5120 Butler Pike
Plymouth Meeting
Pennsylvania 19462
215-825-3000
Fax 215-834-0234

Woodward-Clyde Consultants

July 2, 1990
89C2515A-3

New York State Department
of Environmental Conservation
Region 6
State Office Building
317 Washington Street
Watertown, New York 13601

Attention: Mr. Darrell Sweredoski

REVISED FINAL RI REPORT

Dear Darrell:

On behalf of Reynolds Metals Company, Woodward-Clyde Consultants is pleased to submit the enclosed Revised Final Remedial Investigation (RI) Report, Volume I. This document has been revised in response to NYSDEC comments (May 3, 1990). Further, in accordance with our conversations of June 7, 1990, Volumes II and III of the Final RI Report dated March 30, 1990 are incorporated into this submittal by reference. Attachment I to this letter is an itemized list of responses to each of your comments.

Please call with any questions or comments.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Mark M. Kramer
Senior Staff Geologist

George W. Crouse
Assistant Project Manager

Peter R. Jacobson, P.G.
Project Manager

MMK/GWC/PRJ/kcs/DCS06
encl.
cc: D. DeLisle
J. McKinnon
J. Reagan
J. Luz
W. Stone
G. Laccetti
F. Bifera
K. Jock

ATTACHMENT 1

ITEMIZED RESPONSE TO NYSDEC COMMENTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Figures 16 and 17

Figures 16 and 17 have been updated to indicate measured groundwater level elevations from October 1989.

Page 25, Section 3.1.2 Site Groundwater Conditions

An explanation has been added to the text in Section 3.1.2.

Page 26, Section 3.1.2.1 Coefficient of Permeability

Approximate groundwater velocities for the North Yard utility trench has been calculated. The calculation and explanation appear in Section 3.1.2.1.

Page 27, Section 3.1.2.2 Hydrologic Effect of the Black Mud Pond and Groundwater Containment Wall

The terrain conductivity survey performed in August 1989 was a follow-up to an earlier survey (Black Mud Pond Terrain Conductivity Report, June 1989). The follow-up survey was performed in order to provide additional data in the northeast and southeast corners of the pond. The instrument used was an EM-31 which is less sensitive to external interferences than the EM-34 used in the earlier survey. The data was discussed with NYSDEC personnel and, as a result, monitoring well MW-29S was installed north of the pond.

The containment wall installed in 1985 was installed in order to prevent migration of contaminated groundwater to the northwest via the winnowed till. Migration during high pond liquid levels had previously resulted in a leachate "spring" northwest of the pond. The wall is effective in controlling flow via the winnowed till. The 10^{-6} cm/sec permeability wall was not designed or constructed to be an impermeable barrier to groundwater migration. The possibility of groundwater migration from the pond to the east and south (areas where the wall is not present) was discussed in the June 1989 Terrain Conductivity Report as well as on pages 27 - 28 of the Final RI Report.

Page 28, Section 3.1.2.2 Hydrologic Effect of the Black Mud Pond and Groundwater Containment Wall

The groundwater elevation data from January through June 1990 has been summarized in Table 3-3 and has been incorporated into the report.

Page 28, Section 3.1.2.3 Hydrologic Effect of the North Yard Utility Trenches

A detailed drawing of North Yard utility trenches was included in Work Plan Addendum 3 (June 30, 1989). The line from the thickener area sump to the St. Lawrence River has been blocked off since October 1988. Cross-sections of the utility trenches were included in the PCB Source Identification Assessment Report (February 20, 1989). A more detailed cross-section (E-E') has been included as Figure 18. The location of the cross-section has been added to Figure 3.

Page 30, Section 3.2.1 Raquette River Drainage

The Rectifier Yard drainage system is illustrated in Figure 1 of the Work Plan for performance of additional sediment/soil sampling in the Rectifier Yard and surrounding area (April 11, 1990).

Page 31, Section 3.2.2 St. Lawrence River Drainage

Details of catchbasins and other surface drainage features were included in the PCB Source Identification Assessment (February 20, 1989).

Page 34, Section 4.1.2 Soil

The source of PCBs (.24 ppm) detected in the boring at the MW-32S location is unknown. PCBs were not detected (less than 0.09 ppm) in the remaining two background soil samples.

Page 37, Section 4.2.3 Groundwater

Statements have been added to Section 4.2.3 concerning the deep groundwater samples to supplement the original discussions.

Page 38, Section 4.2.3 Groundwater

Methylene chloride (7 ppb), 2-hexanone (10 ppb), and carbon disulfide (3 ppb) were detected in 21-85-D during the October 1989 sampling event. There is no history of use of these compounds at the Reynolds plant. All three compounds are commonly used in analytical laboratories. Their detection in 21-85-D is, in all likelihood, a result of laboratory contamination.

The fine black sand present southwest of the Black Mud Pond is thought to be potliner-related material based on its appearance and the laboratory analytical result derived from it.

The source of the majority of flow for the drainage south of the Black Mud Pond is apparently groundwater. This area is a groundwater discharge area during some of the year. The area also receives surface water run-off from the southern berm of the Black Mud Pond and from the area to the west. The drainage is dry during some of the year.

Page 41, Section 4.3.2 Waste Characterization

The text has been updated to acknowledge the presence of trace levels of volatile organic compounds in the landfill waste samples. A list of the compounds and concentrations is presented in Table 4-8 of the Final RI Report.

An explanation concerning the origin of the black sand unit in the landfill berm has been added to Section 4.3.2.

Page 42, Section 4.3.2 Waste Characterization

So noted.

Page 44, Section 4.3.3 Groundwater

A summary table indicating groundwater sample PCB analyses has been prepared and is incorporated into the report (Table 4-1).

An explanation for the sporadic concentrations of some of the indicator parameters within the landfill area deep wells has been added to Section 4.3.3.

Page 46, Section 4.4.3 Groundwater

See response for **Page 44, Section 4.3.3 Groundwater.** Analytical results for some parameters in individual wells have been highly variable.

Page 47, Section 4.4.4 Soil

Drawings determining the extent of PCB contamination in the North Yard were presented in the PCB Sampling Program Phase 1, 2, 3, and 4 Report (August 12, 1988) and in the Phase II PCDF/PCDD Sampling report (November 11, 1989). Data presented on these figures has been combined with sample data related to Work Plan Addendum 3 (June 30, 1990). The resultant figure (Figure 30) has been incorporated into the report. Table 4-11 defines the vertical extent of PCB contamination in the North Yard.

Page 48, Section 4.5.1 Results of the Phase I RI

A summary table of groundwater sample PCB analyses has been incorporated into the report (Table 4-1).

Page 49, Section 4.5.2 Groundwater

Additional detail has been added to the text as appropriate (see Response to **Page 44, Section 4.3.3 Groundwater**).

Page 53, Section 4.7.3 Surface Water/Sediment

Clarification will result from additional sampling in the Rectifier Yard and surrounding areas as proposed in the Rectifier Yard Work Plan (April 11, 1990). Figures 31, 32 and 33 have been updated to show Rectifier Yard drainages.

Page 56, Section 4.8.6 Sewage Sludge Drying Beds

The sludge will be removed from the drying beds.

Page 57, Section 5.1.3 Contamination Migration Pathways

The containment wall was installed in 1985 in order to prevent migration of contaminated groundwater via the winnowed till. Migration via the winnowed till during high pond liquid levels had previously resulted in a leachate "spring" northwest of the pond. The wall is effective in controlling flow via the winnowed till. Based on data from Calocerinos and Spina, contaminated water originating from the "spring" was largely collected in trenches and pumped back into the pond, small amounts of the water migrated into the adjacent borrow pit from where it was also pumped back to the pond.

Page 59, Section 5.2.3 Contaminant Migration Pathways

Cross-sections for the Landfill are included in the Final RI Report (Figures 27 and 28), cross-sections for the Black Mud Pond were presented in Revision 2 of the Phase I RI Report, (March 31, 1989), and cross-sections for North Yard and Potliner Pad area have been developed. These cross-sections appear as Figure 18 and Figure 35 respectively.

Page 60 Section 5.3.3 Contamination Migration Pathways

Flow patterns and other hydrogeologic properties (transmissivity, etc.) of groundwater within the utility trenches are not completely understood. Preliminary data indicate that groundwater in the trenches flows northward towards the St. Lawrence River and/or is intercepted by infiltration into sewer lines. Initial calculations presented under comment **Page 26, Section 3.1.2.1 Coefficient of Permeability** indicate a discharge from the utility trench on the order of 80 gal/day.

Page 62, Section 5.4.3 Contamination Migration Pathways

Figure 5 has been updated to show the locations of the former drainage and the cross-section F-F' constructed through the Potliner Pad Area.

Page 62, Section 5.5.2 Sources of Contamination

A Work Plan for additional sediment/soil sampling in the Rectifier Yard and surrounding area was submitted to NYSDEC on April 11, 1990.

Page 65, Section 5.7.2 Sources of Contamination

One of the objectives of the recently completed sampling north of South Grasse River Road is to identify potential sources of the contamination.

The report of 50 to 100 drums of PCB laden material present under the new metal service building has never been substantiated. The presence of the material seems unlikely considering the buildings construction (concrete slab) and easy access for disposal in the on-site landfill.

Page 66, Section 6.1 Outfall 004

The areas noted will be resampled with the opportunity for NYSDEC to split samples.

Page 68, Section 7.1 Black Mud Pond

An additional reason for collecting filtered and unfiltered samples, other than for questions of PCB mobility, is to address questions concerning potential groundwater treatment.

Page 70, Section 7.7 Other Areas of Interest

The contaminated soil in areas around catchbasins is being addressed as part of the PCB Source Assessment and will be a target of future remedial measures.

ADDITIONAL COMMENTS

The text discusses parameters with detected concentrations higher than background and higher than New York Class GA Standards.

A summary table of PCB analyses of groundwater samples has been incorporated into the report (Table 4-1).

Approximate volumes or quantities of hazardous waste have been calculated for each area. These volumes are summarized in Table 5-1. Reference to the table is mentioned in the new Section 5.8.

Figure 19 has been updated.

The detection of analytes other than indicator parameters has not been ignored. The few volatile organic compounds detected in the low ppb range in groundwater sampled from MW-8S are not discussed in detail because of the elevated concentrations of other detected parameters. The report accurately describes the extent of contamination at each area.

The comment concerning surface water run-off is noted.

Woodward-Clyde Consultants

REVISED
FINAL REMEDIAL INVESTIGATION REPORT
ST. LAWRENCE REDUCTION PLANT

Prepared for:

REYNOLDS METALS COMPANY
Massena, New York

Prepared by:

WOODWARD-CLYDE CONSULTANTS
Plymouth Meeting, Pennsylvania

July 1990

REVISED
FINAL REMEDIAL INVESTIGATION REPORT
ST. LAWRENCE REDUCTION PLANT

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Woodward-Clyde Consultants (WCC) is performing a Remedial Investigation (RI) and Feasibility Study (FS) for the Reynolds Metals Company (RMC) at their St. Lawrence Reduction Plant in Massena, New York. The requirements of the RI were established in a Consent Order issued by the New York State Department of Environmental Conservation (NYSDEC). The purpose of the RI is to provide a comprehensive assessment of the environmental conditions at the plant site; in particular, the objectives of the RI are to: 1) gather data necessary to evaluate the need for remediation, and 2) gather data needed to compare remedial options.

On March 31, 1989 a Phase I Remedial Investigation Report, Revision 2 (Phase I RI Report) was submitted to NYSDEC. The report was accepted by NYSDEC as meeting the requirements of the "Preliminary Report" as stated in the Consent Order. This current document represents the Final Remedial Investigation Report and includes all RI data collected subsequent to the Phase I RI Report. The data collected provide information on each plant area of interest, including:

Black Mud Pond: The contents of the pond are characterized by varying concentrations of cyanide, fluoride, polychlorinated biphenyls (PCBs), magnesium, sulfate, and polycyclic aromatic hydrocarbons (PAHs). With the exception of PAHs, these contaminants have been detected in groundwater near the pond. Due to the low permeabilities of the subsurface soils, groundwater contamination is confined to a limited area within a few tens of feet of the pond. However, shallow contaminated groundwater may be discharging to surface water drainage pathways to the south and east of the pond. Airborne transport of contaminants from the pond are well below acceptable levels for human exposure.

Solid Waste Landfill and Former Potliner Storage Area: The Solid Waste Landfill and the Former Potliner Storage Area can be characterized as one contaminant source area, based on their proximity, similarity of contaminants, and receptor zone of contaminants migrating from the area. The contamination detected in the waste, groundwater, leachate and surface water is indicative of potliner-related material, and is characterized by elevated concentrations of cyanides, fluorides, sodium, sulfates, aluminum, and PAHs. Concentrations of PCBs are also detected in both areas. Most surface water run-off is currently controlled by the run-off collection system, but prior to its construction, run-off discharged directly to Wetlands RR-6, a regulated wetlands south of the Landfill area. Contaminated groundwater from the Former Potliner Storage Area is uncontrolled and also discharges to the wetlands. A leachate collection underdrain on the Landfill impedes the flow of some, but not all, contaminated groundwater from the Landfill to the wetlands. Water level and water quality data indicate that contaminated groundwater is constrained to lateral movement through the fill to the wetlands and that downward migration is not occurring.

North Yard: PCBs, polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo-p-dioxins (PCDDs) are distributed in North Yard surficial soils. Concentrations of PCBs decrease dramatically at the contact of fill material with underlying glacial till. PCBs are present in North Yard catchbasins which collect water from subsurface French drains. The heat transfer medium (HTM) system was the source of PCB, PCDF and PCDD contamination. North Yard groundwater contamination is characterized by local areas of elevated concentrations of aluminum, arsenic, cyanide, and fluoride. PCBs have not been detected in groundwater. North Yard utility trenches act as preferential pathways for groundwater flow.

Potliner Pad: Groundwater contamination detected in the vicinity of the Potliner Pad is indicative of potliner-related materials and is characterized by elevated levels of cyanide, fluoride, sodium, sulfate, and aluminum. Surface water and sediment contaminants include those mentioned above and PCBs. The source of the potliner-related contamination was spent potliner which was temporarily stored on the Potliner Pad, and/or other processes in the area. Spent potliner is no longer stored in this area.

Rectifier Yard: Soil samples taken from within the yard confirm the presence of PCBs. Sediment samples taken from within the drainage pathway receiving a portion of the stormwater run-off collected within the Rectifier Yard contain PCBs. The drainage flows to the wetlands. Additional work is planned for this area in 1990.

Wetlands: Wetlands surface water and sediment samples contain aluminum, cyanide, fluoride, sulfate, sodium and PCBs at concentrations above background. The Landfill and Former Potliner Storage Area are the major sources of contamination to the wetlands. The drainageways leading from the Rectifier Yard may be additional sources of PCB contamination to the wetlands. The wetlands are a groundwater discharge area, hence, contaminants are not leaving the wetlands via groundwater. Contaminants can migrate from the wetlands by two intermittent streams which flow to the Raquette River.

Other Areas of Interest: Initial sampling conducted north of South Grasse River Road indicates PCB contamination in soil. PCB contaminated sediments are present in the former 002 drainage ditch. A local area of PCB contaminated soils exists along the diverted 002 pipe trench. Remedial measures addressing each of these areas will begin in 1990. Additional areas of interest, including catchbasins and French drains located outside of the North Yard, will be addressed in the context of the continuing PCB Source Assessment.

TABLE OF CONTENTS

TABLE OF CONTENTS
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TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF TABLES
(continued)

LIST OF PLATES

LIST OF FIGURES

LIST OF FIGURES
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LIST OF FIGURES
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LIST OF APPENDICES

1.0 INTRODUCTION

The Reynolds Metals Company (RMC) is currently involved in a Remedial Investigation (RI) and Feasiblity Study (FS) at their St. Lawrence Reduction Plant in Massena, New York. Woodward-Clyde Consultants (WCC) was retained by RMC in 1987 to initiate the RI. The main objective of the RI is to gather the information necessary to evaluate the overall environmental quality at the plant site. The requirements for the RI were established by a Consent Order negotiated between RMC and the New York State Department of Environmental Conservation (NYSDEC). The Consent Order was signed in September 1987. A formal Work Plan (July 24, 1987) for the RI was incorporated into the Consent Order. A brief synopsis of the path taken from the July 1987 Work Plan to this report, the Final Remedial Investigation Report, is described below.

1.1 BACKGROUND

The results of investigations required by the July 1987 Work Plan were detailed in the initial submittal of the Phase I RI Report (June 27, 1988). NYSDEC comments were addressed and resulted in a Revised Phase I RI Report (September 23, 1988). The revised report was amended to reflect additional comments provided by the NYSDEC and on March 31, 1989 a document titled "Phase I Remedial Investigation Report, Revision 2" (Phase I RI Report) was submitted. The report was accepted by NYSDEC as meeting the requirements of the "Preliminary Report" as stated in the Consent Order. The Phase I RI Report was based on site activities which included a baseline round of groundwater sampling in October 1987 and subsequent sampling rounds in December 1987, May 1988 and July 1988.

Site investigations conducted during Phase I include employee interviews, a review of data from pre-existing monitoring wells, a review of aerial photographs, advancing 6 soil borings for soil sampling, installation of 20 monitoring wells, surveying the entire site, water level measurements, single well permeability testing, groundwater sampling, surface water and sediment sampling, and sampling black mud from the Black Mud Pond. A detailed discussion of these investigations can be found in the Phase I RI Report. Table 1-1 outlines work tasks performed as part of Phase I in specific areas of the plant. The following paragraphs repeat conclusions made in the Phase I RI Report concerning environmental conditions at specific areas around the plant.

The **Black Mud Pond** is built in an area of dense gray glacial till with low permeabilities. This characteristic has helped to confine groundwater contamination to a limited area within a few feet or few tens of feet of the pond. The exception to this is on the northwest side of the pond, where a winnowed till zone of moderate permeability allowed leakage from the pond to discharge as surface flow. This leakage was remediated in 1985 with the construction of a compacted till containment wall on the west and north sides of the pond. Groundwater contamination in the area, characterized by sulfates and magnesium, and to a lesser extent cyanides, fluorides, sodium and aluminum, is probably a relic of the former leakage. No organic constituents of the black mud were detected in groundwater in the area. Active use of the pond, as part of plant processes, has been discontinued.

The **Solid Waste Landfill and the Former Potliner Storage Area** are characterized as one contaminant source area, based on their proximity, similarity of contaminants, and receptor zone of contaminants migrating from the area. The contamination detected in the groundwater, leachate and surface water is indicative of potliner-related material, and is characterized by elevated concentrations of cyanides, fluorides, sodium, sulfates, and aluminum. Surface water run-off from these areas previously discharged directly to **Wetlands RR-6,** a regulated wetlands south of the Landfill Area. Contaminated groundwater from the Former Potliner Storage Area is uncontrolled and also discharges to the wetlands. A leachate collection underdrain at the Landfill impedes the flow of some, but not all, contaminated groundwater from the Landfill to the wetlands. Water level and water quality data indicate that contaminated groundwater is constrained to lateral movement through the fill to the wetlands and that downward migration is not occurring.

Monitoring points in the **north part of the plant** provide an overview of conditions at various facilities there. The most notable contamination in the area, as determined in Phase I, is in the groundwater near the Potliner Pad, where cyanides are present at elevated levels. However, based on the low permeability of the subsurface materials there, it is not likely that an extensive plume of contamination exists in the local groundwater system.

The Phase I RI report was developed, in part, from a Preliminary Risk Assessment which was based entirely on the baseline data and submitted to NYSDEC in February 1988. The purpose of the Preliminary Risk Assessment was to characterize the Reynolds site and to help focus subsequent investigation objectives of the RI.

Consequently, Work Plan Addendum 1 (WPA 1), covering additional studies to be performed for the RI, was submitted to NYSDEC in April 1988. WPA 1 was revised and re-submitted in September 1988 and in March 1989. The Phase I RI Report was prepared prior to the initiation of some of the tasks described in WPA 1.

Work Plan Addendum 2 (WPA 2) was submitted in October 1988 in response to comments made by NYSDEC on the initial Phase I RI Report. WPA 2 was revised in March 1989 in order to address NYSDEC comments on the initial WPA 2 submittal and on the Revised Phase I RI Report.

Work Plan Addendum 3 (WPA 3) was submitted in June 1989. The purpose of WPA 3 was to describe work aimed at defining the occurrence and movement of groundwater, and determine the presence or absence of PCB contamination in groundwater in the North Yard. Additional data collection on the extent of North Yard soil contamination was also addressed.

This document represents the Final Remedial Investigation Report and incorporates all RI data collected subsequent to the submittal of the Phase I RI Report including investigations defined in WPA 1, WPA 2, and WPA 3. This report includes data from four phases of North Yard PCB investigations as well as two phases of polychlorinated dibenzofuran and dibenzo-p-dioxin (PCDD/PCDF) sampling. Selected data from the PCB Source Assessment Report, specifically data related to the sewers acting as contaminant transport pathways, are also included here.

It is not the purpose of this report to re-state the Phase I RI Report; only data from Phase I relevant to the Final RI is included. A summary of documents which were important in the preparation of this report, and were previously submitted to NYSDEC, is provided in the list of references following the text of this report.

1.2 OBJECTIVES

The objectives of the Final Remedial Investigation Report are a subset of the overall objectives of the remedial investigation, defined in the Consent Order as:

- determine the location and extent of contamination at the St. Lawrence Reduction Plant;
- identify past, present and/or potential future releases of contaminants from source areas on the site;
- facilitate the development and approval of potential remediation where required; and
- facilitate the development, if appropriate, of closure plans or permitting schedules for on-site solid waste management units.

The objectives of the Final Remedial Investigation Report are as follows:

- determine the type of contaminants present at the site;
- identify areas of contamination (source areas) at the Reynolds facility including areal and vertical extent; and
- characterize the release and migration of contaminants from source areas through environmental media (groundwater, surface water, soil, sediment, air and any other potential pathways of migration).

1.3 SCOPE OF WORK

The Scope of Work for this Final Remedial Investigation Report has been defined to address the objectives stated above. The remainder of this report is divided into the following sections:

- Section 2.0 provides a review of site investigations. This section gives a detailed description of work performed subsequent to tasks covered in Phase I and references the descriptions and results of prior investigations.

- Section 3.0 provides a discussion of site setting in terms of hydrogeology and surface water hydrology. This section was covered in considerable detail in the Phase I RI Report. The reader is referred to that document for discussions on land use, demographics, water supply, climatology, air quality, ecology and geology. Only the subsections on hydrogeology and hydrology have been updated with new data and are presented in this report.

- Section 4.0 presents a characterization of contamination at the St. Lawrence Reduction Plant. This section discusses areas of interest around the plant and provides a discussion of analytical results and a description of concentration trends (temporal and/or spatial), including comparisons to background conditions. Results from Phase I are reviewed at the beginning of each subsection.

