1	89.6	83.1	79.3	71.1	51.3	39	22.7	10.3	3.9
I	-	100	87.9	84.4	73.9	68.9	55.3	34.2	24.6	9.8	3.1	1.8

- Notes:
- (1) Sieve Analysis by ASTM method D422
 - (2) Sample weights as recieved by Parrat-Wolff were below minimum requirements of test method ASTM D422

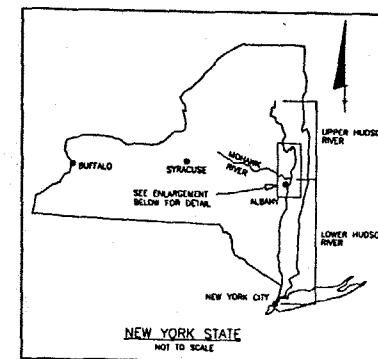
Figures



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FIGURE 1



**GENERAL ELECTRIC
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HUDSON RIVER PROGRAM
CHARACTERIZATION PROGRAM

**HABITAT STATION
LOCATIONS**

SOURCE:
NEW YORK STATE BARGE CANAL
SYSTEM MAPS (NOAA, 1973)

NOT TO SCALE

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ENGINEERS INC.
Syracuse, New York

06/01/93

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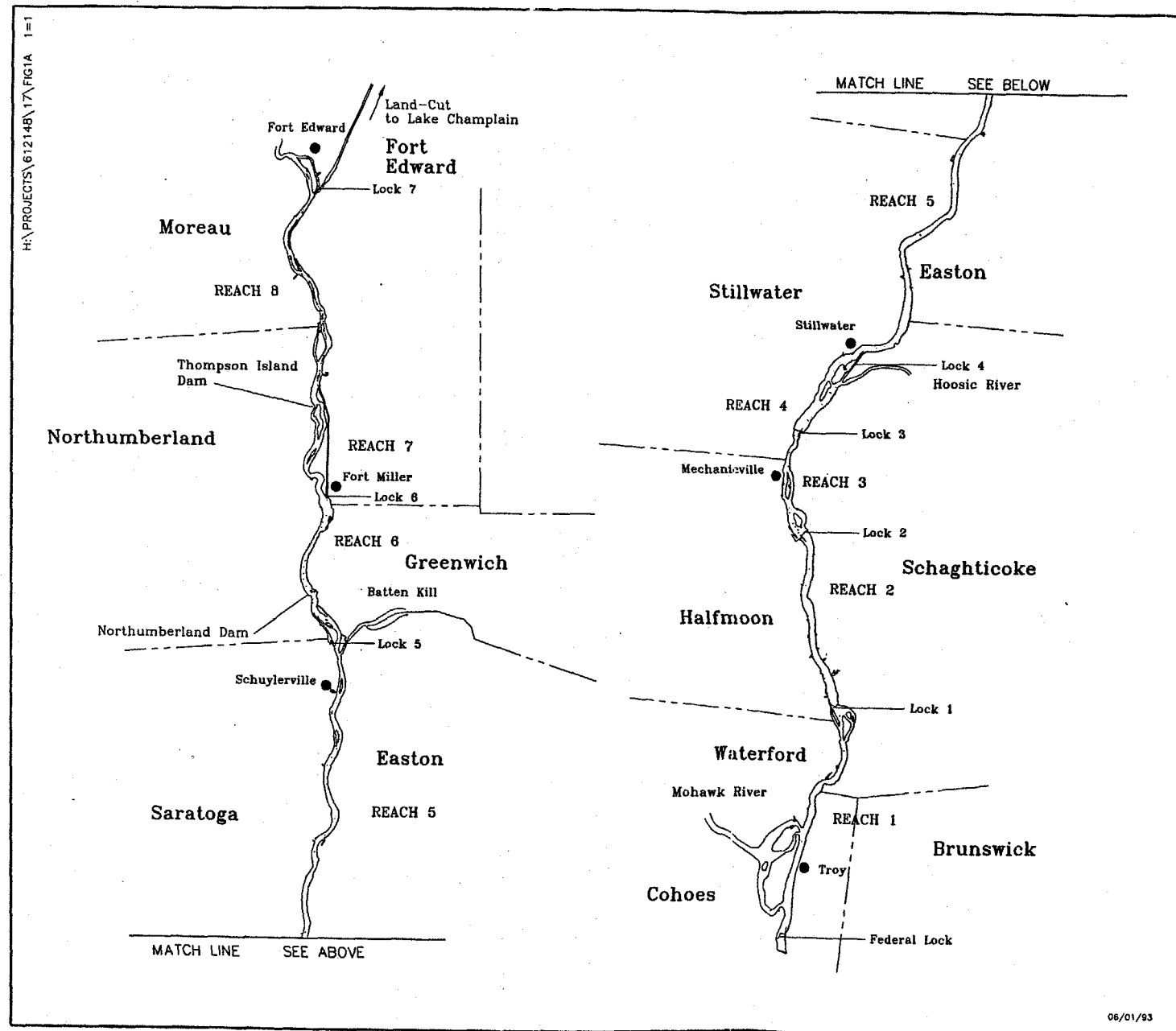
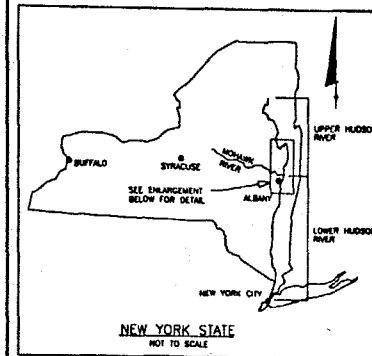
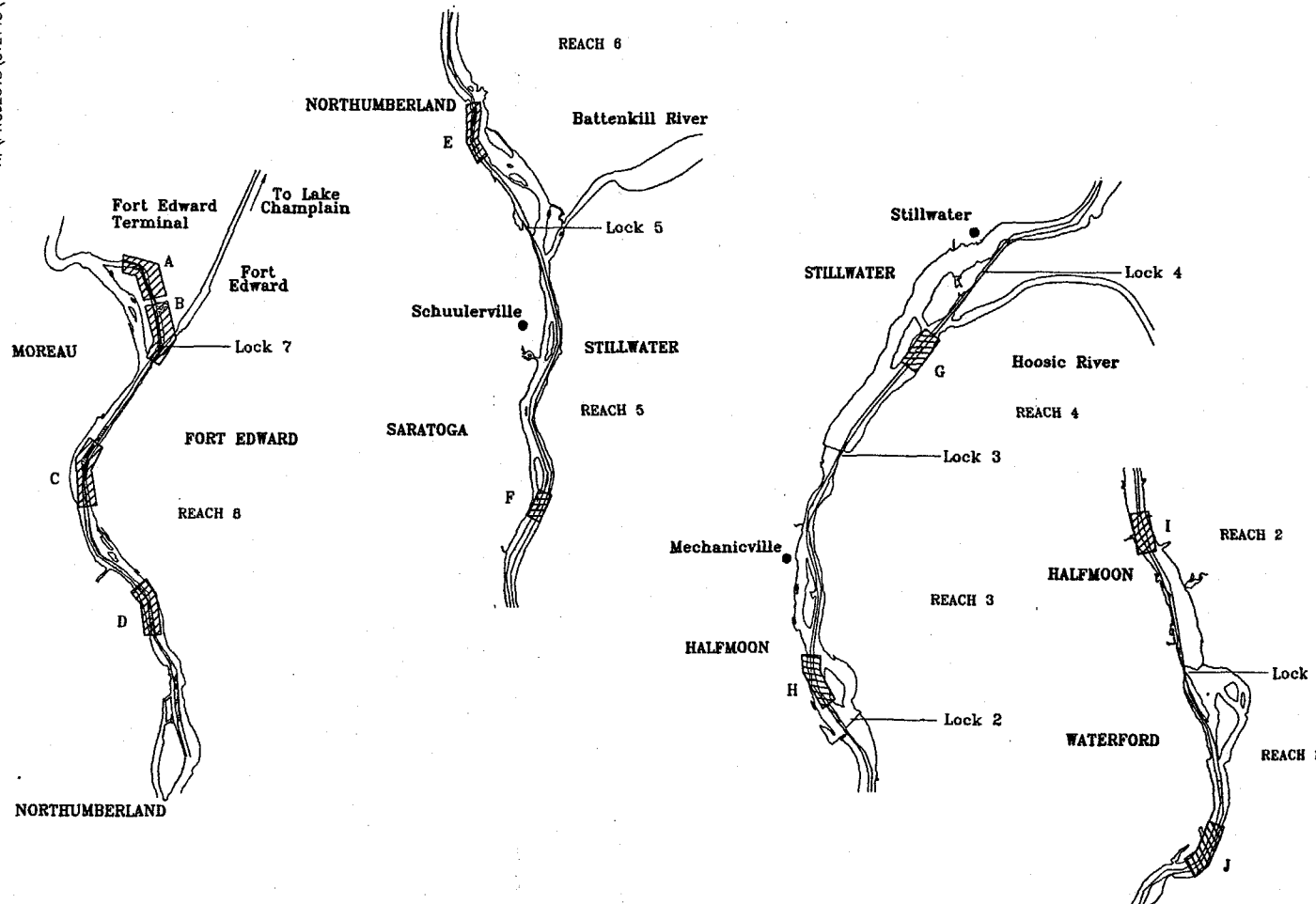


FIGURE 2



GENERAL ELECTRIC
COMPANY

HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRA

SAMPLING AREAS

AREAS WITHIN THE CHAMPLAIN
CANAL WITH LESS THAN
12 FEET OF WATER DEPTH

NOT TO SCALE

O'BRIEN & GERE
ENGINEERS INC.
Syracuse, New York

06/02/93

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FIGURE 3



LEGEND

- 226 BOUY LOCATION
- ▲ APPROXIMATE SAMPLE LOCATIONS
- APPROXIMATE REILL AREA

6.0 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

**GENERAL ELECTRIC
COMPANY**

HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

**SEDIMENT SAMPLE LOCATIONS
SITE A & B
(FORT EDWARD TERMINAL)**

100 0 100 200

612.151



05/27/93

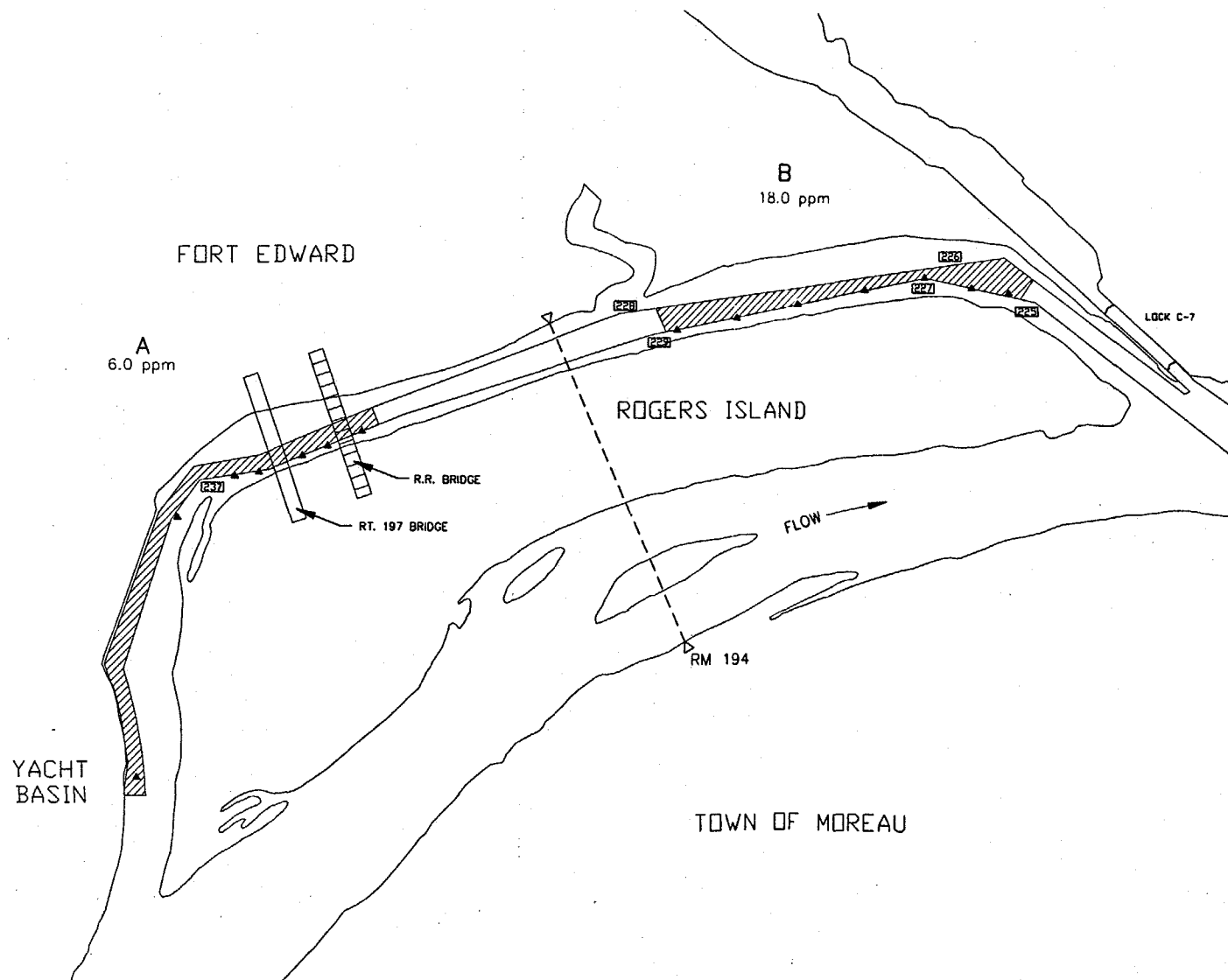
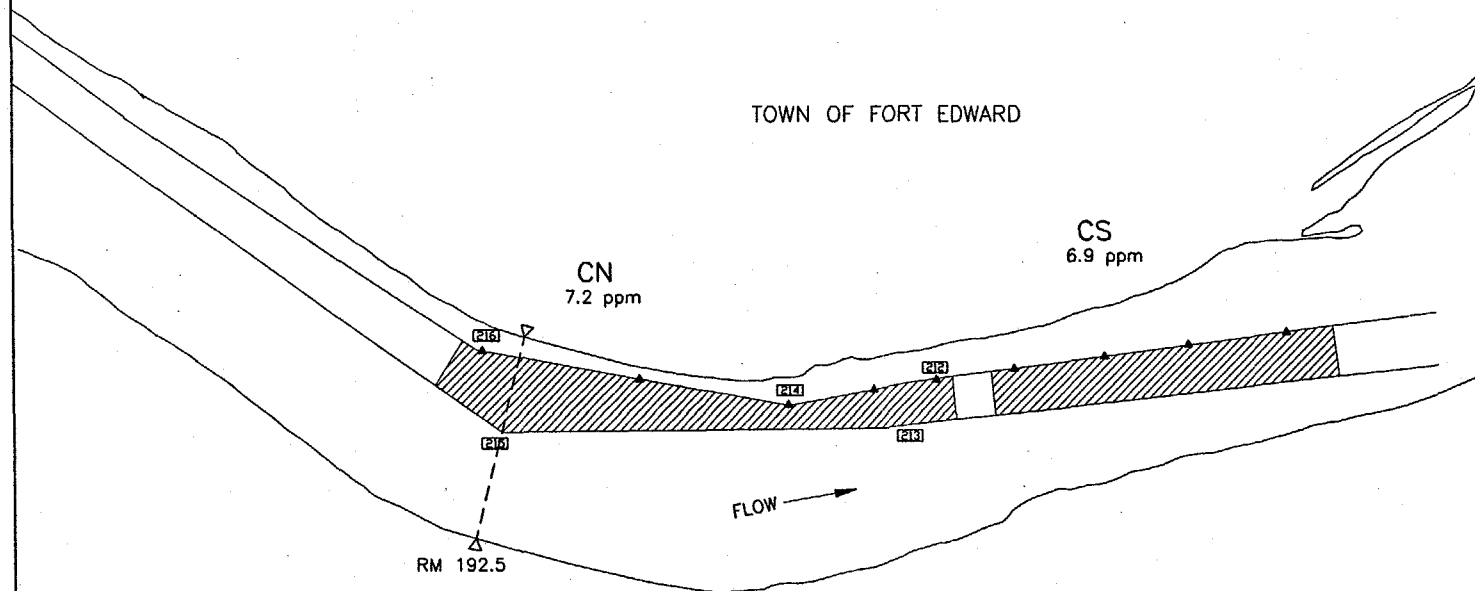