- Section 5.0 summarizes the contamination assessment, and presents conclusions, with a chemical characterization of the primary areas, an identification of source areas, and a discussion of contaminant transport mechanisms.

- Section 6.0 briefly presents interim remedial measures that have been conducted to date at the St. Lawrence Reduction Plant.

- Section 7.0 presents recommendations for additional RI data collection.

2.0 SITE INVESTIGATIONS

This section of the report describes site investigations performed by WCC subsequent to the submittal of the Phase I RI Report. Investigations and methods are described briefly here with reference to appropriate reports and work plans previously submitted to NYSDEC for detailed descriptions. The results of the investigations described here are presented in Sections 4.0 and 5.0. Section 2.0 has been divided into subsections discussing each plant area of interest.

Appendix B of the original Work Plan (June 30, 1987) presents WCC's Standard Operating Procedures (SOPs) for conducting fieldwork. Pertinent topics include: Boring Advancement, Monitoring Well Installation and Development, Slug Testing, Surface Water Sampling, Sediment Sampling, Groundwater Sampling, and Equipment Decontamination. All fieldwork was completed in compliance with these procedures or as presented in referenced reports and addendums to the Work Plan. Only procedures for fieldwork which have not been presented in previously submitted documents are described in this section. Analytical work was provided by laboratories that are listed as technically acceptable by NYSDEC. Boring logs for all borings and wells drilled subsequent to the Phase I RI Report are presented in Appendix A; monitoring well construction diagrams are presented in Appendix B. Table 2-1 presents construction details for all monitoring wells.

2.1 BACKGROUND CONDITIONS

WCC collected 3 soil samples (2 collected from soil borings and 1 collected by hand) and installed 2 groundwater wells to define background soil and groundwater quality for the site. The fieldwork was outlined in WPA 2 and was completed during August 1989.

2.1.1 SOIL

Three soil samples were collected to provide background soil quality data. MW-31S-2-4 is located southwest of the Borrow Pit and is intended to provide background data for the Black Mud Pond Area. MW-32S-2-4 was collected east of the plant parking area and is considered to represent background conditions for the entire plant area. An additional sample (BMP-BACK) was taken from an area west of the Borrow Pit (Plate 1).

A truck mounted drilling rig was used to obtain split-spoon samples MW-31S-2-4 and MW-32S-2-4 from 2 to 4 feet below grade. A hand operated piston core sampler was used to take the BMP-BACK sample from 2 to 4 feet below grade. All 3 samples were analyzed for the site indicator parameters (Table 2-2).

2.1.2 GROUNDWATER

The 2 soil borings advanced for collecting soil background samples were completed as monitoring wells MW-31S and MW-32S to provide background groundwater quality data (Plate 1). Existing monitoring well MW-10S will continue to provide background information for the Landfill and Former Potliner Storage Area.

Single well permeability tests (slug tests) were performed on MW-31S and MW-32S. In addition, these wells were sampled in October 1989 and January 1990. The groundwater samples were analyzed for the indicator parameters.

2.2 BLACK MUD POND

2.2.1 WASTE CHARACTERIZATION

The solid phase contained in the Black Mud Pond (black mud) was previously sampled as reported in the Phase I RI Report. Samples of the aqueous phase (liquor) and black mud were collected by WCC and NYSDEC on August 11, 1988. The aqueous and solid samples (WPU-RE-1) were collected from a ponded area near the northern edge of the Black Mud Pond. The WPU-RE-1 liquor sample was analyzed for PCBs, total cyanide, priority pollutant metals, and fluoride. The solid sample was analyzed for PCBs only. On June 22, 1989 a second liquor sample (BMPL) was obtained from approximately the same location. Sample BMPL was analyzed for Target Compound List (TCL) volatiles, semi-volatiles, metals, cyanide, and PCBs. Active us of the pond, as a result of revisions to plant processes, has been discontinued.

2.2.2 GROUNDWATER

Two piezometers were installed to help evaluate the effectiveness of the groundwater containment wall situated along the western and northern sides of the Black Mud Pond. BMPB-1 was installed inside of the containment wall, 15 to 20 feet east of monitoring well MW-13S. BMPB-2 was installed outside of the wall, west of MW-14S (Figure 1). Both piezometers were constructed and developed to monitor the same zone as their shallow monitoring well counterparts.

Two monitoring wells (MW-29S and MW-30S) were installed in the vicinity of the Black Mud Pond to help characterize the extent of groundwater contamination. Monitoring well MW-29S was completed north of the pond. MW-30S was installed southwest of the Black Mud Pond. Slug tests were conducted in both wells.

Groundwater was sampled during February, April, July, and October of 1989 and again in January 1990 as part of the routine quarterly monitoring program. During the first three quarters of 1989, the 8 wells comprising the routine quarterly program were sampled. Samples from monitoring wells MW-11S, MW-15D and 21-85-D during October 1989 were analyzed for TCL volatile and semi-volatile compounds in addition to the indicator parameters. In October 1989, all 18 monitoring wells in the vicinity of the Black Mud Pond were sampled. In January 1990, the wells installed subsequent to Phase I (MW-19S and MW-30S) were sampled along with the routine quarterly wells and analyzed for the site indicator parameters.

In January 1990, a monthly water level measurement program for selected wells and piezometers in the vicinity of the Black Mud Pond was initiated. These measurements will help define seasonal fluctuations in groundwater elevations, help define the occurrence and movement of groundwater in relation with the level of liquor in the pond, and aid in an evaluation of the effectiveness of the containment wall.

2.2.3 SOIL

During the drilling program of 1989, WCC completed exploratory borings near the southwest corner of the Black Mud Pond. Four borings were completed (BMPB-3 to BMPB-6) at locations shown on Plate 1. A black sandy unit was discovered in BMPB-6 from 4 to 6 feet below grade. Sample BMPB-6-4-6 was taken of this material and analyzed for indicator parameters along with polycyclic aromatic hydrocarbons (PAHs).

2.2.4 SURFACE WATER AND SEDIMENT

Three surface water and sediment samples were collected from the drainage pathway south of the Black Mud Pond (Figure 2). The BMPDW-1/BMPDS-1 sample location was 165 feet southeast of the monitoring well 20-85-S/20-85-D couplet. The BMPDW-2/BMPDS-2 location was at the confluence of this drainageway with a second stream which drains the railroad tracks area near the southwest corner of the plant. The third sample location (BMPDW-3/BMPDS-3) is located along the western side of the Landfill just downstream from a culvert which passes under the road leading to the area west of the Black Mud Pond. A duplicate surface water and sediment sample (SW-DUP3, SED-DUP3) were obtained from the BMPDW-3/BMPDS-3 location. All sediment samples were collected from the surface of the stream sediment.

All surface water samples were analyzed for the indicator parameters. The sediment samples were analyzed for all indicator parameters with the exception of amenable cyanide.

2.2.5 AIR

In June, 1989 WCC personnel conducted air sampling around the Black Mud Pond. Three high volume air sampling stations were set up around the perimeter at 120° locations. During sampling, a meteorological monitoring station recorded hourly averages of wind speed, wind direction, sigma theta (the standard deviation of the wind direction fluctuations), air temperature, soil temperature, and solar radiation. Sampling commenced on June 17, 1989 and continued for nine days.

A total of 15 filters (including two field blanks) consisting of 24-hour composite samples were sent to Hazen Research Laboratories for analysis. The analytical parameters selected include fluoride, cyanide, aluminum, chromium, and nickel. The analytical results are briefly discussed in Section 4.0. Complete analytical results and additional information on sampling methods and meteorological data are presented in the Black Mud Pond Air Sampling Report (Appendix C).

2.2.6 TERRAIN CONDUCTIVITY SURVEY

A terrain conductivity survey was conducted in the vicinity of the Black Mud Pond during May 1989. The objectives of the survey were to: 1) evaluate the effectiveness of the groundwater containment wall previously installed by RMC and; 2) aid in delineating contaminant plumes emanating from the Black Mud Pond.

WCC personnel repeated the geophysical survey performed by Calocerinos and Spina (1985), using similar equipment and methodology. In addition, the survey was expanded further north, northwest, west and east. A EM-34 terrain conductivity meter was used to record variations in the electromagnetic field associated with free-ion concentrations of the groundwater. Results of the 1989 WCC conductivity survey are presented in the Landfill Underdrain and Black Mud Pond Terrain Conductivity Report (June 30, 1989).

A second geophysical survey was conducted in August 1989 using a EM-38 terrain conductivity meter. The purpose was to confirm the results obtained in May. The EM-38 is less susceptible to interferences and records at greater depths.

2.3 LANDFILL AND FORMER POTLINER STORAGE AREA

The Landfill and Former Potliner Storage Area lie adjacent to one another south of the main plant structure. Waste, groundwater, surface water, sediment, and leachate were sampled during fieldwork conducted subsequent to the Phase I RI Report.

2.3.1 WASTE CHARACTERIZATION

Borings were completed in the Landfill and Former Potliner Storage Area for waste characterization. Five borings (LFB-1 through LFB-5) were completed in the Landfill and 2 (FPSAB-1, FPSAB-2) in the Former Potliner Storage Area (Plate 1). The borings were terminated just below the contact between fill or waste and natural material.

Two waste samples from each Landfill boring location were submitted for laboratory analysis for indicator parameters. The samples were selected based on field screening with an organic vapor analyzer (OVA) and visual observations. Two samples of soils from below the fill were analyzed (LFB1-26-28, LFB2-20-22). In addition, 2 composite samples (LFB-2C, LFB-4C) were collected and analyzed for TCL semi-volatile and volatile parameters.

Two samples from each of the boring locations in the Former Potliner Storage Area were also submitted for laboratory analysis. The samples were obtained from near the surface and near the fill/till interface and analyzed for the indicator parameters. A soil sample was also obtained from the Landfill Road (LFRS-1) and analyzed for PCBs only.

2.3.2 GROUNDWATER

Two piezometers were constructed in the Landfill (LFB-2 and LFB-4) to help define the occurrence and movement of groundwater in the Landfill. Piezometer LFB-2 was constructed along the road accessing the southern portion of the Landfill. LFB-4 was placed on top of fill in the central portion of the Landfill near the point of highest elevation. In both instances, the bottom of the screened interval was set at the contact of the fill and natural clay unit.

Groundwater from 9 monitoring wells in the vicinity of the Landfill and Former Potliner Storage Area was sampled during four quarters in 1989 (February, April, July and October) and once in 1990 (January). All of the samples were analyzed for the indicator parameters. During the October sampling round, monitoring wells MW-5S and MW-8S were analyzed for TCL volatile and semi-volatile compounds as well as the indicator parameters.

2.3.3 SURFACE WATER AND SEDIMENT

During a NYSDEC sampling event on August 11, 1988 split surface water and sediment samples were collected from within the Landfill Surface Water Collection Tank. One aqueous (WPU-RE-2) and 3 sediment samples (WPU-RE-2A, B, C) were obtained.

Samples WPU-RE-2A and WPU-RE-2C were collected from sediment that had accumulated below the drainage pipe inlets. Sample WPU-RE-2B was obtained adjacent to the tank's outlet drain. WPU-RE-2 was collected from standing water near the WPU-RE-2C location. The aqueous sample was analyzed for full scan priority pollutants, fluoride, and cyanide. The sediment samples were analyzed for PCBs only.

During the NYSDEC sampling event on August 11, 1988, 8 additional sediment samples were collected from small intermittent run-off pathways in the Landfill and Former Potliner Storage Area. These samples, WPU-RE-17 to WPU-RE-24, were analyzed for PCBs.

2.3.4 LEACHATE

One sample was taken from the leachate collection sump during April 1989 and analyzed for the indicator parameters. The sample was collected by holding a sample container under a stream of leachate being pumped into the sump.

2.3.5 LANDFILL UNDERDRAIN

The effectiveness of the Landfill Underdrain was evaluated by reviewing available information including underdrain design diagrams, groundwater elevation data, and a review of boring logs. The purpose of the evaluation was to: 1) determine if additional studies were necessary to fully characterize the leachate collection system and; 2) determine what additional activities would be necessary to provide a more detailed evaluation of the system's effectiveness.

Conclusions from the study were presented in detail in the Landfill Underdrain and Black Mud Pond Terrain Conductivity Report (June 30, 1989). In addition, some of the conclusions have been incorporated into discussions on the Landfill and adjacent wetlands (Sections 4.0 and 5.0).

2.4 NORTH YARD

The North Yard is the area located between the main plant building and of the RMC fence line along South Grasse River Road. Various plant processes including the Heat Transfer Medium (HTM) System, the Thickener System, the Alumina Unloading Shed, and the diked areas are located in the North Yard (Figure 3). The yard was graded to its current topography by both cutting and filling during the construction of the plant. WCC's investigations in the North Yard include HTM System sampling, groundwater sampling, soil sampling, and utility sampling.

2.4.1 HTM SYSTEM

The HTM System and associated piping is believed to have been the major source of PCB contamination in the North Yard. The HTM System equipment is housed in the pumphouse located in the central portion of the North Yard, with HTM piping extending to the pitch tanks to the north and the Carbon Plant to the south. WCC has collected 3 samples of oil from the HTM System. Two were analyzed for PCBs, as reported in the PCB Source Assessment Period 3 Report (September 12, 1989). The third sample was analyzed for PCDFs and PCDDs and is reported in the Phase I PCDF/PCDD Sampling Report (January 10, 1989).

2.4.2 GROUNDWATER

Two monitoring wells (MW-1S and MW-2S) were previously installed in the North Yard. Four additional monitoring wells (MW-16S through MW-19S) were installed during WPA 3 fieldwork conducted in August 1989. Monitoring wells MW-16S and MW-18S were installed in utility trench backfill to evaluate the possibility of the trenches acting as preferential migratory pathways for groundwater. The MW-17S and MW-19S locations were selected according to PCB distribution patterns. The basis for selecting North Yard well locations was discussed in WPA 3. Actual locations were selected by considering access and utility locations.

All of the North Yard wells were sampled during the October 1989 groundwater sampling round. Monitoring wells MW-16S, MW-17S, MW-18S, and MW-19S were sampled again in January 1990. All of the samples were analyzed for indicator parameters.

2.4.3 SOIL

Approximately 400 soil samples have been collected at the surface and at depth from the North Yard Area during 4 phases of PCB soil sampling and 2 phases of polychlorinated dibenzofuran and dibenzo-p-dioxin (PCDF/PCDD) sampling. The initial PCB investigations concentrated on potential source areas (i.e., HTM System, diked areas, and the Pipe Bridge Area). Later phases expanded the investigation to provide adequate areal coverage and evaluate potential migration pathways. The first phase of PCDF/PCDD sampling concentrated on areas of substantial PCB contamination. The second phase extended the investigation to encompass a larger area and followed a modified grid pattern (Figure 4).

Twenty-seven soil samples (including 2 duplicates) were taken during advancement of 3 North Yard soil borings (NYB-1, NYB-2 and NYB-3) and 4 shallow North Yard monitoring wells (MW-16S through MW-19S) (Figure 3). An attempt was made to collect samples from near the surface (0 to 2 feet), directly above the fill/till contact, directly below the contact, 3 to 4 feet below the contact, and 5 to 6 feet below the contact.

Water rotary drilling techniques were used to complete the borings. At each location, the upper 4 feet of soil was isolated from the rest of the boring by a 12-inch I.D. segment of casing driven in by hammering. After removing the soil from within the 12-inch casing, 4-inch I.D. casing was advanced through the upper casing. Drilling fluid was not re-circulated but was pumped into the center fuel oil dike area and subsequently treated at 003 by granular activated carbon (GAC). All boreholes were backfilled with a cement/bentonite grout following completion.

Reports which provide detailed descriptions of North Yard soil sample locations and methodologies include:

- Work Plan for PCB Sampling (Phase I) (April 18, 1988)
- PCB Investigation Report (Phases I and II) (July 6, 1988)
- PCB Soil Sampling Program Phases I, II, III, and IV (October 12, 1988)
- PCDF/PCDD Sampling Report (January 10, 1989)
- Work Plan Addendum 3 (WPA 3) (June 30, 1989)
- Revised Phase II PCDF/PCDD Sampling Plan (June 30, 1989)
- Phase II PCDF/PCDD Sampling Report (November 6, 1989)

2.4.4 UTILITIES

As part of Phases I and II of the PCB Source Assessment, several aqueous and sediment samples were collected from sanitary sewer manholes in the North Yard. The sample locations were selected according to the availability of adequate sample volume. Sampling methodologies and analytical results were presented in the PCB Source Identification Assessment Report (February 20, 1989).

The North Yard Railroad Tracks Area is drained by a network of French drains and catchbasins. Aqueous samples were collected from the French drains immediately following a storm by lowering the sample container into the stream of water discharging into the catchbasin. The French drains entering catchbasin CB70 from the east and west were sampled (FDCB70E, FDCB70W). The western French drain lines entering catchbasins CB67 and CB69 were sampled and labeled FDCB67W and FDCB69W, respectively. Catchbasin locations are shown on Figure 3. The samples were analyzed for PCBs.

2.5 POTLINER PAD

The Potliner Pad is a concrete surface located adjacent to the Crusher Building. Spent potliner has been handled in this area. As a result, additional studies were performed to assess groundwater, surface water, and sediment contamination associated with the Potliner Pad.

2.5.1 GROUNDWATER

Monitoring wells MW-26S, MW-27S, and MW-28S were installed in the vicinity of the Potliner Pad during WPA 2 fieldwork (Plate 1). MW-27S was installed to provide upgradient information. Its location is just off of the southwest corner of the crusher building adjacent to the Potliner Pad. Monitoring well MW-26S is downgradient and north-northwest of the Potliner Pad. MW-28S was installed north-northeast of the pad. Rising and falling head slug tests were conducted on MW-28S. Falling head slug tests were performed on MW-26S and MW-27S.

During October 1989, MW-26S, MW-27S, and MW-28S were sampled along with existing monitoring well MW-3S. Monitoring wells MW-26S, MW-27S, and MW-28S were sampled again in January 1990. Each sample was analyzed for the indicator parameters. In addition, the October 1989 sample from MW-3S was analyzed for TCL volatile and semi-volatile compounds.

2.5.2 SURFACE WATER AND SEDIMENT

Three aqueous and sediment sample pairs were collected from the drainage pathway adjacent to the Potliner Pad (Figure 5). This drainageway was originally sampled in October 1987. The results were discussed in the Phase I RI Report. Subsequent sampling includes location TSDW-1/TSDS-1 which is located 200 feet upstream of the pipe which diverts flow under the railroad tracks. There was visual evidence of intermittent drainage entering the stream at this point from an area adjacent to the Potliner Pad. The second sample location (TSDW-2/TSDS-2) was located 100 feet upstream of the pipe culvert. The final location (TSDW-3/TSDS-3) was approximately 130 feet north (downstream) of the pipe culvert within the ditch west of the Thickener System tanks.

All sediment samples were collected as surface samples. Aqueous samples were analyzed for indicator parameters. Sediment samples were analyzed for all indicator parameters with the exception of amenable cyanide.

2.6 RECTIFIER YARD

The plant Rectifier Yard is located adjacent to the south side of the plant. The area consists of rectifiers, transformers and power lines. Surface water is drained from the yard by a network of catchbasins (Section 3.2). Sediment and soil samples were collected throughout the yard and in associated drainageways to assess the yard as a potential source of PCB contamination.

2.6.1 SOIL

Three soil samples were taken from the Rectifier Yard and analyzed during Phase I Remedial Investigation fieldwork. Five additional surface soil samples (RCYD1/0 through RCYD4/0, RCYD7/0) and one duplicate sample (RCYD3/DUP/0) were collected from the Rectifier Yard during subsequent fieldwork (Figure 6). The samples were analyzed for PCBs.

2.6.2 SEDIMENT

Sediment samples were collected from locations within a Rectifier Yard drainage pathway located near the southeast corner of the plant (Figure 7). The sources of this drainage include catchbasins located within the yard (CB-104, CB-106, CB-107, CB-108, CB-109 and CB-110), a catchbasin located in the parking area adjacent to the shipping and receiving warehouse (CB-111), and additional surface water run-off from the southeast corner of the plant.

Two surface sample locations (RCYD5/0, RCYD6/0) are situated in the ditch just south of the plant road (PCB Soil Sampling Phases I, II, III, and IV, October, 1988). Additional surface sample locations (RCYD7A/0 through RCYD14/0) are spaced along the length of the identifiable drainage pathway. Two samples (RCYD9/1, RCYD12/1) were taken at 1-foot depth intervals below their surface counterparts.

2.7 WETLANDS

NYSDEC regulated wetland RR-6 is located adjacent to the Landfill and Former Potliner Storage Area and surrounding areas and encompasses an area of approximately 172 acres. Fieldwork completed in the wetlands subsequent to the Phase I RI Report includes vegetative and benthic invertebrate reconnaissance surveys as well as surface water and sediment sample collection.

2.7.1 ECOLOGICAL CONDITIONS

A seasonal (spring, summer and fall) ecological survey of the wetlands located adjacent to (south of) the RMC Landfill was undertaken in 1989. Previously, single season surveys had been completed in 1987 (fall) and 1988 (summer). The 1987 effort was limited to a reconnaissance of the wetland area and the downgradient drainageways, with no field sampling. The 1988 survey included the collection of vegetation data and sediment samples for benthic population evaluation. The results of this effort were included in the WPA 1.

The objective of the 1989 wetland survey was to evaluate the seasonal variation in the vegetative and benthic communities and evaluate these results in terms of sediment and surface water chemistry. The 1989 survey consisted of three separate sampling efforts in May, July and October. As part of each effort, vegetation data were collected along transects established in 1988 and replicate sediment samples for benthic community analysis were collected from locations in the wetland area, the downgradient drainageway, and a control area located west of the RMC site. The benthic sampling locations included those sampled in 1988 plus additional locations that were added to provide a more comprehensive survey of the distribution of benthic macroinvertebrates in the wetland area. All sample locations were staked and surface water and sediment samples were collected for chemical analyses at these locations as part of WPA 1 (Figure 8).

The 1989 survey also included an evaluation of the incidence of vegetation stress in the vicinity of the RMC Landfill and the adjacent wetland area. This evaluation was conducted by Dr. Leonard H. Weinstein of Boyce Thompson Institute for Plant Research at Cornell University, an expert in the field of phytotoxicant effects.

The complete results of the Wetland Survey of Ecological Conditions are presented in Appendix D.

2.7.2 SURFACE WATER AND SEDIMENT

On August 11, 1988, NYSDEC and WCC representatives collected split samples from various areas throughout the site. During this event, 2 aqueous and 12 sediment samples were obtained from the wetlands area. An additional sediment sample was collected from the drainage pathway exiting the wetlands toward the southeast at a location near Route 37. The sample locations are shown on Figure 7. All sediment samples were collected as surface sediment samples and analyzed for PCBs only. The aqueous sample from the RE13 location was analyzed for PCBs, the aqueous sample from the RE14 location was analyzed for full scan priority pollutants, fluoride, cyanide.