FIGURE 4



LEGEND

BOUY LOCATION

APPROXIMATE SAMPLE LOCATIONS

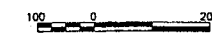
APPROXIMATE REFILL AREA

7.2 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

GENERAL ELECTRIC COMPANY

HUDSON RIVER CHANNEL CHARACTERIZATION PROGRAM

SEDIMENT SAMPLE LOCATIONS SITE C



612.151



05/27/93

FIGURE 5



LEGEND

226 BOUY LOCATION

▲ APPROXIMATE SAMPLE LOCATIONS

▲_c APPROXIMATE CORE SAMPLE LOCATIONS

REFILL AREA

3.2 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

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HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

SITE D

100 0 100 200

612.151



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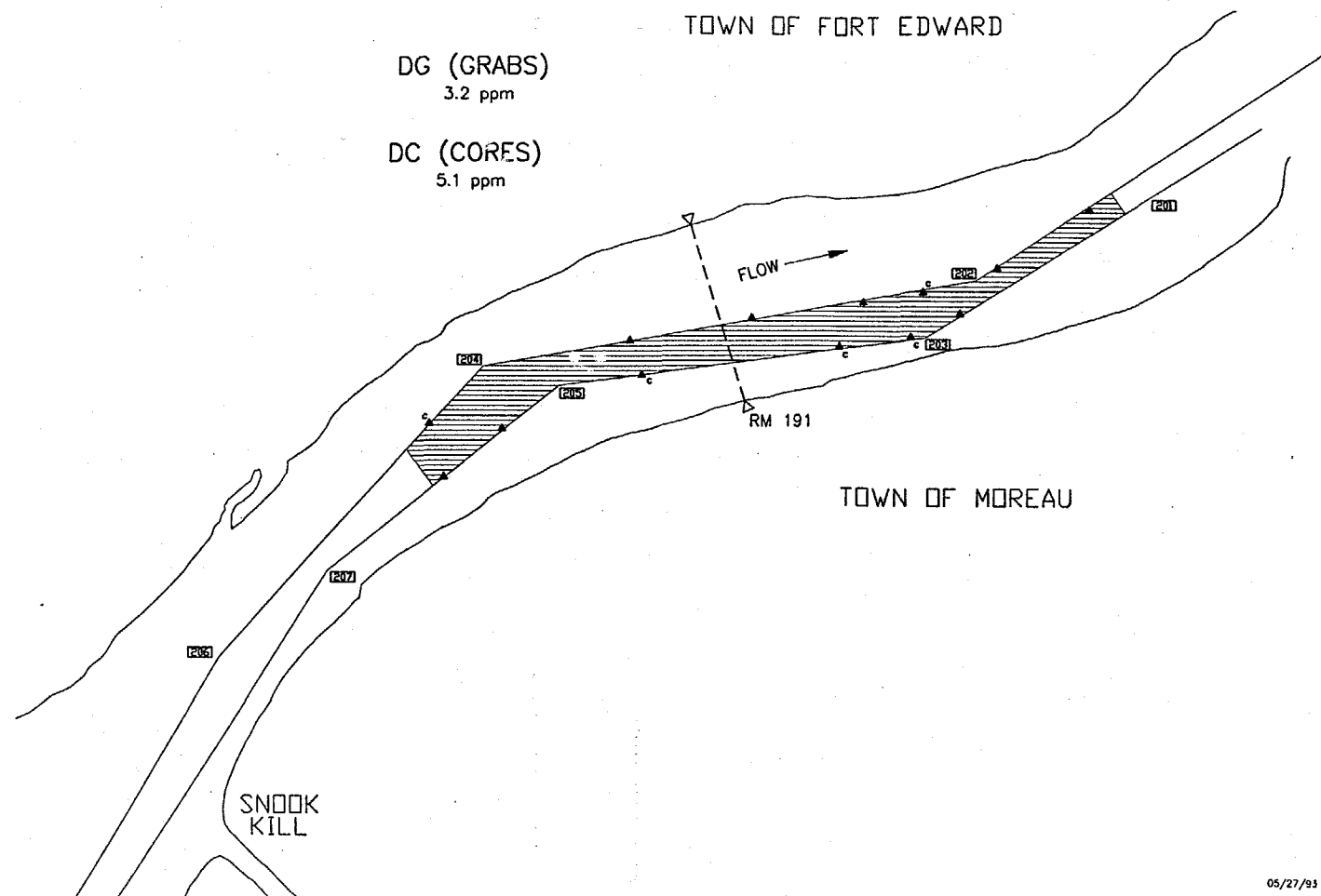
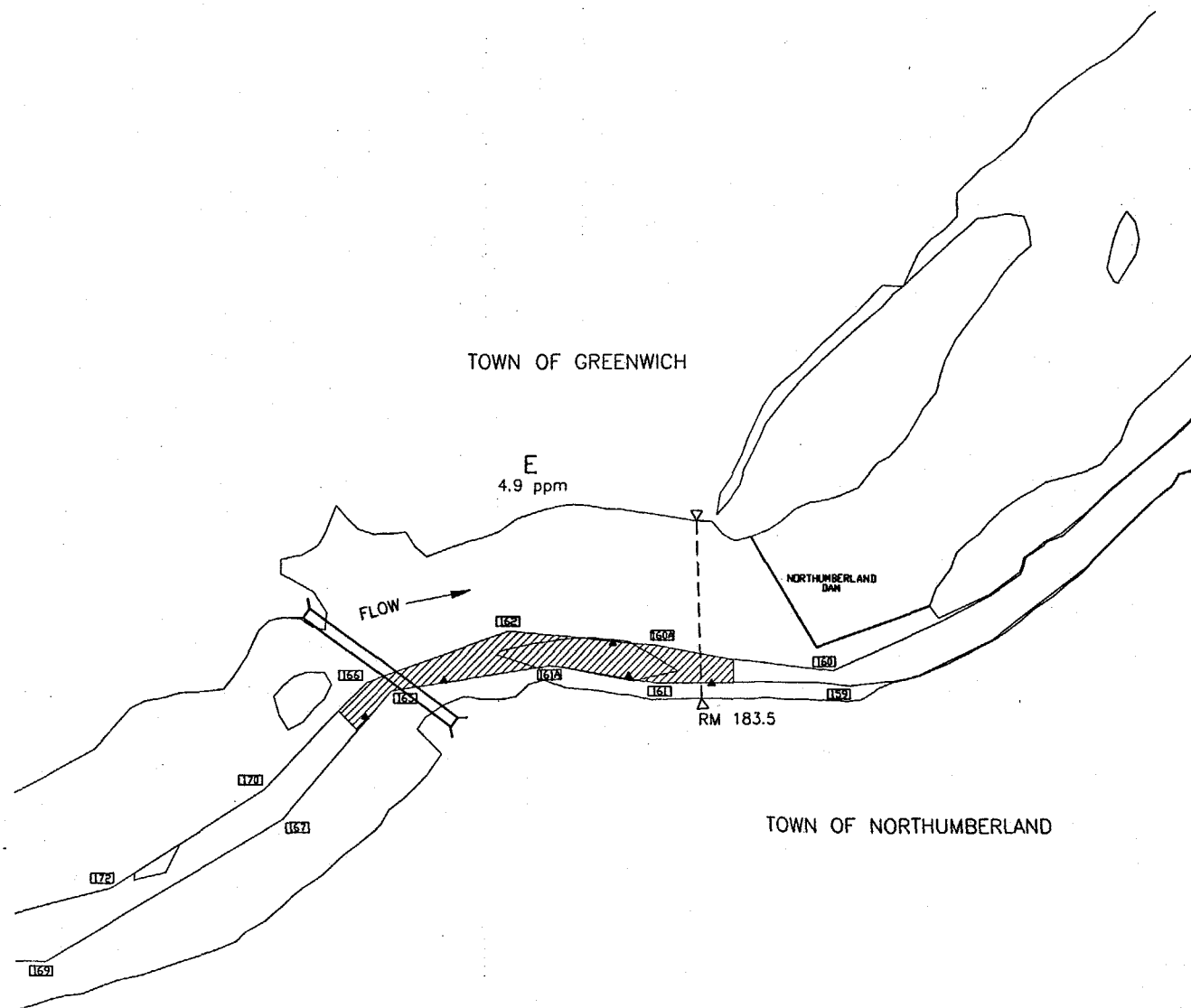


FIGURE 6



LEGEND

- 225 BOUY LOCATION
- ▲ APPROXIMATE SAMPLE LOCATIONS
- APPROXIMATE REFILL AREA
- 4.9 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

GENERAL ELECTRIC
COMPANY
HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

SITE E
(NORTHUMBERLAND)



612.151



320840

05/27/93

FIGURE 7



LEGEND

-  BOUTY LOCATION
-  PRELIMINARY SAMPLE LOCATIONS
-  APPROXIMATE REFILL AREA
- 1.6 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

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CHARACTERIZATION PROGRAM

SITE F

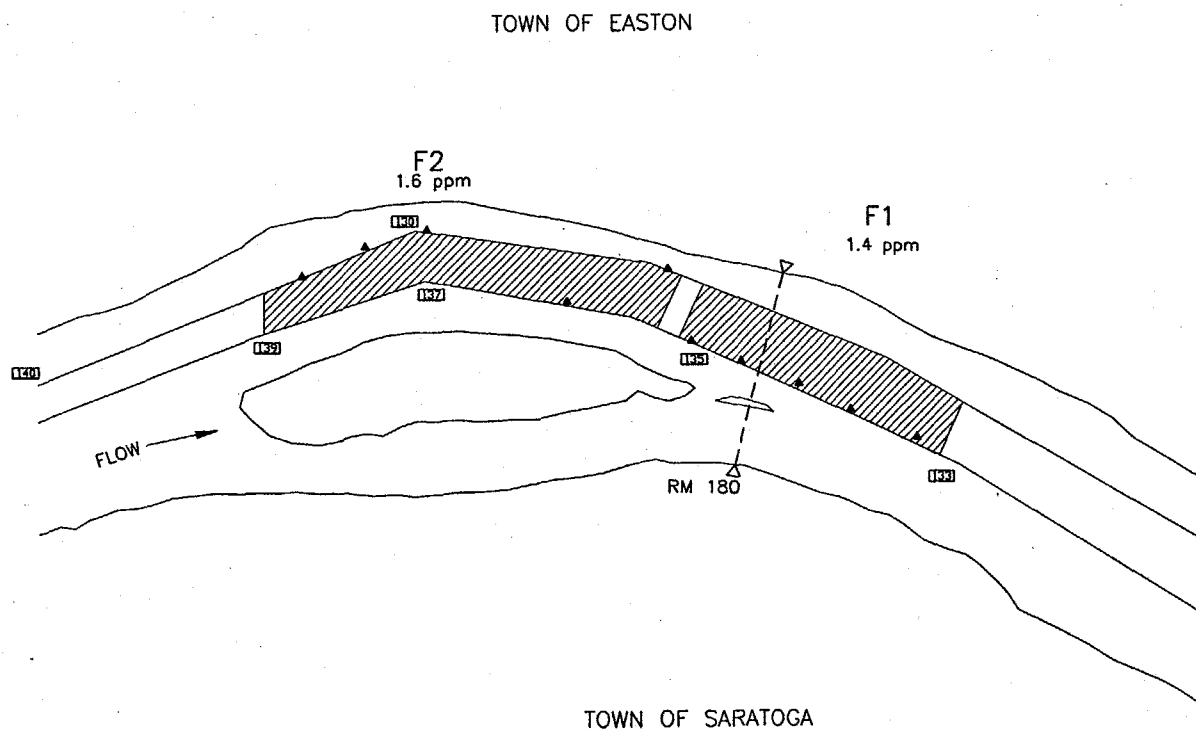
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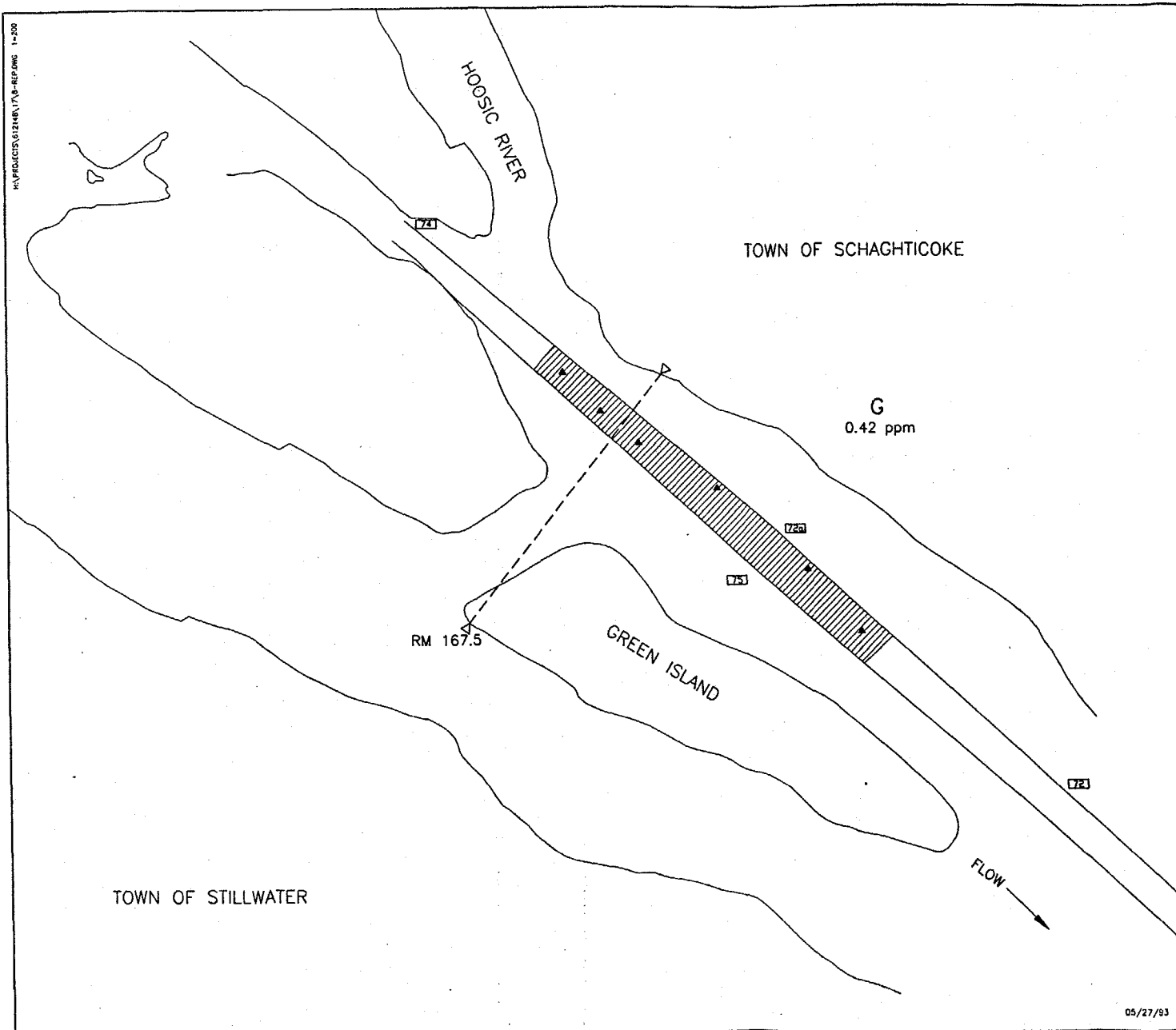


FIGURE 8



LEGEND

-  BOUY LOCATION
-  APPROXIMATE SAMPLE LOCATIONS
-  APPROXIMATE REFILL AREA
- 0.42 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

GENERAL ELECTRIC
COMPANY
HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

SITE G
(HOOSIC RIVER
CONFLUENCE)