As part of WPA 1 fieldwork completed in June 1989, 16 aqueous and 16 sediment samples were obtained from the wetlands area and associated drainage pathways (including blanks and duplicates). Ten stations were selected to provide areal coverage (approximately a grid pattern) of the wetland without duplicating previous stations. Two sample stations were chosen in both the west and east drainage pathways identified as receiving wetlands drainage. A final station was located in a wetlands control area approximately 1 mile west of the plant in order to provide background analytical data. The surface water and sediment samples were coordinated with those of the Wetlands Vegetation and Benthic Reconnaissance Study in order to evaluate any possible correlation between chemical concentrations with environmental stress.

A hand operated piston core sampler was used to take borings at each of the sample stations. Depths of up to 2.6 feet were obtained. The cores were extracted and logged

(Appendix E). An Orion Research fluoride ion-specific electrode coupled with a Beckman pH/conductivity meter was used to determine the pH and fluoride concentrations from certain intervals of each piston core. A small amount of sediment was mixed with deionized water to create a slurry which was measured for pH and fluoride.

The intervals selected for screening were Based on subsurface conditions. Generally, samples for screening were taken at the surface (A-zone: corresponding with the sample sent to the laboratory), at the top of the glacial clay (B-zone), and at about 1-foot below the top of the clay (C-zone). For some of the samples an additional measurement was taken of the slurry after addition of a small amount of pH buffer solution.

2.8 OTHER AREAS OF INTEREST

2.8.1 OUTFALL 004 SYSTEM

Prior to its diversion, the Outfall 004 drainage system collected surface water run-off from the north slope of the dikes and drainage located along South Grasse River Road. The drainage discharged into the St. Lawrence River west of Outfall 001. Several sediment and soil samples were taken in this area and analyzed for PCBs (Figure 9). .

2.8.1.1 SEDIMENT

Three surface sediment samples were collected from the drainageway east of the catchbasin on the south side of South Grasse River Road. The samples were labeled ECB004-1, ECB004-2, and ECB004-3. Their locations were 120 feet, 80 feet, and 40 feet upstream of the catchbasin, respectively (Figure 9). There was no surface water present in the ditch during sampling.

The ditch alongside South Grasse River Road was sampled prior to remediation. Seventeen surface sediment samples, 3 subsurface samples collected from 1-foot below grade and 1 duplicate, were collected from locations spaced along the entire stretch of the drainageway. Additional sampling was performed during and after the remediation of the ditch, as documented in the Interim Remedial Measures Report (January 19, 1989). All samples were analyzed for PCBs.

2.8.1.2 SOIL

Eight surface soil samples were collected at 7 locations north of South Grasse River Road on November 21, 1989. The samples were designated NSGRR-1 through NSGRR-8 (Figure 10). NYSDEC personnel collected sample splits at some of the locations.

2.8.2 OUTFALL 002 SYSTEM

Drainage has been diverted from the Outfall 002 creekbed into a pipeline, part of which is new and part of which is the pipe used by the Outfall 003 discharge. Samples were taken from the old creekbed, the 002 diversion area, and from the vicinity of catchbasins 002S1A and CB-85.

2.8.2.1 SEDIMENT

The Outfall 002 discharge creekbed was sampled in November 1989, approximately 48 hours after the diversion of the effluent stream. Fourteen surface sediment samples (002SB-1 through 002SB-14) were collected and analyzed for PCBs. The most upgradient location, 002SB-1, is situated just downstream of the weir. The remaining 13 samples were spaced along the length of the ditch with the 002SB-14 location closest to the St. Lawrence River (Figure 11).

2.8.2.2 SOIL

Three surface soil samples were collected from the vicinity of catchbasin 002S1A (Figure 12). The samples were labeled CB002S1A-1, CB002S1A-2, and CB002S1A-3 and analyzed for PCBs.

Four surface soil samples (including 1 duplicate) were collected from around catchbasin CB85 and analyzed for PCBs. The sampling locations (CB85-1, CB85-DUP, CB85-2, and CB85-3) are shown on Figure 12.

One additional surface soil sample (002005) was collected from an area of oil stained soil next to an oil skimming device which extended across the 002 creekbed near the weir. The sample was analyzed for PCBs.

Twenty-five surface soil samples were collected from the Outfall 002 diversion area. Sample designations are 002DA1 through 002DA15 and 002DA17 through 002DA27. Samples 002DA25, 26 and 27 are composite samples collected from the pile of excavated soil in the southeast section of the construction area. The samples were taken from the southern half, the northwest quarter, and the northeast quarter of the mound respectively. The remaining samples were collected to complete a sampling grid conducted for RMC by O'Brien and Gere Engineers of Syracuse, New York. Sample locations are shown on Figure 13. The samples were analyzed for PCBs.

2.8.2.3 FRENCH DRAIN

Storm water catchbasin CB85 receives drainage from a French drain system which underlies the railroad tracks along the east side of the west casthouse. The French drain was sampled immediately following a storm. An aqueous sample was collected by holding a sample container under the discharging French drain line. This sample point had a very slow flow rate as the majority of the French drain tile is under the roof of the west casthouse (Figure 12). The sample (FDCB85) was analyzed for PCBs.

2.8.3 GENERAL MOTORS FILL AREAS

This area was sampled for soils only. A total of 12 soil samples (including one duplicate) were taken from 3 areas designated as General Motors (GM) fill areas. Sample locations (GMF1/0 through GMF11/0) are presented on Figures 14 and 15. The samples were collected from low lying areas or drainage pathways. All samples were collected as surface samples and analyzed for PCBs.

2.8.4 SLUDGE DRYING BEDS

Several samples of sludge from the drying beds were collected and analyzed for PCBs as part of the PCB Source Assessment investigation. Two additional samples (NP-34 and NP-35) were collected during the PCDF/PCDD investigation and analyzed for PCBs, PCDFs and PCDDs (Phase II PCDF/PCDD Investigation Report, November 6, 1989).

One soil sample (SDBS-1) was collected as a surface soil sample outside the northeast corner of the sewage sludge drying beds. The sample was analyzed for PCBs.

3.0 SITE SETTING

The Phase I RI Report covered this section in considerable detail. Discussions concerning land use, demographics, water supply, climatology, air quality, ecology, and geology can be found in that document. Subsections on hydrogeology and surface water drainage are updated based on new data and presented below.

3.1 HYDROGEOLOGY

This section of the report discusses the hydrogeologic conditions at the site. Site- and area-specific groundwater conditions interpreted from the available data are described below.

3.1.1 REGIONAL GROUNDWATER CONDITIONS

Groundwater within the unconsolidated glacial deposits of the region is generally unconfined. The water table configuration is generally a reflection of the surface topography. Groundwater under confined conditions is present in many areas at depths of 50 feet or greater (Trainer and Salvas, 1962). Confined conditions, which may exist at depth, are encountered when the low permeability of the till and lacustrine clays overlie lenses of material with a higher gravel and/or sand content. The overlying deposits act as a confining unit to the more permeable sediments below.

Groundwater levels commonly reach their peak in March or April and their low position in August or September. The seasonal fluctuation indicates that groundwater recharge is greatest during late fall and early spring. The use of water by plants, and evaporation from the soil, probably account for less recharge during the summer (Trainer and Salvas, 1962).

3.1.2 SITE GROUNDWATER CONDITIONS

– The water table configuration on-site is generally a reflection of the surface topography. The ridge of glacial till, the site of the Black Mud Pond, forms a groundwater divide from which groundwater flows towards the Raquette River to the south and St. Lawrence River to the north.

Water table elevation maps are presented in Figures 16 and 17, and are based on measurements from all 40 site wells plus 4 piezometers installed in 1989. Separate maps are presented for data generated from the shallow and deep wells. Well construction details are presented in Table 2-1, monitoring well locations are presented on Plate 1, and water level elevations for 1989 and 1990 for all wells are tabulated in Table 3-1.

A review of water table elevations in all on-site monitoring wells and piezometers suggests a slight seasonal variation. For measurements taken in both shallow and deep monitoring wells, water levels at the RMC site generally peak in the spring (April) and are lowest in late summer (July). This variation is consistent with regional changes in water levels. The seasonal change in water levels at the site is on the order of 0 to 3 feet.

Well couplets were used to evaluate possible confined conditions and vertical groundwater flow gradients within the monitored zone. Five complete rounds of water level measurements have been conducted subsequent to the Phase I RI. Data generated is consistent with previous measurements (Phase I RI Report) with downward or recharge gradients in the vicinity of the Black Mud Pond, and upward or discharge gradients adjacent to the wetlands.

Six of the 9 well couplet locations on-site showed a consistent vertical gradient. Data from 3 couplets indicated reversals resulting from seasonal variations. Water levels in well couplets MW-12S, MW-12D; MW-13S, MW-13D; 20-85-S, 20-85-D; and 22-85-S, 22-85-D in the vicinity of the Black Mud Pond, indicated downward (recharge) vertical gradients. Locations MW-5S, MW-5D, and MW-7S, MW-7D are on the southern berm of the Former Potliner Storage Area and the Landfill, adjacent to the wetlands indicated upward (discharge) vertical gradients. Two couplets (21-85-S, 21-85-D and 23-85-S, 23-85-D) in the vicinity of the Black Mud Pond indicate downward vertical gradients for much of the year. Water level data suggest that a reversal in the vertical gradients at these 2 couplet locations occurs in the January quarter and apparently lasts for a short period of time. Couplet MW-15S, MW-15D indicates an upward gradient for most of the year (late summer through winter).

The upward vertical gradient recorded at well couplet MW-15S and MW-15D during some of the year is a result of the high topographic relief on the south side of the Black Mud Pond. The gradient reflects the fact that the low-lying area south of the pond is a groundwater discharge area for some of the year.

3.1.2.1 COEFFICIENT OF PERMEABILITY

Permeability values measured for the till and lacustrine deposits at the site are low. The Phase I RI Report presented data indicating a logarithmic mean permeability for the till of 1.0×10^{-6} cm/sec. The permeability of the winnowed till is higher (1.0×10^{-3} cm/sec) than that of the underlying till.

Three measurements in the lacustrine unit were 2.4×10^{-7}, 6.5×10^{-5} and 1.0×10^{-10} cm/sec. The Phase I RI Report concluded that the general fill materials found on-site have a range of permeabilities higher than the natural materials. Five measurements were taken in fill with values ranging from 4.6×10^{-2} cm/sec to 2.8×10^{-4} cm/sec. A lower permeability (approximately 2 x 10^{-6} cm/sec) containment wall was constructed around the Black Mud Pond.

Permeability values for monitoring wells installed subsequent to the Phase I RI Report are generally consistent with the Phase I data. A measurement from MW-16S, screened in fill comprising the North Yard utility trench, was 1.4 x 10^{-1} cm/sec. Measurements taken in till near the Potliner Pad were on the order of 5.0 x 10^{-4} cm/sec. A value of 1.3 x 10^{-6} cm/sec was determined for well MW-29S, screened in till and located north of the Black Mud Pond. Values are tabulated in Table 3-2.

Groundwater flow velocities have been calculated for certain areas of the plant. The velocity was calculated as the permeability divided by the effective porosity (assumed to be 20 percent) multiplied by the change in head divided by the distance. For the flow path MW-10S to MW-7D the approximate velocity is calculated to be 0.8 ft/year; for MW-6S to MW-5S, 135 ft/year; for MW-13D to 23-85-D, 1.0 ft/year; and for MW-11S to 21-85-S, 3 ft/year.

Based on limited information, a groundwater velocity can be calculated for the flow path from MW-16S to MW-18S within the North Yard utility trench. The approximate velocity is calculated as the permeability divided by the effective porosity (assumed to be 30 percent) multiplied by the change in head divided by the distance.

$$\frac{(1.4 \times 10^{-1} \text{ cm/sec})}{.30} \frac{(2.70 \text{ ft})}{(340 \text{ ft})} = \frac{144{,}850 \text{ ft/yr } (.006)}{.30}$$
$$= 2900 \text{ ft/yr (approximate)}$$

Discharge (Q) for the utility trench can then be calculated as Q = KIA where K is the permeability, I is the hydraulic gradient and A is the cross-sectional area.

$$Q = (1.4 \times 10^{-1} \text{ cm/sec}) \ (.006) \ (250 \text{ ft}^2)$$
$$= 80 \text{ gal/day (approximate)}$$

3.1.2.2 HYDROLOGIC EFFECT OF THE BLACK MUD POND AND GROUNDWATER CONTAINMENT WALL

The site of the Black Mud Pond is on top of a glacial hill which forms a groundwater divide between the Raquette River to the south and the St. Lawrence to the north. Prior to the construction of the pond, groundwater flow was normal (north and south) to the linear divide, towards the adjacent rivers. The existence of the mud pond on top of the divide has not significantly changed the groundwater regime within the unconsolidated deposits.

Previously, when the pond was used, the elevation of the pond liquor was higher than the surrounding topography, increasing the hydraulic head within the water table. The effect of the pond, when in use, is to superimpose a hydraulic mound on the divide, increasing the local hydraulic head of the divide. This creates a slight gradient westward and eastward from the pond. However, at a distance from the pond the east and west hydraulic gradients are low compared to the north and south gradients. Flow is therefore deflected towards the Raquette and St. Lawrence Rivers in response to the higher hydraulic gradients in those directions.

In 1985 an 8-foot wide trench was excavated along the entire length of the north and west sides of the Black Mud Pond (Figure 1) for the purpose of constructing a containment wall and to remediate shallow leakage from the Black Mud Pond via the winnowed till. The trench extended into the low permeability glacial till and intersected the more permeable winnowed till. To construct the containment wall, the trench was backfilled with sorted, compacted till obtained from the borrow pit west of the Black Mud Pond. The borrow material was placed in 8-inch lifts and compacted to 95 percent of maximum density. The estimated mean permeability of the compacted till is 2.0×10^{-6} cm/sec.

A terrain conductivity survey was performed in 1989 in the vicinity of the Black Mud Pond to help delineate the extent of groundwater contamination and to assist in a determination of the effects of the containment wall on groundwater flow. Results of the survey were submitted to NYSDEC in a report dated June 30, 1989 and titled "Landfill

Underdrain and Black Mud Pond Terrain Conductivity Report." The 1989 survey repeated a conductivity survey performed in 1985 by Calcerinos and Spina.

The survey demonstrated that there has been a decrease in conductivity in the shallow subsurface from 1985 to the present. The decrease in conductivities is attributable to the containment wall which restricts flow of contaminated groundwater away from the Black Mud Pond, and to a decrease in the amount of liquor pumped to the Black Mud Pond.

Comparison of data generated in the two surveys demonstrate an increase in conductivity in the 1989 survey on the south edge of the Black Mud Pond. The depth to groundwater in this area is approximately 27 feet. The anomaly may not have been detected in the 1985 survey due to the depth of groundwater (the penetration depth of the 1985 survey is unknown but is thought to be on the order of 25 feet). It is also possible that the containment wall has changed the flow directions of groundwater moving away from the pond, causing an increase in flow to the south.

The 1989 survey also revealed an increase in conductivity near the northeast corner of the Black Mud Pond. The cause of this increase is uncertain, it may be the result of local interferences from a number of possible sources.

Two shallow piezometers (BMP-1 and BMP-2) were installed in 1989 near the Black Mud Pond to determine the effect of the containment wall on groundwater flow. BMP-1 was installed inside of the wall directly across from monitoring well MW-13S. BMP-2 was installed outside of the wall directly across from MW-14S. Monthly groundwater level measurements, starting in January 1990, are being taken at these locations in order to evaluate the containment wall (Table 3-3). Regardless of changes to groundwater movement caused by the containment wall, flow velocities in the vicinity of the pond are extremely low (approximately 1 to 3 feet per year).

The data thus far indicates groundwater flow towards the Black Mud Pond at the MW-13S/BMPB-1 location. At the MW-14S/BMPB-2 location, the gradient was toward the pond during January through March and away from the Black Mud Pond during April through June.

3.1.2.3 HYDROLOGIC EFFECT OF THE NORTH YARD UTILITY TRENCHES

The North Yard is characterized by approximately 1 to 4 feet of fill material overlying gray glacial till, except in utility trenches where up to 25 feet of fill material has been used as backfill. The fill has been documented as having a higher permeability then the underlying till (Section 3.1.2.1). Utility trench locations are presented in detail on Figure 3 of WPA 3. Figure 18 shows a north to south trending cross-section (E-E') through the North Yard.

Monitoring wells MW-1S, MW-2S, MW-16S, MW-17S, MW-18S and MW-19S are located in the North Yard. Monitoring wells MW-1S, MW-2S, MW-17S and MW-19S are screened in the till. Wells MW-16S and MW-18S are screened in fill material comprising the main utility trench which runs parallel to the North Road. The main utility trench holds the sanitary sewer line, the fume scrubber sewer line, and stormwater drainage lines.

Water levels recorded in the North Yard wells are presented in Figure 19. Groundwater north of the Pitch Pumphouse flows directly towards the St. Lawrence River. Some mounding of this flow occurs within the diked areas, due to recharge from the ponded water in these areas.

Groundwater movement south of the pumphouse is not well understood. It is apparent that groundwater from at least a portion of the North Yard flows south into the main utility trench. This southward flow is due to the trench backfill acting as a linear conduit for westward migration and/or a localized groundwater sink, such as infiltration into the sewer pipes. Permeable fill material surrounding the stormwater drainage system, which runs south across the North Yard to the main trench, may also be acting as a collector for shallow groundwater in the North Yard.

3.2 SURFACE WATER HYDROLOGY

Regional surface water hydrologic features consist of 3 main rivers, the St. Lawrence, Grasse, and Raquette. The Grasse and Raquette rivers are tributaries of the St. Lawrence and combine with the St. Lawrence approximately 1 mile west and 3 miles east of the plant, respectively. Each of the rivers flow generally from southwest to northeast, paralleling the axis of the glacial till ridges. The region is characterized by small streams which drain the valleys and occasional wetland areas.

On the plant site, a drainage divide trends southwest-northeast and causes local drainage to either flow south to the Raquette River via NYSDEC regulated Wetland RR-6, or north to the St. Lawrence River via intermittent streams and regulated outfalls. The approximate location of the St. Lawrence/Raquette drainage divide is shown on Figure 20. The subsections that follow discuss drainage at the plant and are separated as either Raquette or St. Lawrence River drainage components.

3.2.1 RAQUETTE RIVER DRAINAGE

The on-site source areas for surface water ultimately discharging to the Raquette River are:

- the area south of the Black Mud Pond;
- a portion of the Miscellaneous Materials Storage Area located west of the plant;
- the Rectifier Yard;
- the Wetland RR-6; and
- the area south of the road connecting the plant with Highway 37.

The open water/emergent wetland portion of Wetland RR-6, located adjacent to the Landfill and Former Potliner Storage Area, acts as an area of surface water accumulation. All plant run-off within the Raquette River drainage system passes through these wetlands. The wetlands are fed from the north by a stream system draining the area south of the Black Mud Pond and a portion of the Miscellaneous Materials Storage Area west of the plant (Figure 2). Additional surface water collected east and west of the Landfill and Former Potliner Storage Area enters the wetlands via small and less prominent drainage pathways. Surface water originating from within the Landfill and Former Potliner Storage Area is collected by the surface water collection system and pumped to the Thickener System.

The Rectifier Yard drainage system consists of three north-to-south trending pipelines fed by a network of stormwater catchbasins and French drains. Surface water collected from the western and central portions of the Rectifier Yard is diverted to a drainage pathway east of the Former Potliner Storage Area (Figure 7) that discharges to the eastern portion of the open water/emergent area of the wetlands. Drainage collected from the eastern portion of the Rectifier Yard combines with drainage from an area southeast of the yard and is piped to another intermittent drainageway which leads to the eastern side of the wetlands.

Most of the surface water exiting the open water/emergent wetlands appears to follow the eastern drainage pathway. A smaller portion of the drainage exiting the wetlands follows the western drainageway (Figure 20). Both drainageways flow under Highway 37 and discharge into the Raquette River approximately 2000 feet southeast of the plant. No surface water connection exists between the open water adjacent to the Landfill and the wetlands control area (located approximately 1 mile west of the plant).

3.2.2 ST. LAWRENCE RIVER DRAINAGE

Surface water originating north of the drainage divide discharges to the St. Lawrence River via intermittent streams or plant outfalls. Based on plant construction and stormwater collection systems, this area can be further subdivided (Figure 20). Accordingly, each of the subdivisions are discussed below.

001: This area includes most of the plant and the portion of the North Yard south of the diked areas. Surface water is collected from the pot room roof drains and the courtyards between the pot rooms by a network of catchbasins. Water originating in the North

Yard is collected by a network of French drains and catchbasins. All of the water collected is discharged to the St. Lawrence River via Outfall 001. Outfall 001 also contains a treated bleed from the waste water treatment process which also collects surface run-off from the Landfill, Black Mud Pond, and the area around the Thickener System.

002: Surface water run-off contributing to Outfall 002 consists of plant area east of the west casthouse, around the east casthouse and near the Maintenance Shops. The run-off is collected in catchbasins and is transported to the outfall in a series of storm sewers.

003: This area includes the fuel oil and pitch tank diked areas and the north slope of the dikes (Former Outfall 004). All surface water collected in this area is pumped into the eastern most fuel oil diked area. From there, the water is pumped to the sanitary sewer system which uses the granular activated carbon (GAC) filtration system for final treatment. The combined effluent is discharged to the St. Lawrence River via Outfall 003.

SLR-1: This area is bound to the east by South Grasse River Road and to the north by the railroad tracks. It includes surface water drainage from the plant parking area, the GM fill area, and the area around the two sewage treatment plants. The now-abandoned Outfall 002 creekbed remains as the main drainageway receiving drainage from smaller tributaries. This intermittent drainage collected flows through a culvert under South Grasse River Road and follows the old 002 creekbed before discharging to the St. Lawrence River.

SLR-2: This drainage area is located between the railroad tracks and South Grasse River Road. It is bound to the west by the remediated Outfall 004 Area. Surface water flows to the catchbasin from both the east and west. From the catchbasin, the water flows through a culvert under South Grasse River Road and forms a drainage pathway north of the road. This intermittent drainage enters the St. Lawrence River approximately 400 feet east of Outfall 001.

SLR-3: This drainage area encompasses most of the plant's Miscellaneous Materials Storage Area located west of the plant including the area around the Potliner Pad and Crusher Building. The drainage in this area combines to form a small intermittent stream that runs along the western side of the Thickener System. The stream is diverted under South Grasse River Road and discharges to the St. Lawrence River north of the Thickener System.