100 0 100 200

612.151



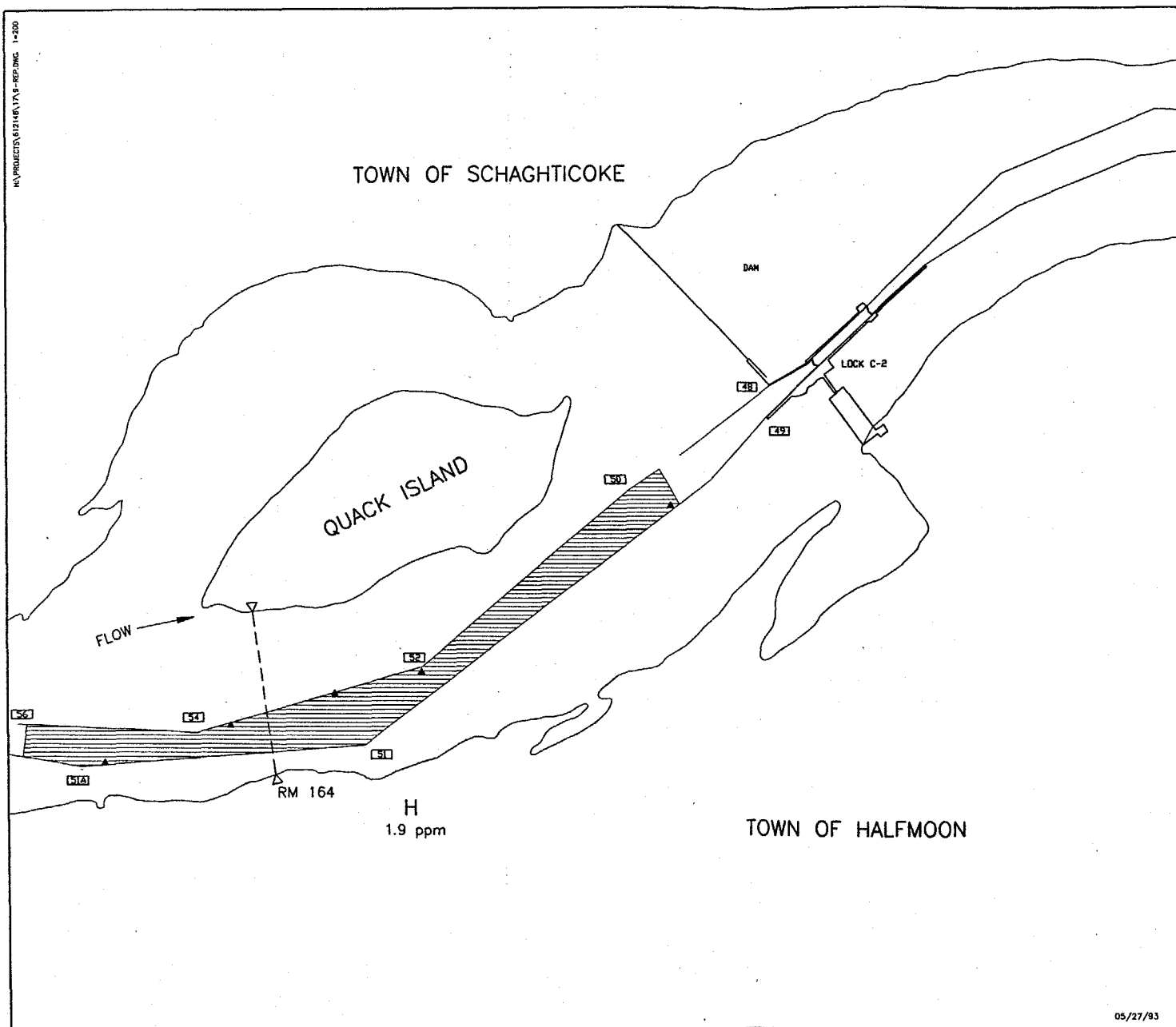


FIGURE 9



LEGEND

-  BOUY LOCATION
-  APPROXIMATE SAMPLE LOCATIONS
-  APPROXIMATE REFILL AREA
-  1.9 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

GENERAL ELECTRIC
COMPANY
HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

SITE H
(LOCK C-2)