4.0 CONTAMINATION CHARACTERIZATION

This section provides a contamination characterization for areas of interest around the plant. A discussion of analytical results is presented. A tabulation of all analytical results is presented in Appendix F. Results from Phase I are reviewed at the beginning of each subsection. Table 4-1 summarizes groundwater sample PCB analyses for all existing on-site monitoring wells sampled as part of the investigation.

4.1 BACKGROUND CONDITIONS

4.1.1 GROUNDWATER

Four monitoring wells are used to define background groundwater conditions at the site:

- Monitoring well MW-32S is considered background for the entire site.
- Black Mud Pond Area background conditions are defined by MW-31S and 25-85-S.
- Monitoring well MW-10S serves as a local background well for the Landfill Area.

MW-31S, MW-32S, and MW-10S were sampled in October 1989 and January 1990. MW-10S has been sampled previously as part of the quarterly monitoring program. Monitoring well 25-85-S was sampled in October 1989 only. Groundwater samples collected from the wells were analyzed for the site indicator parameters. Concentration ranges for the indicator parameters detected in the wells are presented in Table 4-2.

With the exception of iron (1.8 ppm) and magnesium (58.2 ppb), analytical results derived from MW-32S meet New York State Class GA groundwater quality standards. Trainer and Salvas (1962) state that groundwater of the Massena-Waddington area is of a calcium-magnesium bicarbonate type. Trainer and Salvas note a wide range of calcium and magnesium in the water. They also note that combined concentrations of iron and manganese in excess of 0.30 ppm in water is common for the area.

Background water quality conditions for the Black Mud Pond Area are defined by evaluating analytical results derived from MW-31S and 25-85-S. Class GA standards were exceeded by iron, magnesium and manganese.

Monitoring well MW-10S is hydrologically upgradient of the Landfill and exhibits a chemical profile similar to the other background wells. For a total of 7 sampling events, the only parameters which have been detected above Class GA standards are iron, magnesium, and manganese. The values reported lie within, or close to, the range for these parameters cited for Black Mud Pond Area background conditions. Phenol was detected in MW-10S in October 1987 at a concentration of 13 ppb; all subsequent samples have not revealed detectable levels of recoverable phenols.

4.1.2 SOIL

Three soil samples (MW-31S-2-4, MW-32S-2-4, and BMP-BACK) were collected to represent background soil quality conditions (Plate 1). All of the samples were obtained from 2 to 4 feet below grade. Sample results are presented in Table 4-3. Concentration ranges in ppm, for the indicator parameters include: aluminum (13,000 -16,000), arsenic (3.0 -4.0), beryllium (0.5 - 0.8), cobalt (6.1 - 8.5), iron (15,000 - 16,000), magnesium (6500 - 40,000), manganese (370 - 410), sodium (360 - 400), vanadium (29 - 35), fluoride (16 - 36), phenol (less than 0.1 - 1.3), sulfate (less than 20 - 140), and PCBs (less than .09 - .24). Cyanide was not detected.

4.1.3 WETLANDS SURFACE WATER/SEDIMENT

The surface water sample collected from the wetlands control area (WCAW-1, Table 4-16) revealed detectable levels of aluminum (.10 ppm), calcium (27 ppm), iron (2.1 ppm), magnesium (10 ppm), fluoride (0.45 ppm), and sodium (4 ppm). The sample was also analyzed for polycyclic aromatic hydrocarbons (PAHs). PAHs and PCBs were not detected in the WCAW-1 sample.

The sediment sample taken from the wetlands control area (WCAS-1, Table 4-17) contained detectable levels of aluminum (17,000 ppm), arsenic (7.4 ppm), cobalt (5.9 ppm), iron (16,000 ppm), magnesium (3800 ppm), recoverable phenols (17.2 ppm), sodium (460 ppm), vanadium (32 ppm), calcium (4300 ppm), chromium (23 ppm) and nickel (11 ppm). These values are similar to background soil results listed in Table 4-3. There were no detectable PAHs, PCBs or cyanide present.

4.1.4 WETLANDS ECOLOGY

A complete discussion of wetlands ecological background conditions is presented in Appendix D. Appendix D comprises a complete report concerning the ecology of the wetlands.

4.2 BLACK MUD POND

4.2.1 RESULTS OF THE PHASE I RI

Phase I fieldwork consisted of waste characterization, monitoring well installation, and groundwater sampling. Black mud samples indicated that the black mud is composed of varying concentrations of several metals, cyanide, fluoride, sodium, sulfate, PCBs and PAHs. With the exception of PCBs and PAHs which were not detected, shallow groundwater in the vicinity of the pond revealed elevated concentrations of these parameters. Deep monitoring wells exhibited little evidence of contamination during Phase I fieldwork.

4.2.2 WASTE CHARACTERIZATION

The Black Mud Pond liquor was sampled as a NYSDEC sample split (August 1988) and during investigations conducted as part of WPA 2. The two samples (WPU-RE-1W and BMPL) were collected from a ponded area along the north of the pond. Analytical results are included in Appendix F.

Sample results indicate that the liquor contains elevated levels of aluminum (9.31 ppm), arsenic (0.032 ppm), sodium (2290 ppm), and vanadium (1.33 ppm). The liquor also contains detectable levels of barium, calcium, copper, lead, nickel, potassium, and zinc. PCBs (Arochlor 1248) were detected in sample WPU-RE-1W at a concentration of 2.8 ppb. Sample BMPL revealed an Arochlor 1248 concentration of 0.1 ppb. Base neutral compounds detected in the liquor include benzo(b)fluoranthene, chrysene, fluoranthene, and pyrene. There were no acid extractable compounds detected in the liquor.

A sample of the black mud was collected as a NYSDEC sample split (August 1988). The sample (WPU-RE-1S) was analyzed for PCBs and confirmed the presence of Arochlor 1248 (12 ppm).

4.2.3 GROUNDWATER

Five groundwater sampling rounds have been conducted in the vicinity of the Black Mud Pond subsequent to the Phase I RI. These data are presented in Appendix F. Figures 21 through 26 show groundwater concentrations, derived from shallow and deep groundwater monitoring wells, of cyanide, fluoride, magnesium, recoverable phenols, sodium, and sulfate as determined during the October 1989 sampling event. Concentration ranges of site indicator parameters for Black Mud Pond Area wells are presented in Table 4-4.

There are currently 13 shallow monitoring wells in the Black Mud Pond Area (Plate 1). Five of these wells (MW-11S, MW-12S, MW-13S, MW-14S and MW-15S) are located just outside of the berm encircling the pond. Monitoring wells MW-30S, 20-85-S, 21-85-S, 22-85-S, and 23-85-S are located at a greater distance from the pond. Black Mud Pond Area monitoring wells MW-29S, MW-31S and 25-85-S are located furthest from the pond. The locations provide coverage in all directions from the pond.

Contaminant concentrations typically decrease with increasing distance from the pond. Contaminant concentrations and distributions in the majority of Black Mud Pond Area monitoring wells have shown little change with time. Possible exceptions to this are wells MW-11S, MW-12D and MW-13D. Metals concentrations recorded in MW-11S for October 1989 and January 1990 are higher than results from previous sampling rounds. This may reflect a considerable sediment load in the groundwater samples recently collected from MW-11S. Concentrations for a number of contaminants detected in MW-12D and MW-13D, specifically total cyanide, sodium, and sulfate, have increased slightly with time. PCBs have never been detected in any of the deep monitoring wells in the vicinity of the pond. Although the source of the contaminants in the deep wells is undoubtedly the Black Mud Pond, in all cases the shallow wells have higher levels of contaminants than the deep wells. A discussion of individual shallow and deep monitoring wells is presented in the paragraphs that follow.

Analytical results derived from the shallow monitoring wells are consistent with Phase I results. Groundwater collected at MW-11S exhibited elevated concentrations, relative to background, of aluminum, arsenic, cobalt, iron, magnesium, manganese, and vanadium. PCBs were detected at a concentration of .07 ppb in February 1989, and were not detected during any other sampling events. Groundwater from well MW-11S was analyzed for TCL volatile and semi-volatiles during the October 1989 sampling round. The only parameter detected was methylene chloride (2 ppb), a common laboratory contaminant.

MW-12S exhibits elevated concentrations of total and amenable cyanide, fluoride, sodium, and sulfate. PCBs were not detected.

Concentrations of cobalt, total and amenable cyanide, magnesium, sodium, and sulfate are elevated in groundwater sampled from MW-13S. PCBs were detected at a concentration of .07 ppb in April 1989 and .19 ppb in July 1989, but were not detected during all other sampling events.

MW-14S exhibits slightly elevated concentrations of total cyanide and sulfate. PCBs were not detected.

Concentrations of sulfate and PCBs are elevated in MW-15S. PCB concentrations have ranged from less than .065 ppb to .25 ppb.

Concentrations of aluminum and iron are elevated in MW-29S and MW-30S. Total cyanide concentrations were slightly elevated in groundwater sampled from 22-85-S. Groundwater quality from wells 20-85-S, 21-85-S and 23-85-S is comparable to background conditions.

Analytical results from deep monitoring wells (MW-12D, MW-13D, MW-15D, 21-85-D, 22-85-D, and 23-85-D) are consistent with Phase I results and show no apparent geographical trends. Groundwater sampled from wells MW-12D and MW-13D exhibits slightly elevated concentrations, relative to background, of total and amenable cyanide, sodium, sulfate, and magnesium, but these levels are lower than in corresponding shallow wells.

With the exception of an anomalous round in February 1989, groundwater quality in MW-15D is comparable to background conditions. MW-15D was analyzed for TCL volatiles in October 1989. Methylene chloride was detected at a concentration of 6 ppb; no other parameters were detected.

Well 21-85-D exhibits slightly elevated concentrations of aluminum and iron. Groundwater sampled from 21-85-D was analyzed for TCL volatiles and semi-volatiles in October 1989. Methylene chloride (7 ppb), 2-hexanone (10 ppb), and carbon disulfide (3 ppb) were detected. There is no history of use of these compounds at the Reynolds plant, and they are common laboratory solvents. No other parameters were detected.

Groundwater quality in wells 22-85-D and 23-85-D is comparable to background conditions.

4.2.4 SOIL

Four soil borings were advanced in the area off of the southwest corner of the Black Mud Pond during fieldwork conducted as part of WPA 2 (Plate 1). A small lens of black fine sand was discovered from 4.5 to 6.5 feet below grade in boring BMPB-6 and sampled (BMPB-6-4-6). The boring location is approximately 50 feet north and 70 feet east of the corner of the fence around the pond. The sample was analyzed for the site indicator parameters and PAHs. Complete results are presented in Appendix F. The sample contained levels of aluminum (86,000 ppm), fluoride (12,000 ppm), PCBs (Arochlor 1248) (21 ppm), phenols (0.9 ppm), sodium (17,000 ppm), and sulfate (130 ppm) that exceed background. In addition, the following PAH compounds were detected: benzo(a)pyrene (6.7 ppm), benzo(b)fluoranthene (9.1 ppm), benzo(g,h,i)perylene (7.9 ppm), benzo(k)fluoranthene (4.3 ppm), chrysene (4.4 ppm), fluoranthene (4.7 ppm), ideno(1,2,3-cd)pyrene (7.1 ppm), and pyrene (4.0 ppm). The areal distribution of the material is estimated not to exceed 2400 ft^2 with an approximate maximum volume 4800 ft^3 or 178 cubic yards.

4.2.5 SURFACE WATER/SEDIMENT

Two surface water (BMPDW-1 and BMPDW-2) and sediment (BMPDS-1 and BMPDS-2) samples were collected from the drainage pathway located in the area south of the Black Mud Pond to characterize run-off (Figure 2). Analytical results from locations 1 and 2 indicate that both the surface water and sediment contain elevated levels of aluminum, fluoride, magnesium, sodium, and sulfate relative to background (Tables 4-5 and 4-6). BMPDW-2 contained 0.35 ppb PCBs. BMPDS-1 and BMPDS-2 contain PCBs at concentrations of 10 and 24 ppm, respectively.

One additional surface water sample and sediment sample was collected further downstream in this southern drainage pathway (BMPDW-3 and BMPDS-3). Analytical results are included in Tables 4-5 and 4-6. The samples are indicative of additional drainage originating at the southwest corner of the plant and the Landfill Area, and are therefore discussed in Section 4.3.

4.2.6 AIR

A total of 15 high-volume samples (filters) of air in the vicinity of the Black Mud Pond were collected and analyzed. Nine of the selected filters were collected between June 17 and 20, 1989 when prevailing wind directions indicated that the sample results would be least affected by plant stack emissions. A complete discussion of sampling methods and presentation of results is in Appendix C.

Concentrations detected from filters unaffected by plant stack emissions ranged from 6×10^{-6} mg/m^3 to 3×10^{-5} mg/m^3 for fluoride, from below the laboratory detection limit to 3.13×10^{-3} mg/m^3 for cyanide; from 7×10^{-5} mg/m^3 to 2.05×10^{-3} mg/^{3} for aluminum; from below the detection limit to 1.5×10^{-5} mg/m^3 for chromium; and from below detection limit to 1.1×10^{-4} mg/m^3 for nickel. These results should be indicative of airborne contamination originating from the Black Mud Pond. The concentrations measured are well below the AAL and factored TLV values which are or could be applicable. In addition, these analytical results are below OSHA permissible exposure limits (PELs) and 8-hour time-weighted averages (TWAs). Therefore, airborne contamination originating from the Black Mud Pond during the sampling period was minimal.

4.3 SOLID WASTE LANDFILL AND FORMER POTLINER STORAGE AREA

4.3.1 RESULTS OF THE PHASE I RI

The Phase I RI concluded that the prime contaminants in the vicinity of the Landfill and Former Potliner Storage Area, as indicated by leachate, groundwater and run-off samples, are cyanide, fluoride, sulfate, sodium and aluminum. Although there is variability present, the concentrations of these potliner-related contaminants are generally in the same ranges in groundwater at the Landfill as in groundwater at the Former Potliner Storage Area. These trends, combined with a similarity of water quality between MW-6S and wells along the berm, indicated that the Landfill and Former Potliner Storage Area can be thought of as one related source area, with similar chemistry and with contaminated groundwater from both areas discharging to the wetlands.

The discharge of contaminated groundwater to the wetlands from the Landfill and the Former Potliner Storage Area was implied by the hydrology (groundwater flow directions) and presence of similar contaminants (primarily cyanide, fluoride, sodium, sulfate, aluminum) in all three areas. Presumably, this transport of contaminants occurred throughout the operational life of the Landfill and Former Potliner Storage Area. Prior to the construction of the berm on both sides and the underdrain on the Landfill side, leachate discharged directly to the wetlands. The berm, constructed in 1984, may have impeded, but not stopped, flow from either area; neither, apparently, has the underdrain system on the Landfill side. The Phase I RI also concluded that materials comprising the berm impose additional contaminants into this flow path.

4.3.2 WASTE CHARACTERIZATION

Borings were completed in the Landfill, Former Potliner Storage Area and Landfill berm for waste characterization. Analytical results for indicator parameters are presented in Table 4-7. Cross-sections derived from the borings, with sampling depths indicated, are presented in Figures 27 and 28.

Waste materials in the Landfill are black to brown, fine to coarse sand and gravel with variable amounts of wood, paper, plastic, metal, brick, concrete, rubber and occasionally, a white fibrous material. Former Potliner Storage Area waste consists of black or brown to gray, silty coarse sand, gravel, occasional cobbles, and variable amounts of crushed stone and carbon fragments.

External and internal cover lifts, which are placed on the waste daily, are of variable thickness, discontinuous, and of a sandy silt to coarse sand size range. Waste in both areas overlies gray to brown silty glacio-lacustrine clay or till.

Waste samples collected from the borings advanced in the Landfill exhibit elevated concentrations of all of the indicator parameters. PCB concentrations, largely Arochlor 1248, range from 0.39 ppm in the 8 to 10-foot interval of LFB-3 to 690 ppm in the 8 to 10-foot interval of LFB-1. A composite sample was collected from both LFB-2 (LFB-2C) and LFB-4 (LFB-4C). The composite samples were analyzed for TCL volatile and semi-volatile compounds. Analytical results are presented in Table 4-8. Elevated concentrations of a suite of base/neutral compounds were detected in both borings including anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzofuran, fluoranthene, and pyrene. Trace levels of some volatile organic compounds were detected in both samples. At least some of the volatile organic compounds detected may be due to laboratory contamination.

Samples collected from the borings advanced in the Former Potliner Storage Area exhibit elevated concentrations of all of the indicator parameters with the notable exception of PCBs and recoverable phenols. PCB concentrations range from less than .09 ppm in the 6 to 8-foot interval of FPSAB-2, to 1.6 ppm in the 2 to 4-foot interval of FPSAB-1.

One sample (LFBB1-14-16) was collected for analysis from the 14 to 16-foot interval of boring LFBB-1, advanced on the Landfill berm. The sample was taken from the black sand unit and analyzed for indicator parameters and PAH compounds. Results are presented in Tables 4-7 and 4-8. The sample exhibits elevated concentrations of all indicator parameters. Elevated concentrations of the base/neutral compounds anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, phenanthrene and pyrene were detected.

The samples collected suggest that the majority of the indicator parameters have maximum concentrations in the central and southern portions of the Landfill, including the berm. The highly variable concentrations of many parameters indicate a contamination source that is quantitatively heterogenous. However, the presence of similar contaminants at all soil boring locations indicates that the Landfill and Former Potliner Storage Area should be regarded as a single contamination source. With the exception of PCBs, the contaminants detected are characteristic of potliner-related materials. In all likelihood, based on its physical appearance and on analytical results, the black sand unit in the berm represents spent potliner-related material.

One soil sample was collected from the Landfill Road (LFRS-1). PCBs were detected in the sample at a concentration of 1.1 ppm.

4.3.3 GROUNDWATER

Ten groundwater monitoring wells have been sampled in the vicinity of the Landfill and Potliner Storage Area in order to characterize groundwater quality. Wells MW-4S, MW-5S, MW-5D, MW-6S, MW-7S, MW-7D, MW-8S, MW-9S and MW-10S have been sampled as part of routine quarterly sampling. Well TB-6 was sampled in October as part of the complete round for the site. Well locations are indicated on Plate 1. All of the samples collected were analyzed for the indicator parameters. During the October sampling round, monitoring wells MW-5S and MW-8S were analyzed for TCL volatile and semi-volatile compounds as well as the indicator parameters. Concentration ranges are presented in Table 4-9.

While contaminant concentrations in groundwater from different wells vary spatially, distributions for each parameter show little variation over time. The small variations that are observed in individual well concentrations and spatial distribution are apparently not seasonal. There is no discernable overall trend, i.e., parameter concentrations are not tending to either increase or decrease over time. Elevated concentrations of contaminants are present in both areas, confirming the Phase I conclusion that the two areas should be regarded as a single contamination source. Elevated PCB and recoverable phenol concentrations are consistently associated with wells MW-7S and MW-8S in the southwest corner of the Landfill. Cyanide consistently has its highest concentrations in wells MW-6S and MW-5S, near the Former Potliner Storage Area. In general, the highest concentrations of other contaminants tend to occur in MW-5S and MW-8S.

The presence of relatively lower, but still elevated, parameter concentrations in MW-9S and MW-4S, indicate that lateral migration is occurring on the flanks of the Landfill and Former Potliner Storage Area. Analytical results for MW-7S and MW-8S, located downgradient of the Landfill underdrain, confirm the Phase I RI conclusion that the drain does not divert all contaminants migrating towards the wetlands. A discussion of analytical results from individual shallow and deep monitoring wells is presented in the following paragraphs.

Sample results derived from the shallow monitoring wells (MW-4S, MW-5S, MW-6S, MW-7S, MW-8S and MW-9S) are consistent with Phase I results. Monitoring well MW-4S exhibits elevated concentrations, relative to background, of cobalt, total and amenable cyanide, sodium, vanadium and fluoride. PCBs were detected at a concentration of .07 ppb in February 1989, but were not detected during any other sampling events.

Groundwater sampled from MW-5S exhibits elevated concentrations of aluminum, cobalt, total and amenable cyanide, iron, sodium, fluoride, recoverable phenols and vanadium. PCBs were detected at a concentration of .07 ppb in February 1989; PCBs were not detected during any other sampling events. The TCL analysis performed on the October 1989 sample collected from MW-5S detected methylene chloride (6 ppb), bis(2-ethylhexyl) phthalate (890 ppb) and diethyl phthalate (15 ppb). No other TCL parameters were found.

Concentrations of cobalt, total and amenable cyanide, sodium, fluoride, recoverable phenols and vanadium are elevated in groundwater sampled from MW-6S. PCBs were not detected.

MW-7S exhibited elevated concentrations of aluminum, total and amenable cyanide, iron, sodium, fluoride, recoverable phenols, sulfate and vanadium. PCBs have ranged in concentration from less than .05 to .91 ppb.

Elevated concentrations of aluminum, beryllium, cobalt, total and amenable cyanide, iron, sodium, fluoride, recoverable phenols, sulfate, vanadium and PCBs have been detected in MW-8S. PCB concentrations have ranged from 2.6 to 13.3 ppb. Groundwater collected at MW-8S exhibited concentrations of benzene (3 ppb), ethylbenzene (31 ppb), methylene chloride (2 ppb), toluene (6 ppb) total xylenes (20 ppb), 2,4-dimethyl-phenol (6 ppb) and fluorene (4 ppb). No other TCL parameters were detected.

MW-9S exhibits elevated concentrations of total and amenable cyanide, sodium and fluoride. PCBs were not detected in MW-9S.

Sample results from deep monitoring wells (MW-5D and MW-7D) are consistent with Phase 1 results. The deep wells exhibit inconsistent and sporadic contaminant levels with no apparent trends; contaminants reported in these wells may be a result of drilling artifacts. Indicator parameter concentrations in MW-5D are generally comparable to background conditions. PCBs were detected at concentrations of 0.09 ppb and 0.14 ppb during the February and April 1989 sampling rounds, respectively. PCBs were not detected in groundwater sampled from MW-5D during all other sampling events.

Indicator parameter concentrations in MW-7D are consistently in the range of background conditions.

4.3.4 SURFACE WATER/SEDIMENT

One surface water and 11 sediment/waste samples were collected from the Landfill and Former Potliner Storage Area in August 1988. The surface water sample (WPU-RE-2) and 3 sediment samples (WPU-RE-1A, B, C) were obtained from the Landfill Surface Water Collection Tank. The remaining 8 sediment/waste samples (WPU-RE-17 through WPU-RE-24) were obtained from small intermittent drainage pathways within the Former Potliner Storage Area (Figure 28). The water sample was analyzed for priority pollutants and cyanide. Sediment/waste samples were analyzed for PCBs only. Complete analytical results are presented in Appendix F, PCB results are plotted on Figure 29.

PCB concentrations in the 3 sediment samples collected in the tank ranged from 17 to 99 ppm. PCB concentrations in the remaining 8 sediment/waste samples ranged from 3 to 100 ppm. The only organic compounds detected in the water sample were PCBs (1.7 ppb), bis(2-ethylhexyl) phthalate (17 ppb) and chrysene (19 ppb).

One surface water and 1 sediment sample (BMPDS-3) was collected from the small drainage pathway located west of the Landfill (BMPDW-3) as part of WPA 2. This location is downstream from a small leachate seep which is present in the northwest corner of the Landfill. Both samples were analyzed for site indicator parameters. PCBs were detected at concentrations of 24 ppm in sediment and 0.47 ppb in water. Complete analytical results are presented in Tables 4-5 and 4-6 and Appendix F.

4.3.5 LEACHATE

Analytical results for a leachate sample collected from the Landfill sump in April 1989 are presented in Appendix F. The sample was analyzed for indicator parameters. Elevated concentrations of aluminum, cobalt, iron, sodium, vanadium, total cyanide, fluoride, sulfate, recoverable phenols and PCBs (3.4 ppb) were detected. All of these contaminants are known to be present in the Landfill waste.

4.4 NORTH YARD

4.4.1 RESULTS OF THE PHASE I RI

The Phase I RI Report concluded that groundwater contamination in the North Yard is minimal, as indicated by analytical results from MW-1S and MW-2S. PCBs were not detected in samples collected from these wells.

A discussion of PCB soil contamination in the North Yard was the subject of the "PCB Soil Sampling Program, Phases 1, 2, 3, and 4" (October 12, 1988), which became part of the Phase I RI Report by reference in correspondence from D. Sweredowski (NYSDEC) to D. DeLisle (RMC) dated May 10, 1989. The information in that report is summarized and integrated with new data in the discussion below.

4.4.2 HEAT TRANSFER MEDIUM SYSTEM

The Heat Transfer Medium (HTM) System and associated piping is believed to have been the major source of PCB, PCDF and PCDD contamination in the North Yard. Three samples of oil have been collected from the HTM System. Two were analyzed for PCBs as reported in the PCB Source Assessment Report, Period 3 (September 12, 1989). PCBs were not detected in the samples. The second sample was analyzed for PCDFs and PCDDs as reported in the PCDF/PCDD Sampling Report (January 10, 1989). PCDDs were not detected and PCDFs were present at low concentrations.

4.4.3 GROUNDWATER

Additional investigations in the North Yard, as specified in WPA 3, were undertaken to better define groundwater movement and to confirm the presence or absence of PCBs in groundwater. This included installation and sampling of 4 additional monitoring wells, MW-16S through MW-19S (Figure 3).

All North Yard monitoring wells were sampled in October 1989 and January 1990. The samples were analyzed for site indicator parameters. Analytical results are presented in Table 4-10 and in Appendix F. PCBs and recoverable phenols were not detected in any of the groundwater samples collected from the North Yard monitoring wells. Fluoride in groundwater sampled from MW-1S was detected in concentrations above background conditions. Monitoring well MW-2S exhibited elevated concentrations, relative to background, for aluminum, arsenic, fluoride, iron, sodium and vanadium. Groundwater sampled from MW-16S, screened in the main North Yard utility trench, contains elevated concentrations of aluminum, fluoride, iron, and vanadium. Samples from MW-18S, also screened in the utility trench, exhibit elevated concentrations of total cyanide, fluoride, and sulfate relative to background.

4.4.4 SOIL

Approximately 400 soil samples have been collected in the North Yard during 4 phases of PCB soil sampling and 2 phases of polychlorinated dibenzofuran and dibenzo-p-dioxin (PCDF/PCDD) sampling. Detailed descriptions of the analytical results obtained from the samples have been presented in the PCB Soil Sampling Program Report, Phases 1, 2, 3, and 4 (October 12, 1988), the PCDF/PCDD Sampling Report (January 10, 1989) and the Phase II PCDF/PCDD Sampling Report (November 6, 1989).

Additional soil sampling was conducted in the North Yard, as specified in WPA 3, to define the vertical distribution of PCB contamination. Twenty-seven soil samples were taken during the advancement of borings NYB-1, NYB-2, NYB-3, MW-16S, MW-17S, MW-18S and MW-19S. Boring locations are indicated on Figure 3. Analytical results are presented in Table 4-11 and Appendix F.

Samples collected during boring advancement from 0 to 2 feet below the ground surface exhibit PCB concentrations ranging from 21 to 430 ppm. The distribution is consistent with the distribution revealed during Phases 1 through 4 of the PCB investigation. PCBs were detected in soil samples collected from the 2 to 4-foot interval in borings NYB-1 (3.3 ppm), NYB-3 (19 ppm) and MW-19S (30 ppm). PCBs were detected in the 4 to 6-foot interval of NYB-1 (5.9 ppm), MW-17S (0.42 ppm) and MW-19S (1.7 ppm). PCBs were not detected in all other samples collected including the 5 to 7-foot interval of NYB-2, the 20 to 22, 22 to 24, 24 to 26, and 26 to 28-foot intervals of MW-16S, the 6 to 8, 10 to 12, and 12 to 14-foot intervals of MW-17S, the 20 to 22, and 24 to 26-foot intervals of MW-18S and the 8 to 10 and 10 to 12-foot intervals of MW-19S. A comparison of PCB concentrations to soil lithology indicates that, with the exception of samples collected immediately below the contact between fill materials and the underlying glacial till (2 to 4-foot interval of NYB-3, 4 to 6-foot intervals of NYB-1, MW-17S and MW-19S), PCBs were not detected in the till. A generalized North Yard surface PCB concentration map is presented as Figure 30.

4.4.5 SUBSURFACE UTILITIES

Four aqueous samples were collected from French drains in the North Yard. The French drains entering catchbasin CB70 from the east and west were sampled (FDCB70E, FDCB70W). The western French drain lines entering catchbasins CB67 and CB69 were sampled and labeled FDCB67W and FDCB69W. Catchbasin locations are shown on Figure 3. The samples were analyzed for PCBs.

PCB concentrations range from 1 ppb in FDCB67W to 150 ppb in FDCB70W. Samples FDCB70E and FDCB69W exhibit concentrations of 93 and 94 ppb, respectively. The concentrations appear to reflect corresponding surface soil PCB concentrations. For example, FDCB67W collects stormwater infiltration from an area with relatively low surface soil PCB concentrations. In contrast, FDCB70W collects stormwater from an area of relatively high surface soil PCB concentrations.

4.5 POTLINER PAD AREA

4.5.1 RESULTS OF THE PHASE I RI

Data collected from monitoring well MW-3S, installed downgradient of the Potliner Pad, was used in Phase I to evaluate groundwater quality in the area. Historically, groundwater has contained elevated levels of cyanide, fluoride, sulfate, iron, and magnesium when compared to background. There were no priority pollutant volatile or semi-volatile compounds detected.

One pair of surface water and sediment samples were collected from the drainage pathway north of the Potliner Pad. The surface water sample (SW-1) revealed elevated levels of fluoride and cyanide. There were no PCBs detected. The sediment sample (SS-1) contained .27 ppm of Arochlor 1248.

4.5.2 GROUNDWATER

The installation of three new monitoring wells (MW-26S, MW-27S, and MW-28S) has enabled improved characterization of groundwater quality in the vicinity of the Potliner Pad and Crusher Building (Plate 1). All of the wells were sampled in October 1989 and analyzed for indicator parameters. In addition, the sample from MW-3S was analyzed for TCL volatile and semi-volatile compounds. Monitoring wells MW-26S, MW-27S, and MW-28S were sampled again in January 1990. The samples were analyzed for indicator parameters only.

Table 4-12 summarizes indicator parameter analytical results from October 1989 and January 1990. Elevated levels of aluminum, iron, sodium, cyanide, fluoride, and sulfate are common to these wells.

Monitoring well MW-26S contains concentrations of indicator parameters that slightly exceed background concentrations. Conversely, MW-28S reveals cyanide (52.6 ppm), sodium (3040 ppm), and fluoride (346 ppm) at concentrations several orders of magnitude greater than background levels. Monitoring well MW-27S contains elevated concentrations of aluminum, iron, and magnesium. Arsenic, beryllium, and vanadium were detected only in MW-27S. A comparison of sample results versus time in MW-3S indicates slightly increasing concentrations of aluminum, cyanide, fluoride, magnesium, and sulfate. PCBs were detected in MW-26S (0.1 ppb) during the January 1990 sampling round.

4.5.3 SURFACE WATER/SEDIMENT

Three surface water and sediment samples were collected from the drainage pathway located west and north of the potliner pad (Figure 5). Two locations were upstream and one downstream of the Phase I SW-1/SS-1 sample location. The samples were analyzed for the site indicator parameters. Sample results are presented in Appendix F.

The surface water samples (TSDW-1, TSDW-2, and TSDW-3) contained slightly elevated levels of cyanide, fluoride, PCBs (Arochlor 1248), sodium, and sulfate. Sample TSDW-3 also had elevated levels of aluminum (2300 ppb) and manganese (126 ppb) when compared to the other 2 samples. The highest levels of cyanide (60 ppb), fluoride (19 ppm), and PCBs (0.14 ppb) were detected at TSDW-3, the sample location furthest downstream. The highest levels of sodium (210 ppm) and sulfate (360 ppb) were found in TSDW-1. A summary of surface water sample results is presented in Table 4-13.

The three sediment samples (TSDS-1, TSDS-2, and TSDS-3) contained elevated levels of similar parameters, namely aluminum, cyanide, fluoride, PCBs (Arochlor 1248), sodium, and sulfate (Table 4-14). Some of the concentrations that exceed background soil levels were found in TSDS-2 and include aluminum (72,000 ppm), arsenic (46 ppm), and fluoride (2700 ppm). The highest level of PCBs (6.6 ppm) was found in sample TSDS-3.

4.6 RECTIFIER YARD

4.6.1 RESULTS OF THE PHASE I RI

As noted in the Phase I Remedial Investigation Report, two soil samples (TY-1 and TY-2) were collected from within the Rectifier Yard. The samples were analyzed for PCBs only. Sample TY-2 exhibited detectable levels of Arochlor-1242 (0.62 ppm) and Arochlor-1260 (0.15 ppm). PCBs were not detected at the TY-1 sample location.

4.6.2 SOIL

Six surface soil samples were collected from the eastern portion of the yard as part of work conducted subsequent to Phase I (Figure 6). The samples were analyzed for PCBs only. Detectable levels of PCBs were found in 5 of the 6 samples (Table 4-15). Concentrations ranged from 2.2 ppm (RCYD3/0) to 7.1 ppm (RCYD7/0). Arochlors 1248 and 1260 were detected in sample RCYD1/0 while all other samples contained only Arochlor 1260.

4.6.3 SEDIMENT

Two surface sediment samples were collected from the drainage pathway south of the Rectifier Yard in August 1988 (Figure 7). Arochlor 1248 was detected in RCYD5/0 at a concentration of 17 ppm. Arochlor 1260 was detected in RCYD6/0 at a concentration of 590 ppm. Sample RCYD6/0 was collected just downstream of the junction of the stormwater drainage from the eastern portion of the Rectifier Yard with the drainage pathway.

Additional samples were collected from the drainageway in June 1989. Twelve sediment samples were collected from locations spaced along the length of the drainageway (including one duplicate). Arochlors 1248 and 1260 were detected in sample SHDS-1 at a total concentration of 1.4 ppm. The remaining surface sediment samples were collected downstream from SHDS-1. Arochlor 1260 was detected in concentrations ranging from 260 ppm in the furthest downstream sample (RCYD14/0) to 2300 ppm in sample RCYD9/0. Two samples were taken at 1-foot depth intervals at locations RCYD9/1 and RCYD12/1, Arochlor 1260 was detected at concentrations of 3200 ppm and 13 ppm, respectively. Sample results are summarized in Table 4-15.

4.7 WETLANDS

4.7.1 RESULTS OF THE PHASE I RI

The discharge of contaminated groundwater to the wetlands from the Former Potliner Storage Area and the Landfill was implied by the hydrology (groundwater flow directions) and presence of similar contaminants (primarily cyanides, fluorides, sodium, sulfates, aluminum) in all three areas. The Phase I RI concluded that this transport of contaminants has occurred throughout the operational life of the Landfill and Former Potliner Storage Area, additionally, that materials comprising the berm are introducing contaminants to the wetlands.

Prior to the construction of the berm on both sides and the underdrain on the Landfill side, leachate discharged directly to the wetlands. The berm, constructed in 1984, may have impeded, but not stopped, flow from either area; neither, apparently, has the underdrain system on the Landfill side. Also, the Phase I RI concluded that materials within a portion of the berm introduce additional contaminants into this flow path.

4.7.2 GROUNDWATER

The wetlands area is an area of groundwater discharge (Section 3.1). Therefore, groundwater should not be affected by surface water and surficial sediment contamination within the wetlands. Shallow groundwater at the Landfill, contaminated by leachate, discharges directly as surface water in the wetlands. Deeper groundwater, not contaminated in the Landfill Area, has an upward flow path to the wetlands through the underlying soils and sediments. These conditions, and the absence of vertical infiltration from above, indicate that contamination of groundwater underlying the wetlands is not of concern. This is confirmed by monitoring well TB-6, located about 500 feet south of MW-7S, which sampled in October 1989. Analytical results in TB-6 are comparable to those of MW-10S, the Landfill background well, for the same period.

4.7.3 SURFACE WATER/SEDIMENT

Sixteen surface water samples were collected in the wetlands as part of WPA 1. Sample locations are presented on Figure 8. Analytical results for indicator parameters are presented in Table 4-16 and Appendix F. All the samples exhibit elevated concentrations, relative to background, for sodium, fluoride, and sulfate. With the exception of sample EDW-2, concentrations of PCBs were above background in all samples. Concentration distributions for fluoride (Figure 31) and PCBs (Figure 32) are typical for most of the contaminants, with highest concentrations occurring adjacent to the Landfill. Concentrations in general, decrease away from the Landfill and along the 2 stream courses leaving the wetlands. Levels of PAH compounds in the 8 surface water samples tested were below detection.

Two surface water samples (RE-13, RE-14) were collected from the wetlands as splits with NYSDEC during August 1988. Analytical results are presented in Appendix F. PCBs were detected at concentrations (1.1 ppb and 2.6 ppb) above background conditions. Chrysene (19 ppb) and bis(2-ethylhexyl)phthalate (17 ppb) were detected in RE-14.

Sixteen sediment samples were collected, in conjunction with the 16 surface water samples, as part of WPA 1 (Figure 8). Analytical indicator parameters and results are presented in Table 4-17 and Appendix F. Elevated concentrations, relative to background, of sodium, fluoride, cyanide, and arsenic were detected in the majority of the samples. With the exception of EDS-2 and WCAS-1 (background), PCBs were detected in all samples (Figure 33). PCB concentrations range from .27 ppm in WS-11 to 19 ppm in WS-13. Arochlors 1248 and 1260 were detected. In general, contaminant concentrations decrease away from the Landfill and Former Potliner Storage Area, although the higher PCB concentrations were detected in the eastern portion of the area sampled.

Eight of the 16 sediment samples were also analyzed for PAH compounds. PAHs were not detected at 5 of the locations including the wetlands control area. Benzo(b+k)fluoranthene was detected in two samples, WS-9 and WS-13 located near the Landfill, at total concentrations of 19 ppm and 8.9 ppm, respectively. Chrysene was detected in sample WS-9 (1.1 ppm) and in sample EDS-1 (8.4 ppb).

An ion-specific electrode (fluoride) and a pH meter were used in an evaluation of the depth of contamination in wetland sediment. Samples were taken from 3 zones at 14 locations (Section 2.7). Results are presented in Appendix F. Fluoride concentrations decrease dramatically with depth.

4.7.4 WETLANDS ECOLOGY

A complete discussion of the wetlands ecosystem is presented in Appendix D. Appendix D reviews the impact of contamination in the wetlands on the ecosystem.

4.8 OTHER AREAS OF INTEREST

4.8.1 OUTFALL 002

Sediment samples were collected from the bed of the 002 drainage ditch for PCB analysis after the diversion of water from the ditch. Sample designations are 002SB1 through 002SB14. Sample locations and analytical results are shown on Figure 11. Oil staining was apparent in most of the samples collected south of the railroad tracks. Samples collected north of the tracks were rich in clay; it is apparent that the 002 ditch cuts into glacial till north of the tracks and that this is an area of little sediment accumulation. The sediment samples were analyzed for PCBs. Arochlors 1242, 1248 and 1260 were detected. Total PCB concentrations range from 18 to 280 ppm in samples collected south of the railroad tracks. PCBs were not detected in 3 of the 4 samples collected north of the tracks. The fourth sample, 002SB13, PCBs were reported at a concentration of 1.6 ppm. This is consistent with the fact that the ditch north of the railroad tracks is an area of erosion, not deposition, due to the 30-foot drop in elevation of the ditch from the tracks to the river. In contrast, the drop in elevation between samples collected south of the tracks is 3 feet, indicating an environment conducive to deposition of particulates.

Seven surface soil/sediment samples were collected at 6 locations in the vicinity of stormwater catchbasins CB85 and CB002S1A. The two catchbasins are located between the West Casthouse and the Metal Storage Building (Figure 12). Sample CB85-1 and CB85-DUP were collected 13 feet north of CB85. PCBs were detected at concentrations of 2.5 and 1.8 ppm, respectively. Sample CB85-2 (0.55 ppm total PCBs) was collected 10 feet east of CB85. CB85-3 (2.9 ppm total PCBs) was collected 13 feet south of CB85. Sample CB002S1A-1 (0.64 ppm total PCBs) was collected 17 feet northwest of CB002S1A. Samples CB002S1A-2 (0.17 ppm total PCBs) and CB002S1A-3 (less than 0.09 ppm total PCBs) were collected 24 feet east and 15 feet south of CB002S1A-2, respectively. Sample locations are illustrated on Figure 12.

One aqueous sample, FDCB85, was collected from the French drain system which enters CB85 following a rainfall event. The system is under railroad tracks within the West Casthouse. The French drain system is generally dry except during high rainfall events. PCBs were detected in the sample at a concentration of 0.8 ppb.

One soil sample (002005) was collected in the visibly oil-stained area next to the former Outfall 002 weir. PCBs were detected in the sample at a concentration of 8.4 ppm.

4.8.2 002 DIVERSION AREA

Soil samples were collected in a grid pattern over the area which includes the diverted Outfall 002. Sample locations and results are presented in Figure 13.

A total of 125 soil samples were analyzed for PCBs. PCBs were not detected, or were detected at a concentration less than 5 ppm, in 117 of the 125 samples. Five samples contained PCBs at concentrations between 5 and 10 ppm, 3 contained concentrations greater than 10 ppm (11, 13 and 74 ppm).

4.8.3 GM FILL AREA

Three locations have been identified on the Reynolds property where General Motors (GM) deposited fill materials from their facility. Sediments were sampled in run-off areas and drainageways in order to evaluate the possibility of PCB contamination in the fill areas. Sample locations and analytical results are presented on Figures 14 and 15. PCBs were not detected in 9 of the 12 samples collected. PCBs were detected in the remaining 3 samples (GMF6/0, GMF3/0, and GMF8/0) at concentrations of 1.5 ppm, 1.6 ppm, and 4.3 ppm, respectively.

4.8.4 004 DRAINAGE DITCH

PCBs were detected in 004 drainage ditch sediments during the PCB soil sampling program (PCB Soil Sampling Program, October 12, 1988). Sample locations and PCB concentrations are presented in Figure 9. Remedial action began in 1988 and was completed in 1989. The remedial action is discussed in Section 6 of this report, Interim Remedial Measures.

Three surface sediment samples, (east of where 004 passes under South Grasse River Road). ECB005-1, ECB004-2, and ECB004-3 were collected south of the road at distances of 120, 80 and 40 feet east of 004. Total PCB concentrations range from 0.95 ppm in ECB004-1 to 2.8 ppm in ECB004-2. PCBs were detected in ECB004-3 at a concentration of 2.4 ppm. Standing or flowing water was not present.

4.8.5 AREA NORTH OF SOUTH GRASSE RIVER ROAD

Eight soil samples were collected at 7 locations north of South Grasse River Road near Outfall 004 and analyzed for PCBs. Sample designations are NSGRR-1 through NSGRR-8. Sample NSGRR-8 is a duplicate of NSGRR-7. Sample locations and analytical results are presented in Figure 10. Arochlors 1248 and 1260 were detected. Total PCB concentrations ranged from 4.2 ppm to 830 ppm. The 004 ditch is located directly across the road from this area. Additional work is planned to delineate the extent of contamination in this area.

4.8.6 SEWAGE SLUDGE DRYING BEDS

PCBs were detected in drying bed sewage sludge in samples collected as part of the PCB source assessment (PCB Source Identification Assessment, February 20, 1989). Two additional samples (NP-34 and NP-35) were collected during the PCDF/PCDD investigation (Phase II PCDF/PCDD Investigation Report, November 6, 1989). PCB concentrations of 4100 ppm (NP-34) and 4600 ppm (NP-35) were recorded. The same 2 samples exhibited relatively low concentrations of PCDF (10.9 and 12.4 ppb, respectively). PCDDs were not detected in either sample.

One soil sample (SDBS-1) was collected adjacent to the sludge drying beds near the sewage treatment plant. PCBs were detected in the sample at a concentration of 1.7 ppm.

5.0 SUMMARY AND CONCLUSIONS

This report presents data generated subsequent to the Phase I RI Report. Note that this report is intended as a characterization of site conditions only. The Risk Analysis Report evaluates the significance of these conditions by comparison to promulgated standards and criteria and other non-regulatory policies and decisions which have been documented at site with similar conditions. The paragraphs below present a summary and conclusions for the contamination characterization with an identification of contaminants of concern, an identification of source areas, and a discussion of contaminant transport mechanisms.

5.1 BLACK MUD POND

5.1.1 CONTAMINANTS OF CONCERN

The contents of the pond (black mud and liquor) are characterized by concentrations of cyanide, fluoride, magnesium, sodium, sulfate, aluminum, PAHs and PCBs.

With the exception of PAHs, these contaminants have been detected in both the groundwater and surface water near the pond.

5.1.2 SOURCES OF CONTAMINATION

The Black Mud Pond is the source of groundwater contamination in the area. Contamination is most evident in wells near the northwest corner of the pond.

Another possible source of groundwater contamination is a localized lens of contaminated fine black sand identified at about 4.5 to 6.5 feet below grade near the southwest corner of the pond. The source of this black material is unknown. The location of this contamination is presumed to be outside of the containment wall.