100 0 100 200

612.151



05/27/93

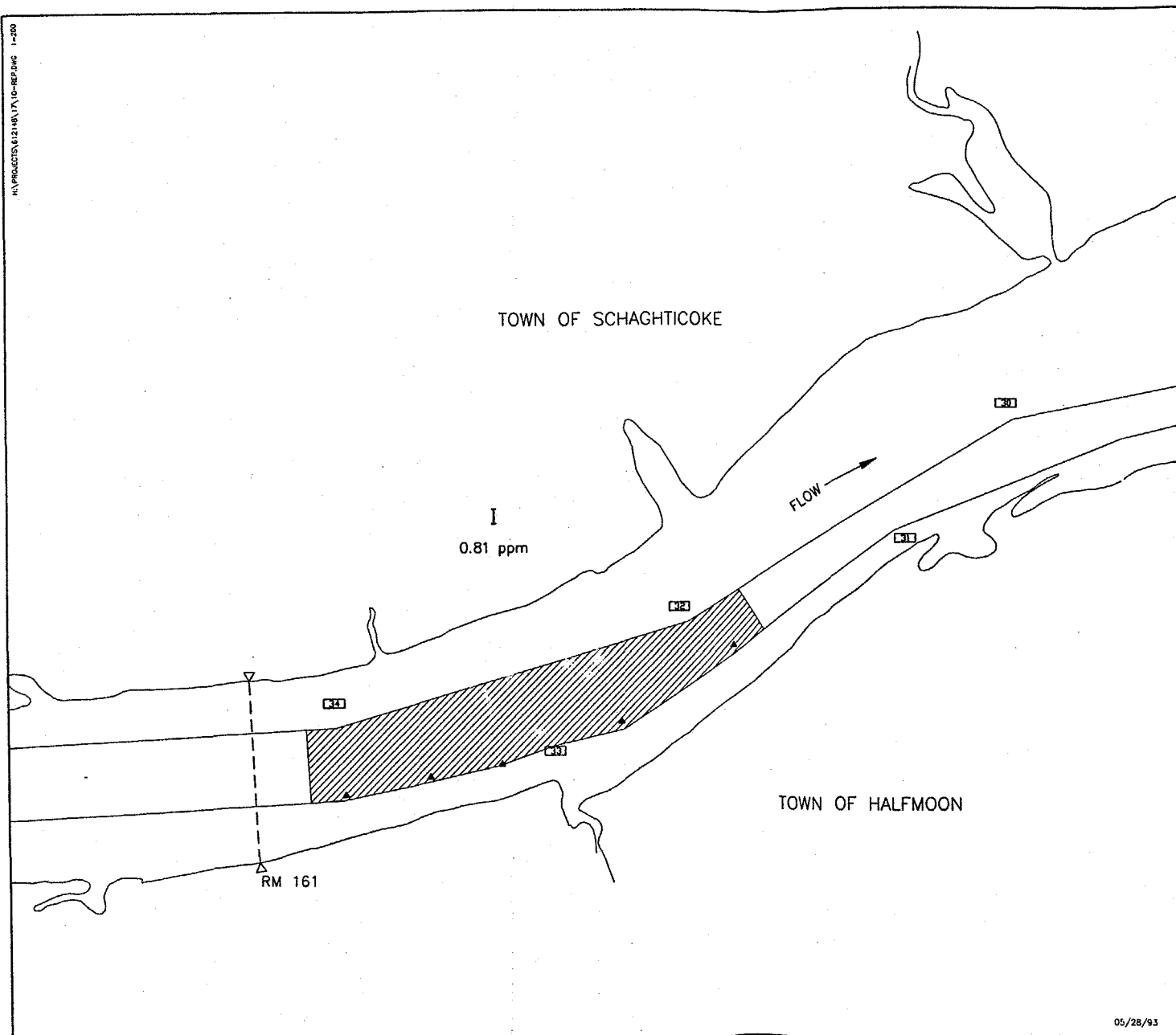


FIGURE 10



LEGEND

- 220 BOUY LOCATION
- ▲ APPROXIMATE SAMPLE LOCATIONS
- APPROXIMATE REFILL AREA
- 0.81 ppm COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

GENERAL ELECTRIC
COMPANY
HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

SITE I



612.151

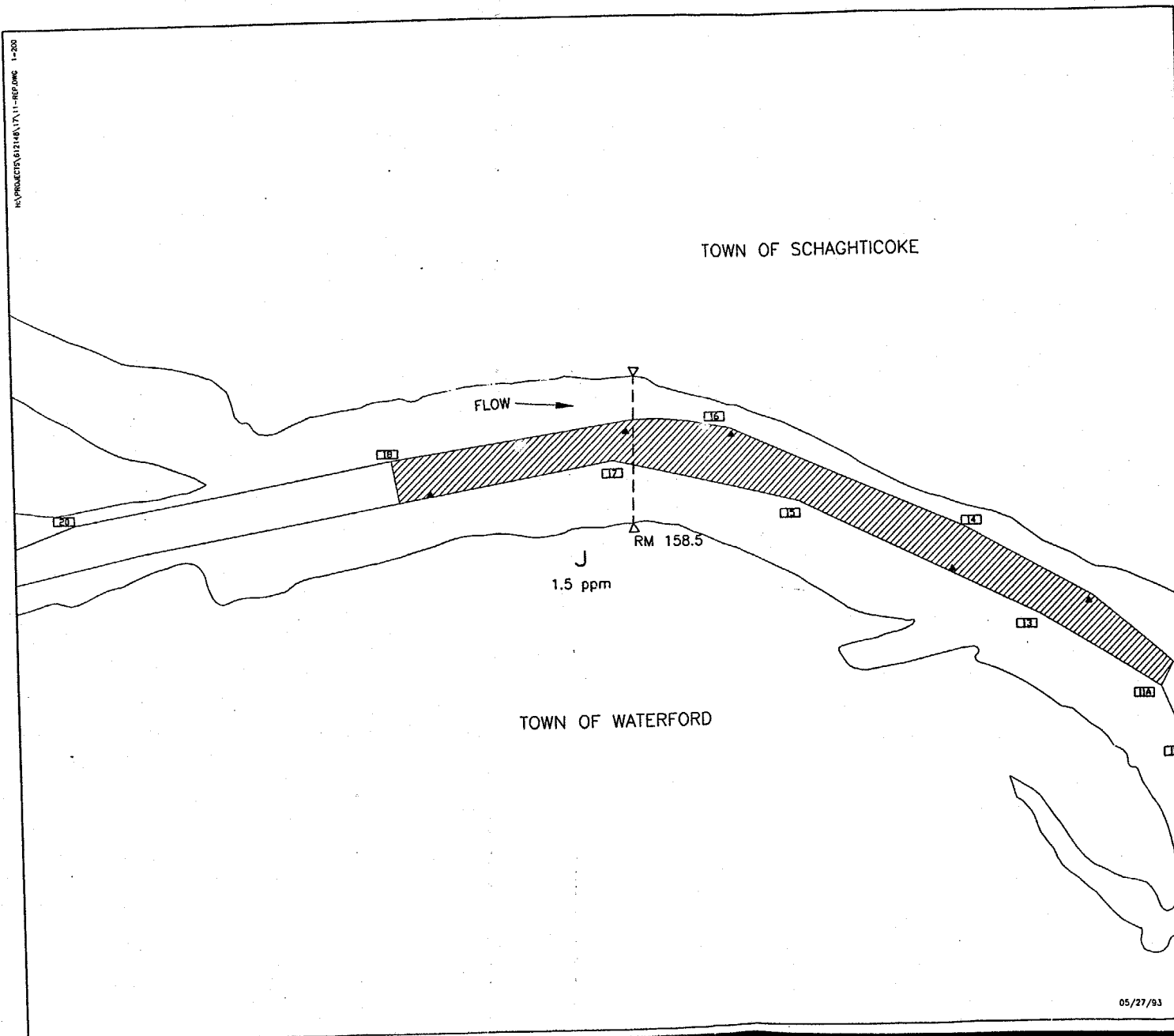


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FIGURE 11



LEGEND

-  BOUY LOCATION
-  APPROXIMATE SAMPLE LOCATIONS
-  APPROXIMATE REFILL AREA
- 1.5 ppm** COMPOSITE PCB TESTING RESULTS (mg/kg dry weight)

**GENERAL ELECTRIC
COMPANY**
HUDSON RIVER CHANNEL
CHARACTERIZATION PROGRAM

**SITE J
(WATERFORD)**

100 0 100 200

612.151



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