5.1.3 CONTAMINANT MIGRATION PATHWAYS

Shallow groundwater is a migration pathway for Black Mud Pond contaminants. Contaminants have not migrated far from the pond owing to the presence of the groundwater containment wall, the presence of a reverse gradient across the containment wall, and permeabilities averaging about 1×10^{-6} cm/sec in the saturated zone in the vicinity of the Black Mud Pond. Evidence that supports this includes:

- o Shallow groundwater contaminant levels have not increased with time.
- o Contaminant concentrations decrease with increasing distance from the pond.
- o The terrain conductivity survey conducted in the vicinity of the Black Mud Pond indicates that the only areas of higher conductivity are located adjacent to the pond. In fact, with minor exceptions, a comparison of the 1985 and 1989 surveys show that the conductance has dropped in the pond's vicinity.

Shallow groundwater may be discharging to drainageways to the south and east of the Black Mud Pond. The berm encircling the pond to the south and east was constructed with up to about 12 to 15 feet of fill (Figure 34). The higher permeability fill may be a preferred migration pathway for groundwater. Contaminated groundwater may have migrated laterally to the south and east above the fill/till interface and discharged into the drainageways. Therefore, shallow groundwater migrating from the pond may be responsible for contamination detected in surface water and sediment samples taken from the drainage to the south.

Deep groundwater is a limited migration pathway for contamination. Deep groundwater contamination associated with the Black Mud Pond has not migrated far from the pond due to the low permeability of the till. Most of the deep wells exhibit groundwater quality comparable to background conditions. However, contaminant concentrations in deep groundwater are increasing with time near the northwest corner of the pond.

Air sampling confirmed the results of the atmospheric modeling study performed as part of the Preliminary Risk Assessment. Airborne transport of contaminants from the pond are well below acceptable levels for human exposure.

5.2 SOLID WASTE LANDFILL AND FORMER POTLINER STORAGE AREA

5.2.1 CONTAMINANTS OF CONCERN

All site indicator parameters are present in elevated concentrations in Landfill/Former Potliner Storage Area waste and leachate. Elevated concentrations of some base neutral compounds including anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzofuran, fluoranthene, and pyrene, are present in Landfill waste.

Elevated concentrations of all site indicator parameters are present in groundwater in one or more of the monitoring wells in the area. PCBs are consistently present in groundwater sampled from MW-8S.

5.2.2 SOURCES OF CONTAMINATION

Most of the contamination in the Landfill and Former Potliner Storage Area is characteristic of potliner-related materials. The source of these contaminants is the former disposal of some potliner materials in the Landfill and residual potliner materials in the Former Potliner Storage Area. A portion of the berm of the Landfill is also a source of groundwater contamination and should be considered as part of the Landfill.

The source of PCB contamination in the Landfill may be sewage sludge. The sludge, prior to 1988, was disposed of in the Landfill. PCBs were detected in sewage sludge contained in the sludge drying beds as part of the PCB Source Assessment. The source of PCB contamination in the Former Potliner Storage Area is unknown.

5.2.3 CONTAMINATION MIGRATION PATHWAYS

Shallow groundwater flow is a migration pathway for contaminants from the Landfill and Former Potliner Storage Area. Shallow groundwater originating in the source area discharges directly to the adjacent wetlands. The Landfill underdrain is intercepting some, but not all, of the contaminated groundwater.

Vertical groundwater flow is not a pathway. The hydraulic gradient in the low permeability glacial till at depth is generally directed upwards.

Surface water is not a major migration pathway as it is collected as run-off and flows to the Landfill tank. However, a small leachate seep, present in the northwest corner of the Landfill, occasionally overflows the berm and drains to the small stream west of the Landfill. The stream leads to the adjoining wetland. Also, during high rainfall events, overflow of sediment clogged ditches leading to the collection tank may occur. The resulting run-off flows over the berm to the wetlands.

Air is not a significant transport pathway in the Landfill due to the placement of daily cover. No data are available concerning the potential for airborne transport of contaminants from the Former Potliner Storage Area.

5.3 NORTH YARD

5.3.1 CONTAMINANTS OF CONCERN

PCBs, PCDFs and PCDDs are distributed in North Yard surficial sediment; however, 2,3,7,8-TCDD has only been detected twice, and its distribution is limited to a small area of the North Yard. PCBs are also present in sediments within North Yard catchbasins which collect water from subsurface French drains.

North Yard groundwater contamination is characterized by local areas of elevated concentrations, relative to background, of aluminum, arsenic, cyanide, and fluoride. PCBs have not been detected in groundwater.

5.3.2 SOURCES OF CONTAMINATION

The similarity in spatial and vertical distributions of PCBs, PCDFs and PCDDs indicate a common origin for these contaminants in the North Yard. All three have their highest occurrence around the Pitch Pumphouse and Pipe Bridge, components of the HTM System. The HTM System was the source of the PCB, PCDF and PCDD contamination. The HTM System no longer uses PCB oils.

Aluminum, arsenic, cyanide and fluoride concentrations in groundwater are locally elevated relative to background. These parameters are characteristic of potliner material. Specific sources for this local contamination are not known. North Yard wells are located in the vicinity of a number of plant processes including the Cryolite Recovery Plant and the Carbon Paste Plant.

5.3.3 CONTAMINATION MIGRATION PATHWAYS

Groundwater flow is a migration pathway for some North Yard contaminants. The utility trenches act as preferential pathways for groundwater flow (Figure 18).

Groundwater in the underlying glacial till, due to the till's low permeability, is not a significant migration pathway.

The presence of PCB contaminated sediment in North Yard catchbasins and French drains indicate that stormwater run-off and infiltration is a migration pathway. Spreading of contaminated soils via wind, foot and vehicle traffic is also possible.

5.4 POTLINER PAD AREA

5.4.1 CONTAMINANTS OF CONCERN

The contamination detected in the groundwater in the vicinity of the Potliner Pad is indicative of potliner-related materials and is characterized by elevated levels of cyanide, fluoride, sodium, sulfate, and aluminum. Surface water and sediment area-specific indicator contaminants include those mentioned above and PCBs.

5.4.2 SOURCES OF CONTAMINATION

The Potliner Pad and Crusher Building Area was the source of the groundwater contamination in the vicinity of the Potliner Pad. Formerly, spent potliner was temporarily stored on the Potliner Pad prior to processing. Spent potliner is no longer stored in this area.

Fluoride and cyanide distribution patterns in the Potliner Pad Area generally reflect shallow groundwater flow patterns. Groundwater generally migrates to the northeast due to the sub-radial influence created by the Black Mud Pond. The highest concentrations of both fluoride and cyanide are present in MW-28S, located northeast and downgradient of the Potliner Pad.

The Potliner Pad and Crusher Building Area is also a source of contamination (fluoride and cyanide) in surface water and sediment. Some run-off from the Potliner Pad Area has apparently entered the drainage west of the Thickener System. Surface water and sediment sample results indicate elevated levels of fluoride, cyanide, and PCBs, with the highest levels of cyanide and PCBs in the most downstream sample location. The source of the PCBs is unknown.

5.4.3 CONTAMINATION MIGRATION PATHWAYS

It is evident that fluoride and cyanide contamination is migrating from the Potliner Pad Area via groundwater. The plume may follow a former stream bed which runs south-to-north about 40 to 60 feet east of the Potliner Pad (Figure 5). The stream was filled in during construction of the plant with approximately 10 - 12 feet of fill. The resulting zone of more permeable soil may serve as a preferred groundwater migration pathway. Figure 35 depicts a north-to-south trending cross-section through the Potliner Pad Area.

Surface water contamination originates from around the Potliner Pad as run-off. The run-off flows to the small drainage located west of the Thickener System which discharges to the St. Lawrence River.

Potliner is no longer stored on the Potliner Pad. Therefore, airborne transport of contaminants is not a significant migration pathway.

5.5 RECTIFIER YARD

5.5.1 CONTAMINANTS OF CONCERN

PCBs are the contaminants of concern associated with the Rectifier Yard. Soil samples taken from within the yard confirm the presence of PCBs. Sediment samples taken from within the drainageway receiving a portion of the stormwater run-off collected within the Rectifier Yard contains PCBs. The drainage flows to the wetlands.

5.5.2 SOURCES OF CONTAMINATION

The exact source of the PCBs within the Rectifier Yard is unknown. It may be related to past handling practices for wasted test PCB oils. There is no current source of contamination. The Rectifier Yard is the source of PCBs to the drainage leading to the wetlands.

Sediment sample SHDS-1, collected from a small, separate, drainageway near the weigh station southeast of the Rectifier Yard (Figure 6) also contained detectable levels of PCBs. The source of PCBs detected in this drainage is unknown.

5.5.3 CONTAMINANT MIGRATION PATHWAYS

PCB contamination in the Rectifier Yard is transported via surface water run-off. Stormwater run-off occurring within the Rectifier Yard is collected by a network of stormwater catchbasins and French drains which lead to 2 drainageways. The presence of PCBs in 1 of the 2 drainageways has been confirmed. The second drainage has not been sampled. These drainageways discharge to the wetlands.

5.6 WETLANDS

5.6.1 CONTAMINANTS OF CONCERN

Wetlands surface water samples contain PCBs, aluminum, cyanide, fluoride, sulfate, and sodium at concentrations above background. Other site indicator parameters are present at levels comparable to, or slightly above, background. These same contaminants are present at elevated levels in wetlands surficial sediments. PAH compounds chrysene and total benzo(b+k)fluoranthene have also been detected in wetland sediments.

5.6.2 SOURCES OF CONTAMINATION

The data suggests that the Landfill and Former Potliner Storage Area are the major sources of contamination to the wetlands. Substantiating evidence is summarized as follows:

- The suite of contaminants in sediment and surface water in the wetlands is similar to contaminants found in the waste materials, collected leachate and run-off, and groundwater in the Landfill and Former Potliner Storage Area.

- The presence of potliner-related contaminants within a portion of the Landfill berm and in associated groundwater indicates that this contamination is migrating to the wetlands.

- The presence of permeable materials in the berm and the hydraulic gradients within the Landfill, agree with shallow groundwater discharge from the Landfill to the wetlands.

- The distribution pattern of contaminants in the wetlands indicates that the Landfill and Former Potliner Storage Area comprise the source area. Transport mechanisms for contamination from the Landfill include historical and current groundwater discharges and historical (prior to berm construction) surface water discharge.

The drainageways leading from the Rectifier Yard, and the drainage west of the Landfill, may be additional sources of PCB contamination to the wetlands. Additional work, to be conducted in this area, is scheduled for 1990.

5.6.3 CONTAMINATION MIGRATION PATHWAYS

Since wetlands are a groundwater discharge area, contaminants are not leaving the wetlands via groundwater. Contaminants can migrate from the wetlands by two intermittent streams which flow to the Raquette River.

5.7 OTHER AREAS OF INTEREST

5.7.1 CONTAMINANTS OF CONCERN

Initial sampling conducted north of South Grasse River Road indicates PCB contamination in soil. PCB contaminated sediments are present in the former 002 ditch. A local area of PCB contaminated soils exists along the diverted 002 pipe trench. Additional areas of interest, including catchbasins and French drains located near the railroad tracks by the west casthouse will be addressed in the context of the continuing PCB Source Assessment.

5.7.2 SOURCES OF CONTAMINATION

The source of PCB contamination north of South Grasse River Road is unknown but is subject of an upcoming investigation.

The source of the majority of PCB contaminated sediments in the 002 ditch is apparently historical. The former 002 ditch is no longer the route of Outfall 002. Diversion of the outfall to a piped system occurred in November 1989. The source of the PCB contaminated soils in the 002 diversion area is unknown.

5.7.3 CONTAMINANT MIGRATION PATHWAYS

Stormwater run-off is a potential contaminant migration pathway for the area north of South Grasse River Road, the 002 ditch, and the local area along the 002 pipe trench. All of these areas will be subject to interim remedial measures in 1990, thus eliminating any potential migration pathways.

5.8 PLANT-WIDE VOLUME ESTIMATES

In accordance with Paragraph VI b. of the Consent Order, approximate volumes of contaminated soil and sediment were calculated for each of the areas of concern (Table 5-1). PCB contaminant levels were used exclusively to estimate the volumes. In areas of limited sampling data, WCC has made reasonable assumptions regarding the limits of contamination, based on topography, geology, our understanding of contaminant migration, and other factors. Table 5-1 presents a range of volume estimates associated with several concentrations, since remedial criteria for the site have not yet been established.

6.0 INTERIM REMEDIATIONS

This section of the report describes Interim Remedial Measures (IRMs) and discharge abatements that have been performed by RMC since the initiation of the RI. These IRMs have been undertaken by RMC to eliminate potential run-off areas and exposure points of contamination. Details of the scope of these IRMs, as well as data collected, are included in reports to NYSDEC previously submitted, which document the specific projects.

6.1 OUTFALL 004

Outfall 004 previously consisted of drainage from the 3 diked areas in the North Yard. Drainage from these areas previously flowed along a flat area north of the dikes before entering the ditch alongside South Grasse River Road, and then flowed easterly to a culvert crossing under the road and discharging into the St. Lawrence River. Two remedial measures have been taken relative to this outfall: 1) The use of the outfall, as an outlet from the 3 diked areas has been discontinued. Run-off and other waters collected in these diked areas is now pumped to the sanitary sewer system for treatment with discharge to Outfall 003. 2) The roadside ditch has been remediated by removing sediments to a depth of approximately one-foot along the entire length of the ditch and capping the underlying soils with gravel and and asphalt. In addition, the stretch of the ditch from the road to the river has been relocated east of its original location.

6.2 OUTFALL 002 DIVERSION

Outfall 002 consisted of a surface flow. The former 002 creekbed is located in the vicinity of the sewage treatment plants and continues easterly along the south side of the railroad tracks before crossing underneath the tracks and continuing to an embayment in the

St. Lawrence River. In November of 1989, this flow was diverted to a piped system, which collects all Outfall 002 cooling waters and most of the surface water run-off in this system. This water flows to a retention basin located northeast of the East Casthouse. Effluent then discharges into the pre-existing pipe which carries the Outfall 003 discharge to the St. Lawrence River.

6.3 OUTFALL 003

In July 1988, RMC installed a granular activated carbon (GAC) treatment system on the final effluent of Outfall 003. The purpose of the GAC system is to remove PCBs from water discharge. The GAC system has been operating continuously since its installation.

6.4 NORTH YARD

IRMs in the North Yard consist of covering contaminated soils and limiting access to contaminated areas. Upon notification by WCC of the results of PCB sampling in the soils in the North Yard in June of 1988, RMC covered high concentration areas with polyethylene sheeting. Subsequently, additional layers of plastic were installed and selected areas were paved with asphalt. Fencing was also installed to control access to areas of contamination.

6.5 OTHER REMEDIATIONS

RMC undertook a decontamination process of structural surfaces in the Pitch Pumphouse in 1989. Also, in 1989 and early 1990, the floor of the oil storage shed was replaced.

7.0 RECOMMENDATIONS

Recommendations by WCC for additional RI investigations concerning each area of concern at the plant are presented below. Work Plans addressing additional investigations in some of these areas have been, or will soon be, submitted to NYSDEC. The recommendations presented in this section are aimed at gaining a better understanding and definition of contamination in each of the areas. Non-RI related investigations, such as remedial evaluations, are addressed elsewhere.

7.1 BLACK MUD POND

Observations should be made concerning the possible discharge of contaminated groundwater, flowing through fill materials, to drainages south and east of the Black Mud Pond. The observations could be made on a seasonal basis in order to determine if seasonal groundwater level fluctuations affect discharge to the drainages. Observations concerning the amount of flowing water in the drainages could also be made. A limited number of samples could be collected from the drainage east of the pond to help verify that Black Mud Pond groundwater is discharging there and to determine the extent and nature of contamination. PCBs have been detected in groundwater in a limited number of Black Mud Pond monitoring wells. In order to address questions concerning mobility of PCBs in the subsurface, WCC recommends that filtered and unfiltered samples for PCB analysis be collected from wells where PCBs have been detected during previous groundwater sampling rounds.

7.2 LANDFILL AND FORMER POTLINER STORAGE AREA

Control measures for groundwater, surface water and air should be conducted as part of the final remediation for the Landfill and Former Potliner Storage Area. No additional investigative tasks are necessary for this area.

7.3 NORTH YARD

WCC recommends that RMC pave the North Yard as an interim remedial measure. This would:

1) Eliminate potential transport of contamination by air, pedestrians and vehicles.

2) Eliminate the transport of contaminated soil via surface water.
3) Eliminate infiltration of water through contaminated soils.

If possible, measures should be taken to check the integrity of subsurface utility lines. Specifically, the sanitary and storm sewer and fume scrubber return line, located in the main utility trench, should be checked.

The depth of PCDF/PCDD soil contamination has not been defined. PCDF/PCDD contamination is associated with North Yard PCB contamination, the depth of which has been defined. A limited number of depth samples could be collected, or retrieved from archived samples, for PCDF/PCDD analysis in order to confirm the limited vertical distribution of contamination.

7.4 POTLINER PAD AREA

The backfilled drainageway which is located near the Potliner Pad Area and leads across South Grasse River Road to the St. Lawrence River has been identified as possible migration pathway for contaminated groundwater. Visual surveys to investigate seepage, and a terrain conductivity survey, are recommended in order to evaluate potential migration of contaminants via this pathway.

PCBs have been detected in groundwater sampled from Potliner Pad monitoring wells. As at the Black Mud Pond, WCC recommends collection of filtered and unfiltered samples, in order to address questions concerning PCB mobility, from wells where PCBs have been detected.

Contamination in the drainage west of the Potliner Pad has been detected at low concentrations. Results of the Risk Analysis and Feasibility Study will define the significance of the contaminant concentrations and, therefore, define the need for additional data collection in this drainage.

7.5 RECTIFIER YARD

WCC recommends the collection of additional sediment samples, in the Rectifier Yard and drainages leading from the Rectifier Yard, in order to define the extent of PCB contamination.

7.6 WETLANDS

WCC recommends monthly observations, and observations during rainfall events of the intermittent drainages leading from the wetlands in order to quantify the amount of discharge from the wetlands. Surface water and sediment samples could be collected at intervals along the drainages in order to assess any impact from the contaminated area of the wetlands.

7.7 OTHER AREAS OF INTEREST

Work Plans covering additional sampling work north of South Grasse River Road, the 002 ditch, and a local area along the 002 pipe trench have been submitted to NYSDEC. The work will be conducted in 1990. Catchbasins, and the areas around them, will be addressed in the context of the PCB Source Assessment.

REFERENCES

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Woodward-Clyde Consultants, June 1989, Landfill Underdrain and Black Mud Pond Terrain Conductivity Report, St. Lawrence Reduction Plant.

Woodward-Clyde Consultants, November 1989, Phase II PCDF/PCDD Sampling Report, St. Lawrence Reduction Plant.

TABLE 1-1

PHASE I REMEDIAL INVESTIGATION WORK TASKS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Phase I Remedial Investigation Work Plan	Landfill/ Former Potliner Storage Area	Wetlands	Black Mud Pond	Rectifier Yard	Misc. Debris Storage Area	Potliner Pad	North Yard	Entire Plant
Review of Pre-Existing Monitoring Wells (12)	3		9					
Soil Borings (26)	10		8		4	1	3	
Monitoring Well Installation (20)	9		8			1	2	
Soil Sampling (11)	3			3	4		1	
Review of Aerial Photographs (3)								3
Preparation of Topographic Base Maps								1
Monitoring Well and Soil Boring Elevation Survey (37)	13		16		4	1	3	
Water Table Elevation Measurement (4)	4		4		4	4	4	
Single Well Permeability Tests (20)	9		8			1	2	
Laboratory Permeability Tests (3)	2				1			
Groundwater Sampling Rounds (4)	4		4		4	4	4	
Surface Water Sampling (12)	4	6	1			1		
Sediment Sampling (6)		4	1			1		
Black Mud Sampling (4)			4					
Black Mud Pond Liquor Sampling (1)			1					
Employee Interviews (4)								

TABLE 2-1

SUMMARY OF WELL CONSTRUCTION DETAILS
REYNOLDS METALS
MASSENA, NEW YORK

Well No.	Date Installed	Total Depth of Boring (ft.)*	Screened Interval (ft.)*	Casing and Screen Diameter (inches)	Casing and Screen Material	Ground Elevation (ft, msl)	Top of PVC Casing (ft, msl)	Comments
TB-4	10/30/81	36.5	30 - 35	2	PVC	197.3		Wetlands
TB-6	11/03/81	46.0	20 - 30	2	PVC	193.0		Wetlands
TB-7	12/02/81	26.5	21 - 26	2	PVC	214.5		Separated at depth
20-85-S	08/15/85	30.5	20.5 - 30.5	2	PVC	223.1	225.38	Black Mud Pond
20-85-D	08/20/85	61.2	51.2 - 61.2	2	PVC	222.9	225.48	Black Mud Pond
21-85-S	08/22/85	31	21 - 31	2	PVC	225.8	227.93	Black Mud Pond/ Material Storage Area
21-85-D	08/22/85	58	48 - 58	2	PVC	225.9	228.14	Black Mud Pond/ Material Storage Area
22-85-S	08/07/85	30.3	20.3 - 30.3	2	PVC	244.5	246.95	Black Mud Pond
22-85-D	08/15/85	60.6	50.6 - 60.6	2	PVC	244.1	246.57	Black Mud Pond
23-85-S	08/06/85	30.5	20.5 - 30.5	2	PVC	241.9	244.88	Black Mud Pond
23-85-D	08/05/85	58.0	48 - 58	2	PVC	241.9	244.45	Black Mud Pond
24-85-S	08/07/85	30.3	20.3 - 30.3	2	PVC			Destroyed During Construction
25-85-S	08/08/85	30.2	20.2 - 30.2	2	PVC	229	231	Borrow Pit

TABLE 2-1
(continued)

Well No.	Date Installed	Total Depth of Boring (ft.)*	Screened Interval (ft.)*	Casing and Screen Diameter (inches)	Casing and Screen Material	Ground Elevation (ft, msl)	Top of PVC Casing (ft, msl)	Comments
MW-1S	09/16/87	16.5	6 - 16	2	PVC	222.36	224.11	Plant Area
MW-2S	08/24/87	24	12.5 - 22.5	2	PVC	217.88	219.68	Plant Area
MW-3S	08/21/87	24	13 - 23	2	PVC	223.90	225.89	Plant Area
MW-4S	08/28/87	18	6.5 - 16.5	2	PVC	207.12	208.47	Landfill
MW-5S	08/25/87	22	11 - 21	2	PVC	205.3	207.05	Landfill
MW-5D	08/25/87	50	39 - 49	2	PVC	205.27	207.02	Landfill
MW-6S	08/25/87	15.8	9 - 15	2	PVC	211	212.15	Landfill
MW-7S	08/27/87	21	10 - 20	2	PVC	206.83	209.03	Landfill
MW-7D	08/27/87	50	39 - 49	2	PVC	206.86	208.66	Landfill
MW-8S	08/31/87	21.5	10.5 - 20.5	2	PVC	208	209.09	Landfill
MW-9S	09/01/87	21	10 - 20	2	PVC	205.94	207.84	Landfill
MW-10S	09/01/87	21.5	10.5 - 20.5	2	PVC	214.65	216.65	Background
MW-11S	09/11/87	28	17 - 27	2	PVC	246.04	248.04	Black Mud Pond
MW-12S	09/16/87	16.5	6 - 16	2	PVC	243.78	247.08	Black Mud Pond
MW-12D	09/15/87	50	39 - 49	2	PVC	245.01	247.01	Black Mud Pond
MW-13S	09/14/87	17.5	6.5 - 16.5	2	PVC	243.17	245.17	Black Mud Pond
MW-13D	09/09/87	50	39 - 49	2	PVC	243.74	245.19	Black Mud Pond
MW-14S	09/04/87	18.5	8 - 18	2	PVC	245.82	247.97	Black Mud Pond
MW-15S	09/10/87	31.5	21 - 31	2	PVC	246.72	248.72	Black Mud Pond
MW-15D	09/03/87	58	47 - 57	2	PVC	246.92	248.77	Black Mud Pond

TABLE 2-1
(continued)

See letter dated 10/4/91 from M. Kramer of WCC

Well No.	Date Installed	Total Depth of Boring (ft.)*	Screened Interval (ft.)*	Casing and Screen Diameter (inches)	Casing and Screen Material	Ground Elevation (ft, msl)	Top of PVC Casing (ft, msl)	Comments
MW-16S	8/29/89	23.5	12.5-22.5	2	PVC	225.82	~~228.32~~ 228.68	North Yard
MW-17S	8/24/89	18	8-18	2	PVC	224.25	225.65	North Yard
MW-18S	8/30/89	26.5	12-22	2	PVC	224.12	226.67	North Yard
MW-19S	8/29/89	18	6.5-16.5	2	PVC	224.05	226.55	North Yard
MW-26S	8/23/89	28	17.5-27.5	2	PVC	223.14	225.14	Potliner Pad
MW-27S	8/23/89	23	12.5-22.5	2	PVC	227.49	229.71	Potliner Pad
MW-28S	8/21/89	25	15-25	2	PVC	223.81	226.21	Potliner Pad
MW-29S	8/14/89	20	7-17	2	PVC	238.88	240.58	Black Mud Pond
MW-30S	8/14/89	17	7-17	2	PVC	232.55	235.05	Black Mud Pond
MW-31S	8/11/89	19.5	9.5-19.5	2	PVC	221.58	224.28	Black Mud Pond Background
MW-32S	8/08/89	40.5	27-37	2	PVC	223.98	226.93	Plant Background
BMPB-1	8/15/89	17	7-17	2	PVC	245.02	248.12	Black Mud Pond Piezometer
BMPB-2	8/16/89	18	8-18	2	PVC	244.60	247.05	Black Mud Pond Piezometer
LFB-2	8/03/89	22	10-20	2	PVC	213.67	216.47	Landfill Piezometer
LFB-4	8/07/89	32	20-30	2	PVC	229.06	232.86	Landfill Piezometer

* Depth below ground surface.

TABLE 2-2

INDICATOR PARAMETERS FOR GROUNDWATER, SURFACE WATER/SEDIMENT AND SOIL SAMPLING REYNOLDS METALS COMPANY MASSENA, NEW YORK

METALS

Aluminum
Arsenic
Beryllium
Cobalt
Iron
Magnesium
Manganese
Vanadium

GENERAL

Cyanide, Total
Cyanide, Free
Fluoride
Sulfate
Sodium
Total Phenolics

PRIORITY POLLUTANTS

PCBs

TABLE 3-1

WATER TABLE ELEVATIONS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Location	2/89	4/89	7/89	10/89	1/90
MW-1S	211.43	212.61	212.03	212.83	211.86
MW-2S	207.90	211.58	209.47	213.92	213.28
MW-3S	212.19	214.79	211.85	214.09	212.69
MW-4S	200.49	202.37	201.97	202.52	201.82
MW-5S	193.47	193.50	192.37	193.13	193.65
MW-5D	195.36	195.75	195.31	195.70	195.82
MW-6S	202.81	202.08	203.06	202.55	202.45
MW-7S	192.75	193.23	191.98	192.58	193.43
MW-7D	195.70	195.16	195.32	195.76	197.46
MW-8S	192.71	193.49	193.11	193.17	193.29
MW-9S	195.08	196.36	195.02	195.46	195.94
MW-10S	206.08	209.75	205.90	208.24	209.45
MW-11S	231.90	232.64	233.64	234.91	233.54
MW-12S	238.82	242.18	239.48	239.94	242.48
MW-12D	233.18	236.76	231.87	234.40	236.36
MW-13S	236.57	239.12	237.19	238.69	239.17
MW-13D	236.81	238.59	235.61	237.71	238.49
MW-14S	238.64	241.92	238.48	240.87	240.97
MW-15S	225.72	227.07	224.62	223.98	224.12
MW-15D	224.39	222.42	225.50	226.27	226.17
MW-16S	--	--	--	211.20	210.67
MW-17S	--	--	--	217.02	216.90
MW-18S	--	--	--	208.67	207.97
MW-19S	--	--	--	214.46	214.35
20-85-S	222.58	217.58	220.40	220.36	221.78
20-85-D	221.70	216.38	216.05	219.53	221.18

TABLE 3-1
(continued)

Location	2/89	4/89	7/89	10/89	1/90
21-85-S	--	222.43	222.50	224.18	221.58
21-85-D	--	220.44	221.18	224.13	221.59
22-85-S	237.42	242.85	234.34	235.18	239.95
22-85-D	234.77	241.37	233.16	233.79	237.62
23-85-S	234.52	236.98	234.14	235.53	237.43
23-85-D	234.15	236.95	233.44	235.17	238.10
25-85-S	--	221.40	217.93	219.82	222.05
MW-26S	--	--	--	214.64	214.19
MW-27S	--	--	--	221.52	218.59
MW-28S	--	--	--	211.96	210.11
MW-29S	--	--	--	230.23	233.58
MW-30S	--	--	--	229.03	229.35
MW-31S	--	--	--	215.63	216.68
MW-32S	--	--	--	216.62	217.33
LFB-2	--	--	--	--	Dry
LFB-4	--	--	--	--	200.76
BMP-1	--	--	--	--	238.52
BMP-2	--	--	--	--	241.95

TABLE 3-2

COEFFICIENT OF PERMEABILITY VALUES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Well Number	Method	Performed By	Geology	Permeability (cm/sec)
20-85-S	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	7×10^{-6}
20-85-D	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	7×10^{-7}
21-85-S	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	2×10^{-6}
21-85-D	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	5×10^{-7}
22-85-S	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	3×10^{-7}
22-85-D	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	1×10^{-5}
23-85-S	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	7×10^{-8}
23-85-D	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	2×10^{-7}
24-85-S	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	5×10^{-7}
24-85-D	Bouwer & Rice	Calocerinos & Spina	Gray Glacial Till	6×10^{-7}
TB-4 (35')	Falling Head	Tisdel	Lacustrine Deposit	1×10^{-10}
TB-4 (25')	Falling Head	Tisdel	Lacustrine Deposit	6.5×10^{-5}
TB-4 (15')	Falling Head	Tisdel	Lacustrine Deposit	2.4×10^{-7}
MW-1S	Bouwer & Rice	WCC	Fill Material	2.8×10^{-4}
MW-4S	Bouwer & Rice	WCC	Fill Material	4.6×10^{-2}
MW-5D (40-42')	Bjerrum & Huder[1]	WCC	Gray Glacial Till	2.69×10^{-8}
MW-5D (45-47')	Bjerrum & Huder[1]	WCC	Gray Glacial Till	4.86×10^{-9}
MW-6S	Bouwer & Rice	WCC	Fill Material	1.0×10^{-3}
MW-7S	Bouwer & Rice	WCC	Fill Material	4.5×10^{-3}
MW-9S	Bouwer & Rice	WCC	Fill Material	4.5×10^{-3}
MW-10S	Bouwer & Rice	WCC	Gray Glacial Till	9.5×10^{-6}
MW-11S	Bouwer & Rice	WCC	Gray Glacial Till	1.1×10^{-4}
MW-13S	Bouwer & Rice	WCC	Orange-Brown Sand	1.0×10^{-3}
MW-13D	Bouwer & Rice	WCC	Gray Glacial Till	1.3×10^{-4}
MW-16S	Bouwer & Rice	WCC	Fill Material	1.4×10^{-1}
MW-26S	Bouwer & Rice	WCC	Gray Glacial Till	4.7×10^{-4}
MW-27S	Bouwer & Rice	WCC	Gray Glacial Till	3.5×10^{-4}
MW-29S	Bouwer & Rice	WCC	Gray Glacial Till	1.3×10^{-6}

1 Laboratory measurement

WM-42Q

TABLE 3-3

GROUNDWATER ELEVATION DATA
BLACK MUD POND AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Well No.	1/90	2/90	3/90	4/90	5/90	6/90
MW-11S	233.54	234.36	233.89	235.33	234.72	234.74
MW-12S	242.48	243.51	242.85	243.18	242.40	241.92
MW-12D	236.36	238.25	237.15	239.00	237.77	235.45
MW-13S	239.17	240.28	239.64	240.84	240.46	239.72
MW-13D	238.49	239.64	239.05	240.00	239.56	238.69
MW-14S	240.97	243.02	242.39	243.55	242.93	242.46
MW-15S	224.12	221.49	223.59	225.28	227.41	221.92
MW-15D	226.17	227.65	226.90	227.66	226.15	226.94
BMPB-1	238.52	239.81	239.46	240.70	240.20	239.47
BMPB-2	241.95	243.08	242.53	243.07	242.48	242.14

TABLE 4-1

SUMMARY OF GROUNDWATER SAMPLE PCB ANALYSES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Sample Location	Date 10/87	12/87	5/88	2/89	4/89	7/89	10/89	1/90	Hits/ Analyses
MW-1S	< 1.0	-	-	-	-	-	< 0.50	< 0.50	0/3
MW-2S	< 1.0	-	-	-	-	-	< 5.0	< 0.95	0/3
MW-3S	1.1	-	-	-	-	-	< 0.50	< 0.05	1/3
MW-4S	-	-	-	0.08	< 0.05	< 0.065	< 0.50	< 0.10	1/5
MW-5S	< 1.0	-	< 0.05	0.07	< 0.05	< 0.065	< 0.50	< 0.10	1/7
MW-5D	< 1.0	-	-	0.09	0.14	< 0.065	< 0.50	< 0.05	2/6
MW-6S	-	-	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/5
MW-7S	< 1.0	< 1.0	< 0.05	0.91	0.69	0.42	< 0.50	< 0.05	3/8
MW-7D	< 1.0	< 1.0	-	0.24	0.06	< 0.065	< 0.50	< 0.05	2/7
MW-8S	-	-	-	6.1	2.6	8.4	13.3	0.33	5/5
MW-9S	-	-	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/5
MW-10S	< 1.0	-	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/6
MW-11S	-	-	-	0.07	< 0.05	< 0.065	< 0.50	< 0.05	1/4
MW-12S	-	2.0	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/6
MW-12D	-	2.0	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/6
MW-13S	< 1.0	-	-	0.13	0.07	0.19	< 0.50	< 0.05	3/6
MW-13D	< 1.0	-	-	< 0.05	< 0.05	< 0.065	< 0.50	< 0.05	0/6
MW-14S	-	-	-	0.06	< 0.05	< 0.065	< 0.50	< 0.05	1/5
MW-15S	-	-	-	0.25	0.18	0.10	< 0.50	< 0.05	3/5
MW-15D	-	-	-	< 0.05	0.05	< 0.065	< 0.50	< 0.05	0/5
MW-16S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-17S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-18S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-19S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
20-85-S	-	-	-	-	-	-	< 0.50	-	0/1
21-85-S	-	-	-	-	-	-	< 0.50	-	0/1
21-85-D	-	-	-	-	-	-	< 0.50	-	0/1
22-85-S	-	-	-	-	-	-	< 0.50	-	0/1
22-85-D	-	-	-	-	-	-	< 0.50	-	0/1
23-85-S	-	-	-	-	-	-	< 0.50	-	0/1
23-85-D	-	-	-	-	-	-	< 0.50	-	0/1
25-85-S	-	-	-	-	-	-	< 0.50	-	0/1
MW-26S	-	-	-	-	-	-	< 0.50	0.10	1/2
MW-27S	-	-	-	-	-	-	< 0.50	0.04	1/2
MW-28S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-29S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-30S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-31S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
MW-32S	-	-	-	-	-	-	< 0.50	< 0.05	0/2
TB-6B	-	-	-	-	-	-	< 0.50	-	0/1

TABLE 4-2

BACKGROUND GROUNDWATER SAMPLE RESULTS
CONCENTRATION RANGES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Unit	MW-32S	MW-31S	25-85-S	MW-10S
Aluminum	ppb	1940-8990	4200-21300	720	400-11000
Arsenic	ppb	3.2-3.3	ND-4.1	ND	ND
Beryllium	ppb	ND	ND	ND	ND
Cobalt	ppb	ND	10.7-104	4.0	ND
Cyanide, Free	ppb	ND	ND	ND	ND
Cyanide, Total	ppb	ND	ND	ND	ND
Fluoride	ppm	0.39-0.4	1.0-1.2	0.2	0.15-0.7
Iron	ppb	1810-8930	3830-26200	1840	490-7900
Magnesium	ppb	58200-64600	38300-69200	123000	47000-65000
Manganese	ppb	23.2-79.3	168-945	110	160-980
PCBs, Total	ppb	ND	ND	ND	ND
Recoverable Phenols	ppb	ND	ND	ND	ND
Sodium	ppb	18000-28300	20000-23700	144000	34000-47000
Sulfate	ppm	136-153	64-83	128	160-215
Vanadium	ppb	ND-12.2	8.2-40.3	ND	ND-8.9

ND = Not Detected

TABLE 4-3

BACKGROUND SOIL SAMPLE RESULTS
OCTOBER 1989
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Unit	MW-32S-2-4	MW-31S-2-4	BMP-BACK
Aluminum	ppm	13,000	16,000	13,000
Arsenic	ppm	4.0	3.0	3.0
Beryllium	ppm	0.5	0.8	0.5
Cobalt	ppm	6.1	8.5	6.4
Cyanide, Free	ppm	--	--	--
Cyanide, Total	ppm	ND	ND	ND
Fluoride	ppm	36	27	16
Iron	ppm	16,000	16,000	15,000
Magnesium	ppm	6500	40,000	33,000
Manganese	ppm	370	400	410
PCB-1016	ppm	ND	ND	ND
PCB-1221	ppm	ND	ND	ND
PCB-1232	ppm	ND	ND	ND
PCB-1242	ppm	ND	ND	ND
PCB-1248	ppm	.24	ND	ND
PCB-1254	ppm	ND	ND	ND
PCB-1260	ppm	ND	ND	ND
Recoverable Phenols	ppm	1.3	ND	ND
Sodium	ppm	400	380	360
Sulfate	ppm	ND	130	140
Vanadium	ppm	25	35	29

ND = Not Detected

WM-42Q

TABLE 4-4

BLACK MUD POND
GROUNDWATER SAMPLE RESULT RANGES
CONCENTRATION RANGES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	MW-11S	MW-12D	MW-12S	MW-13D	MW-13S	MW-14S
Aluminum	ppb	1500.-44500.	700.-7600.	1490.-8100.	300.-14000.	286.-12800.	700.-22100.
Arsenic	ppb	ND-11.2	ND-4.1	ND	ND-7.	ND	ND-3.8
Beryllium	ppb	ND	ND	ND	ND	ND	ND
Cobalt	ppb	ND-25.	ND-9.	ND	4.0-21.	16.3-27.	ND-12.5
Cyanide, Free	ppb	ND-10.	ND-240.	ND-120.	24.-80.	ND-480.	ND-110.
Cyanide, Total	ppb	ND-10.	150.-306.	60.-120.	250.-361.	1800.-2490.	80.-230.
Fluoride	ppm	1.1-1.4	0.2-0.3	12.-18.	0.24-0.33	1.3-3.0	0.66-0.87
Iron	ppb	440.-85700.	1500.-12000.	720.-7000.	1300.-25000.	945.-1700.	970.-27300.
Magnesium	ppb	53000.-19300.	160000.-207000.	29200.-42000.	230000.-307000.	19000.-520000.	96000.-159000.
Manganese	ppb	130.-2810.	97.-340.	160.-720.	110.-860.	20.3-1000.	120.-951.
PCBs, Total	ppb	ND-0.07	ND	ND	ND	ND-0.19	ND-0.06
Recoverable Phenols	ppb	ND-30.	ND-9.	ND-2.	ND-11.	ND-15.	ND-7.2
Sodium	ppb	38000.-48200.	260000.-486000.	295000.-400000.	390000.-709000.	687000.-2400000.	24000.-42500.
Sulfate	ppm	230.-440.	1000.-1840.	213.-480.	1800.-2910.	4500.-8900.	350.-455.
Vanadium	ppb	ND-138.	ND	ND	ND	ND	ND-36.5

ND = Not Detected

WM-42Q

TABLE 4-4
(continued)

Parameter	Units	MW-15D	MW-15S	MW-20-85S	MW-85-21D	MW-21-85S	MW-22-85D	MW-22-85S
luminum	ppb	3200.-230000.	74.6-34200.	1420.	26800.	33200.	797.	1310.
rsenic	ppb	3.-4.7	ND-5.9	3.5	4.5	7.9	4.9	ND
eryllium	ppb	ND	ND-1.3	ND	ND	1.3	ND	ND
obalt	ppb	ND-206.	ND-20.4	ND	8.9	11.	ND	ND
yanide, Free	ppb	ND-10.	ND	ND	ND	ND	30.	50.
yanide, Total	ppb	ND-20.	ND	ND	ND	ND	145.	323.
luoride	ppm	0.45-0.66	0.8-1.4	0.6	2.8	0.7	0.3	0.2
ron	ppb	3200.-380000.	63.2-40200.	1200.	27800.	37100.	1620.	1470.
agnesium	ppb	4900.-690000.	82000.-150000.	48600.	58500.	91400.	79500.	43900.
anganese	ppb	82.7-9500.	12.8-1370.	37.2	67.3	845.	75.8	69.8
CBs, Total	ppb	ND	ND-0.25	ND	ND	ND	ND	ND
ecoverable Phenols	ppb	ND-3.	ND-6.9	ND	ND	ND	ND	--
odium	ppb	55000.-61000.	87000.-10300.	59800.	73800.	54000.	72400.	1990.
ulfate	ppm	250.-360.	585.-810.	300.	271.	259.	419.	991.
anadium	ppb	6.1-490.	ND-61.2	ND	41.	58.9	ND	ND

D = Not Detected

M-42Q

TABLE 4-4
(continued)

Parameter	Units	MW-23-85D	MW-23-85S	MW-25-85S	MW-29S	MW-30S	MW-31S
Aluminum	ppb	197.	917.	720.	1410.-14900.	31700.-33100.	4200.-21300.
Arsenic	ppb	3.4	3.8	ND	ND	ND-6.6	ND-4.1
Beryllium	ppb	ND	ND	ND	ND	ND-1.6	ND
Cobalt	ppb	ND	ND	4.	27.6-35.1	ND-13.8	10.7-104.
Cyanide, Free	ppb	20.	ND	ND	ND	ND	ND
Cyanide, Total	ppb	ND	ND	ND	ND	ND	ND
Fluoride	ppm	0.4	0.3	0.2	0.7-0.91	9.5-10.	1.0-1.2
Iron	ppb	295.	1060.	1840.	1300.-15700.	2790.-32600.	3830.-26200.
Magnesium	ppb	36900.	58800.	123000.	80000.-95400.	57700.-99000.	38300.-69200.
Manganese	ppb	13.	31.5	110.	464.-465.	1090.-1860.	169.-945.
PCBs, Total	ppb	ND	ND	ND	ND	ND	ND
Recoverable Phenols	ppb	ND	ND	ND	ND-50.	ND-9.	ND
Sodium	ppb	55500.	39700.	144000.	20900.-21900.	114000.-159000.	20000.-23700.
Sulfate	ppm	311.	309.	128.	314.-370.	154.-165.	64.-83.
Vanadium	ppb	ND	ND	ND	ND-27.5	ND-53.8	8.2-40.3

ND = Not Detected

TABLE 4-5

SOUTH OF THE BLACK MUD POND
SURFACE WATER SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	BMPDW-1	BMPDW-2	BMPDW-3
Aluminum	ppb	400	700	500
Arsenic	ppb	ND	ND	ND
Beryllium	ppb	ND	ND	ND
Cobalt	ppb	ND	ND	5
Cyanide, Free	ppb	ND	40	80
Cyanide, Total	ppb	ND	190	140
Fluoride	ppm	19	20	19
Iron	ppb	240	260	130
Magnesium	ppb	36,000	28,000	28,000
Manganese	ppb	28	62	70
PCB-1016	ppb	ND	ND	ND
PCB-1221	ppb	ND	ND	ND
PCB-1232	ppb	ND	ND	ND
PCB-1242	ppb	ND	ND	ND
PCB-1248	ppb	ND	0.35	0.47
PCB-1254	ppb	ND	ND	ND
PCB-1260	ppb	ND	ND	ND
Recoverable Phenols	ppb	ND	ND	ND
Sodium	ppb	190,000	85,000	85,000
Sulfate	ppm	370	140	140
Vanadium	ppb	ND	ND	ND

ND = Not Detected

WM-42Q

TABLE 4-6

SOUTH OF THE BLACK MUD POND
SEDIMENT SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	BMPDS-1	BMPDS-2	BMPDS-3
Aluminum	ppm	28,000	30,000	39,000
Arsenic	ppm	13	22	25
Beryllium	ppm	5.2	4	4.8
Cobalt	ppm	5.2	7	12
Cyanide, Free	ppm	--	--	--
Cyanide, Total	ppm	4.3	9.5	2.9
Fluoride	ppm	390	780	1100
Iron	ppm	8910	14,000	20,000
Magnesium	ppm	18,000	16,000	27,000
Manganese	ppm	140	380	510
PCB-1016	ppm	ND	ND	ND
PCB-1221	ppm	ND	ND	ND
PCB-1232	ppm	ND	ND	ND
PCB-1242	ppm	ND	ND	ND
PCB-1248	ppm	.65	10	24
PCB-1254	ppm	ND	ND	ND
PCB-1260	ppm	ND	ND	ND
Recoverable Phenols	ppm	1	1.2	20
Sodium	ppm	1400	2400	2700
Sulfate	ppm	120	310	110
Vanadium	ppm	39	42	78

ND = Not Detected

WM-42Q

TABLE 4-7

LANDFILL AND FORMER POTLINER STORAGE AREA BORINGS
SAMPLE ANALYTICAL RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	LFB-1 8-10(1)	LFB-1 14-16	LFB-1 26-28	LFB-2 10-12	LFB-2 14-16	LFB-2 20-22	LFB-3 8-10	LFB-3 18-20
PCB (ppm):	690.	87.	4.2	74.	260.	17.	0.39	480.
Arochlor	1248	1248	1248	1248+1260	1248	1248	1248	1248
Total Metals (ppm):								
Aluminum	64,000.	64,000.	38,000.	87,000.	58,000.	40,000.	25,000.	48,000.
Arsenic	52.	49.	26.	110.	62.	25.	34.	28.
Beryllium	11.	4.2	1.8	3.3	2.9	1.6	2.3	4.7
Cobalt	9.5	4.9	23.	7.4	12.	16.	5.1	5.5
Iron	130,000.	16,000.	40,000.	21,000.	330,000.	33,000.	8,000.	60,000.
Magnesium	3,500.	11,000.	14,000.	5,400.	6,000.	12,000.	2,300.	4,300.
Manganese	1,600.	300.	770.	190.	4,500.	540.	150.	380.
Sodium	47,000.	14,000.	10,000.	59,000.	13,000.	4,500.	11,000.	21,000.
Vanadium	970.	51.	83.	150.	14	76.	33.	30.
Other Analyses (ppm):								
Fluoride	6,700.	5,000.	2,500.	7,100.	3,600.	3,800.	3,900.	8,500.
Phenol	3.2	3.5	1.7	15.	4.2	5.6	2.2	3.6
Sulfate	740.	420.	160.	3,800.	1,200.	450.	20.	1,400.
Total Cyanide	23.	41.	52.	14.	20.	18.	1.	52.

TABLE 4-7
(continued)

Parameter	LFB-4 18-20	LFB-4 24-26	LFB-5 12-14	LFB-5 24-26	LFBB-1 14-16	FPSAB-1 2-4	FPSAB-1 5-7	FPSAB-2 0-2	FPSAB-2 6-8
PCB (ppm):	3.9	67.	76.	100.	5.9	0.96	1.1	0.34	0.09
Arochlor	1248+1260	1248	1248	1248	1248	1248	1248	1248	--
Total Metals (ppm):									
Aluminum	17,000.	60,000.	74,000.	38,000.	26,000.	15,000.	10,000.	29,000.	8,900.
Arsenic	20.	28.	65.	38.	28.	8.3	15.	19.	5.4
Beryllium	1.7	1.9	5.5	3.1	7.6	1.1	0.6	3.4	0.6
Cobalt	2.8	3.9	6.5	6.4	2.6	7.7	7.2	7.5	6.8
Iron	9,400.	9,100.	20,000.	15,000.	2,400.	15,000.	12,000.	14,000.	13,000.
Magnesium	7,400.	13,000.	13,000.	23,000.	6,200.	32,000.	48,000.	31,000.	32,000.
Manganese	150.	250.	220.	280.	53.	360.	340.	380.	370.
Sodium	6,400.	8,700.	57,000.	16,000.	29,000.	5,900.	4,300.	12,000.	4,900.
Vanadium	20.	25.	150.	60.	12.	26.	20.	39.	23.
Other Analysis (ppm):									
Fluoride	3,400.	4,400.	7,500.	6,200.	8,000.	890.	1,400.	4,600.	150.
Phenol	0.35	16.	3.0	14.	21.	1.6	0.4	0.1	0.3
Sulfate	1,100.	260.	13,000.	6,200.	580.	470.	520.	25.	1,000.
Total Cyanide	7.2	4.4	45.	71.	300.	150.	34.	56.	170.

(1) Depth below ground surface.

TABLE 4-8

LANDFILL BORINGS
TCL VOLATILE AND SEMI-VOLATILE SAMPLE RESULTS
DETECTED PARAMETERS ONLY
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

	Units	LFB-2C	LFB-4C	LFBB-1-14-16
BASE NEUTRALS COMPOUNDS				
Acenaphthene	ppm	<220	63	< 120
Anthracene	ppm	150	47	85
Benzo(a)Anthracene	ppm	1,000	76	220
Benzo(a)Pyrene	ppm	1,100	92	140
Benzo(b)Fluoranthene	ppm	2,100	140	310
Benzo(g,h,i)Perylene	ppm	430	46	58
Benzo(k)Fluoranthene	ppm	1,000	91	170
Chrysene	ppm	1,700	140	450
Dibenzo(a,h)Anthracene	ppm	<200	16	< 120
Dibenzofuran	ppm	15	6.1	--
Fluoranthene	ppm	2,200	14	< 130
Fluorene	ppm	28	17	< 120
Indeno(1,2,3-cd)Pyrene	ppm	<450	51	57
Naphthalene	ppm	16	2.5	< 120
Phenanthrene	ppm	350	85	420
Pyrene	ppm	1,900	150	660
VOLATILE ORGANIC COMPOUNDS				
Acetone	ppb	11	5	--
Carbon Disulfide	ppb	8	< 6	--
Ethylbenzene	ppb	3	< 6	--
Methylene Chloride	ppb	9	3	--
Tetrachloroethene	ppb	< 6	3	--

WM-42Q

TABLE 4-9

LANDFILL/FORMER POTLINER STORAGE AREA
GROUNDWATER SAMPLE RESULTS
CONCENTRATION RANGES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	MW-4S	MW-5D	MW-5S	MW-6S
Aluminum	ppb	1900.-52000.	2500.-15900.	15000.-47000.	230.-2500.
Arsenic	ppb	ND-15.	ND-7.7	ND-23.	ND-7.4
Beryllium	ppb	ND-4.	ND	ND	ND-1.0
Cobalt	ppb	17.5-70.	ND-18.1	47.-54.	16.-38.0
Cyanide, Free	ppb	24.-4100.	ND-20.	ND-150.	ND-13300.
Cyanide, Total	ppb	1500.-4600.	10.-30.	2500.-21700.	3200.-13500.
Fluoride	ppm	15.-37.	0.75.-0.9	83.-220.	58.7-120.
Iron	ppb	3300.-56000.	2500.-15900.	10000.-39000.	2100.-7000.
Magnesium	ppb	2570.-56000.	11300.-20400.	11000.-17100.	34000.-45000.
Manganese	ppb	120.-830.	62.2.-302.	190.-570.	53.-98.
PCBs, Total	ppb	ND-0.08	ND-0.14	ND-0.07	ND
Recoverable Phenols	ppb	ND	ND	ND-7.	ND-21.
Sodium	ppb	452000.-1100000.	72000.-85000.	2220000.-2680000.	65200.-1100000.
Sulfate	ppm	ND-150.	110.-124.	ND-260.	150.-290.
Vanadium	ppb	ND-190.	ND-29.3	54.-250.	ND-20.4

TABLE 4-9
(continued)

Parameter	Units	MW-7D	MW-7S	MW-8S	MW-9S	MW-10S
Aluminum	ppb	1300.-6700.	5100.-21000.	5800.-96600.	1100.-8200.	400.-11000.
Arsenic	ppb	ND-8.8	11.4-19.0	ND-25.	ND	ND
Beryllium	ppb	ND	ND-3.	4.-13.7	ND	ND
Cobalt	ppb	ND-8.0	ND-11.	5.-29.1	ND-8.	ND-7.
Cyanide, Free	ppb	ND	ND-190.	ND-60.	ND-70.	ND
Cyanide, Total	ppb	ND-10.	360.-640.	370.-1670.	70.-130.	ND
Fluoride	ppm	.023-0.3	61.-100.	28.3-16.0	2.6-4.5	0.15-0.35
Iron	ppb	1600.-5700.	6600.-26000.	7000.-87200.	1400.-5400.	490.-7900.
Magnesium	ppb	33900.-38000.	28000.-39000.	35000.-80300.	46700.-59000.	47000.-65000.
Manganese	ppb	70.-150.	350.-700.	970.-3090.	781.-990.	160.-980.
PCBs, Total	ppb	ND-0.24	ND-0.91	0.33-13.3	ND	ND
Recoverable Phenols	ppb	ND-1.	ND-47.	12.-66.	ND	ND
Sodium	ppb	16600.-22000.	627000.-1300000.	460000.-1100000.	51800.-80000.	34000.-47000.
Sulfate	ppm	39.-52.	108.-600.	147.-350.	118.-150.	160.-215.
Vanadium	ppb	ND	ND-21.8	ND-195.	ND	ND-8.9

ND = Not Detected

WM-42Q

TABLE 4-10

NORTH YARD GROUNDWATER SAMPLE RESULTS
CONCENTRATION RANGES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	MW-1S	MW-2S	MW-16S	MW-17S	MW-18S	MW-19S
Aluminum	ppb	1560.-2540.	5670.-26600.	226.-16800.	930.-6930.	1320.-11600.	3450.-4000.
Arsenic	ppb	ND	126.-140.	ND-14.3	ND	ND	ND-3.2
Beryllium	ppb	ND	ND	ND	ND	ND	ND
Cobalt	ppb	ND	ND	ND-13.7	10.2-15.5	ND-19.3	ND
Cyanide, Free	ppb	ND	ND	ND	ND	30.-180.	ND
Cyanide, Total	ppb	ND	15.-31.2	17.8-21.	ND	538.-3920.	ND
Fluoride	ppm	16.-29.	30.-32.	17.-20.	0.2-0.2	15.-56.3	3.8-4.2
Iron	ppb	1010.-1920.	3840.-20700.	270.-27700.	875.-13500.	1320.-10800.	2570.-3780.
Magnesium	ppb	17400.-19200.	5450.-19800.	19000.65600.	142000.-157000.	29500.-36500.	17000.-19100.
Manganese	ppb	21.-44.1	83.8-422.	63.3-855.	842.-1060.	128.-645.	129.-160.
PCBs, Total	ppb	ND	ND	ND	ND	ND	ND
Recoverable Phenols	ppb	ND	ND-5.4	ND	ND	ND	ND
Sodium	ppb	147000.-171000.	1060000.-1100000.	159000.-241000.	138000.-151000.	351000.-120000.	280000.-316000.
Sulfate	ppm	177.-180.	237.-342.	187.-258	625.-770.	417.-2140.	191.-236.
Vanadium	ppb	ND	45.5-85.8	ND-31.1	ND-10.5	6.7-26.7	ND-8.1

ND = Not Detected

WM-42Q

TABLE 4-11

NORTH YARD SOIL BORINGS
SAMPLE ANALYTICAL RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Sample Location	Depth (ft)	PCBs (ppm)	ArocHlor	Total Solids (%)
MW-16S	0 - 2	21.0	1248 + 1260	93.4
	20 - 22	< 0.09	- -	91.1
	22 - 24	< 0.09	- -	91.3
	24 - 26	< 0.09	- -	92.5
See Vol III PCW	26 - 28	< 0.09	- -	91.5
MW-17S	0 - 2	309.0 (390.00)	1248	93.0
	4 - 6	0.42	1248	91.0
	6 - 8	< 0.09	- -	90.0
	10 - 12	< 0.09	- -	91.0
	12 - 14	< 0.09	- -	91.0
MW-18S	0 - 2	120.0	1248 + 1260	89.0
	20 - 22	< 0.09	1248 + 1260	89.9
	24 - 26	< 0.09	- -	89.3
MW-19S	0 - 2	430.0	1248 + 1260	88.9
	2 - 4	30.0	1248 + 1260	91.5
	4 - 6	1.7	1248 + 1260	90.0
	8 - 10	< 0.1	- -	84.6
	10 - 12	< 0.09	- -	91.0
NYB-1	2 - 4	3.3	1248	91.0
	4 - 6	5.9	1248	91.0
NYB-2	0 - 2	120.00	1248 + 1260	95.6
	5 - 7	< 0.09	- -	91.5
NYB-3	0 - 2	150.0	1248 + 1260	90.0
	2 - 4	19.0	1248 + 1260	92.0

TABLE 4-12

POTLINER PAD AREA
GROUNDWATER SAMPLE RESULTS
CONCENTRATION RANGES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Units	MW-3S	MW-26S	MW-27S	MW-28S
Aluminum	ppb	2910.-21100.	674.-1970.	2000.-327000.	8310.-11400.
Arsenic	ppb	ND	ND	ND-38.	ND
Beryllium	ppb	ND	ND	ND-25.3	ND
Cobalt	ppb	70.2-77.4	ND	ND-89.2	92.-101
Cyanide, Free	ppb	360.-1200.	20.	15.-70.	150.-180.
Cyanide, Total	ppb	5260.-34700.	32.	234.-463.	20200.-52600.
Fluoride	ppm	8.0-11.1	5.2	79.-161.	356.-374.
Iron	ppb	12300.-30300.	721.-1740.	945.-278000.	25900.-27400.
Magnesium	ppb	46800.-60600.	38900.-41800.	19000.-275000.	10300.-10900.
Manganese	ppb	85.6-479.*	67.4-95.9*	20.3-5960.*	195.*-197.
PCBs, Total	ppb	ND	ND-0.10	ND-0.04	ND
Recoverable Phenols	ppm	ND	ND-0.03	ND-0.19	ND-0.009
Sodium	ppb	314000.-361000.	116000.-146000.	687000.-781000.	2800000.-3040000.
Sulfate	ppm	425.-529.	236.	645.-1160.	1650.-1690.
Vanadium	ppb	ND-38.	ND	ND-578.	ND-24.8

ND = Not Detected

WM-42Q

TABLE 4-13

POTLINER PAD AREA
SURFACE WATER SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Indicator Parameter	Unit	TSDW-1	TSDW-2	TSDW-3	SW-1
Aluminum	ppb	300	300	2300	304
Arsenic	ppb	ND	ND	ND	ND
Beryllium	ppb	ND	ND	ND	ND
Cobalt	ppb	ND	ND	ND	11
Cyanide, Free	ppb	30	30	ND	37
Cyanide, Total	ppb	40	30	60	288
Fluoride	ppm	18	19	19	25
Iron	ppb	110	110	1100	242
Magnesium	ppb	28,000	27,000	24,000	20,500
Manganese	ppb	12	17	126	22
PCB-1016	ppb	ND	ND	ND	ND
PCB-1221	ppb	ND	ND	ND	ND
PCB-1242	ppb	ND	ND	ND	ND
PCB-1248	ppb	ND	0.066	0.14	ND
PCB-1254	ppb	ND	ND	ND	ND
PCB-1260	ppb	ND	ND	ND	ND
Recoverable Phenols	ppb	6	2	ND	ND
Sodium	ppb	210,000	200,000	140,000	180,000
Sulfate	ppm	360	350	210	200
Vanadium	ppb	ND	ND	ND	21

ND = Not Detected

TABLE 4-14

POTLINER PAD AREA
SEDIMENT SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Indicator Parameter	Unit	TSDS-1	TSDS-2	TSDS-3	SS-1
Aluminum	ppm	60,000	72,000	31,000	12,100
Arsenic	ppm	42	46	14	8.3
Beryllium	ppm	11	8.2	5.7	3.2
Cobalt	ppm	4.8	10	5.2	3.7
Cyanide, Free	ppm	--	--	--	0.86
Cyanide, Total	ppm	28	29	30	18
Fluoride	ppm	700	2700	270	550
Iron	ppm	13,000	16,000	10,000	7920
Magnesium	ppm	15,000	21,000	15,000	27,000
Manganese	ppm	230	380	260	303
PCB-1016	ppm	ND	ND	ND	ND
PCB-1221	ppm	ND	ND	ND	ND
PCB-1242	ppm	ND	ND	ND	ND
PCB-1248	ppm	3.1	1.1	6.6	.27
PCB-1254	ppm	ND	ND	ND	ND
PCB-1260	ppm	ND	ND	ND	ND
Recoverable Phenols	ppm	0.5	0.7	0.6	ND
Sodium	ppm	24,000	3600	4700	5040
Sulfate	ppm	310	350	140	190
Vanadium	ppm	36	66	34	22

ND = Not Detected

TABLE 4-15

RECTIFIER YARD AREA
SOIL/SEDIMENT SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Sample No.	Sample Type	Result (ppm)	Arochlor
TY-1	Soil	ND	--
TY-2	Soil	0.62	1242
		0.15	1260
TY-2 DUP	Soil	0.21	1248
		0.085	1260
RCYD1/0	Soil	3.3	1248 & 1260
RCYD2/0	Soil	4.0	1260
RCYD3/0	Soil	2.2	1260
RCYD3/0 DUP	Soil	3.0	1260
RCYD4/0	Soil	ND	--
RCYD5/0	Sediment	17	1248
RCYD6/0	Sediment	590	1260
RCYD7/0	Sediment	7.1	1260
RCYD7A/0	Sediment	1300	1260
RCYD8/0	Sediment	1100	1260
RCYD9/0	Sediment	2300	1260
RCYD9/1*	Sediment	3200	1260
RCYD10/0	Sediment	690	1260
RCYD11/0	Sediment	920	1260
RCYD12/0	Sediment	1200	1260
RCYD12/0 DUP	Sediment	790	1260
RCYD12/1*	Sediment	13	1260
RCYD13/0	Sediment	510	1260
RCYD14/0	Sediment	260	1260
SHDS-1	Sediment	1.4	1248 & 1260

ND = Not Detected

* Collected at a depth of 1-foot below the ground surface. All other samples are surface samples.

TABLE 4-16

WETLANDS SURFACE WATER SAMPLE RESULTS
METALS AND OTHER ANALYSES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

METALS:	WW-5 (ppm)	WW-7 (ppm)	WW-8 (ppm)
Aluminum	0.4	3.1	2.7
Arsenic	< 0.005	0.011	0.006
Calcium	67	40	37
Chromium	0.01	0.03	< 0.01
Cobalt	< 0.005	< 0.005	< 0.005
Iron	1.8	2.3	2.1
Magnesium	25	19	20
Nickel	< 0.04	< 0.04	< 0.04
Sodium	93	240	240
Vanadium	< 0.05	0.08	0.06

OTHER ANALYSES:

Cyanide	<0.01	0.03	< 0.01
Cyanide, amenable	<0.01	< 0.01	< 0.01
Fluoride	13	52	50
Sulfate	78	120	100
Phenolics	<0.001	0.005	0.005
PCBs	0.07 ppb	0.67 ppb	0.32 ppb

TABLE 4-16
(continued)

METALS:	WW-6 (ppm)	WW-9 (ppm)	WW-11 (ppm)	WW-10 (ppm)	WWDup-1 (ppm)
Aluminum	11	15	19	5.9	4.4
Arsenic	0.030	0.031	0.018	0.018	0.011
Calcium	18	45	34	35	26
Chromium	0.02	0.03	0.02	0.01	< 0.01
Cobalt	0.026	0.010	< 0.005	< 0.005	< 0.005
Iron	12	11	11	3.9	3.0
Magnesium	15	25	19	19	14
Nickel	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Sodium	1800	600	520	400	290
Vanadium	0.21	0.33	0.14	0.13	0.09
OTHER ANALYSES:					
Cyanide	5.4	1.3	0.25	0.06	0.18
Cyanide, amenable	2.8	0.85	0.01	0.03	0.04
Fluoride	350	96	100	85	83
Sulfate	240	240	350	210	120
Phenolics	0.002	0.007	0.003	< 0.001	0.006
PCBs	0.26 ppb	0.72 ppb	0.35 ppb	1.1 ppb	1.2 ppb

TABLE 4-16
(continued)

METALS:	WW-12 (ppm)	WW-14 (ppm)	WW-Blank (ppm)	WW-13 (ppm)	WDW-1 (ppm)
Aluminum	12	6.2	0.1	0.9	3.2
Arsenic	0.020	0.011	0.005	< 0.005	< 0.005
Calcium	41	51	1	44	57
Chromium	0.02	0.01	< 0.01	< 0.01	0.02
Cobalt	0.006	0.006	< 0.005	< 0.005	< 0.005
Iron	8.1	6.9	0.11	1.0	7.9
Magnesium	22	30	< 1.0	25	22
Nickel	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Sodium	510	470	2	250	51
Vanadium	0.14	0.07	< 0.05	< 0.05	< 0.05
OTHER ANALYSES:					
Cyanide	0.45	0.31	< 0.01	0.47	0.49
Cyanide, amenable	< 0.01	0.19	< 0.01	0.19	< 0.01
Fluoride	92	75	0.10	39	10.
Sulfate	99	120	< 1.0	110	38
Phenolics	0.011	0.008	< 0.001	0.005	< 0.001
PCBs	3.7 ppb	1.3 ppb	< 0.065 ppb	0.33 ppb	1.9 ppb

TABLE 4-16
(continued)

METALS:	WCAW-1 (ppm)	WDW-2 (ppm)	EDW-2 (ppm)	EDW-1 (ppm)
Aluminum	0.1	0.2	0.4	0.8
Arsenic	< 0.005	< 0.005	< 0.005	< 0.005
Calcium	27	55	76	25
Chromium	< 0.01	< 0.01	< 0.01	< 0.01
Cobalt	< 0.005	< 0.005	< 0.005	< 0.005
Iron	2.1	0.81	1.2	1.4
Magnesium	10	22	30	17
Nickel	< 0.04	< 0.04	< 0.04	< 0.04
Sodium	4	29	96	190
Vanadium	< 0.05	< 0.05	< 0.05	< 0.05

OTHER ANALYSES:

Cyanide	< 0.01	0.25	0.18	0.27
Cyanide, amenable	< 0.01	0.01	0.03	< 0.01
Fluoride	0.45	4.9	12	31
Sulfate	< 1.0	16	50	110
Phenolics	< 0.001	< 0.001	< 0.001	< 0.001
PCBs	< 0.065 ppb	0.095 ppb	< 0.065 ppb	0.14 ppb

TABLE 4-17

WETLANDS SEDIMENT SAMPLE RESULTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

METALS:	WS-5 (ppm)	WS-7 (ppm)	WS-8 (ppm)	WS-6 (ppm)
Aluminum	33,000	31,000	30,000	74,000
Arsenic	34	70	32	63
Calcium	42,000	25,000	21,000	110,000
Chromium	43	21	32	34
Cobalt	12	2.4	7.0	8.3
Iron	26,000	9100	15,000	16,000
Magnesium	17,000	11,000	9600	34,000
Nickel	29	13	15	31
Sodium	2300	39,000	14,000	75,000
Vanadium	62	41	43	70
OTHER ANALYSES:				
Cyanide	29	62	6.7	92
Fluoride	1060	54,000	5300	45,000
Sulfate	38	54,000	690	15,000
Phenolics	0.2	5.4	3.3	1.0
PCBs	11	< 10	0.60	5.7

TABLE 4-17
(continued)

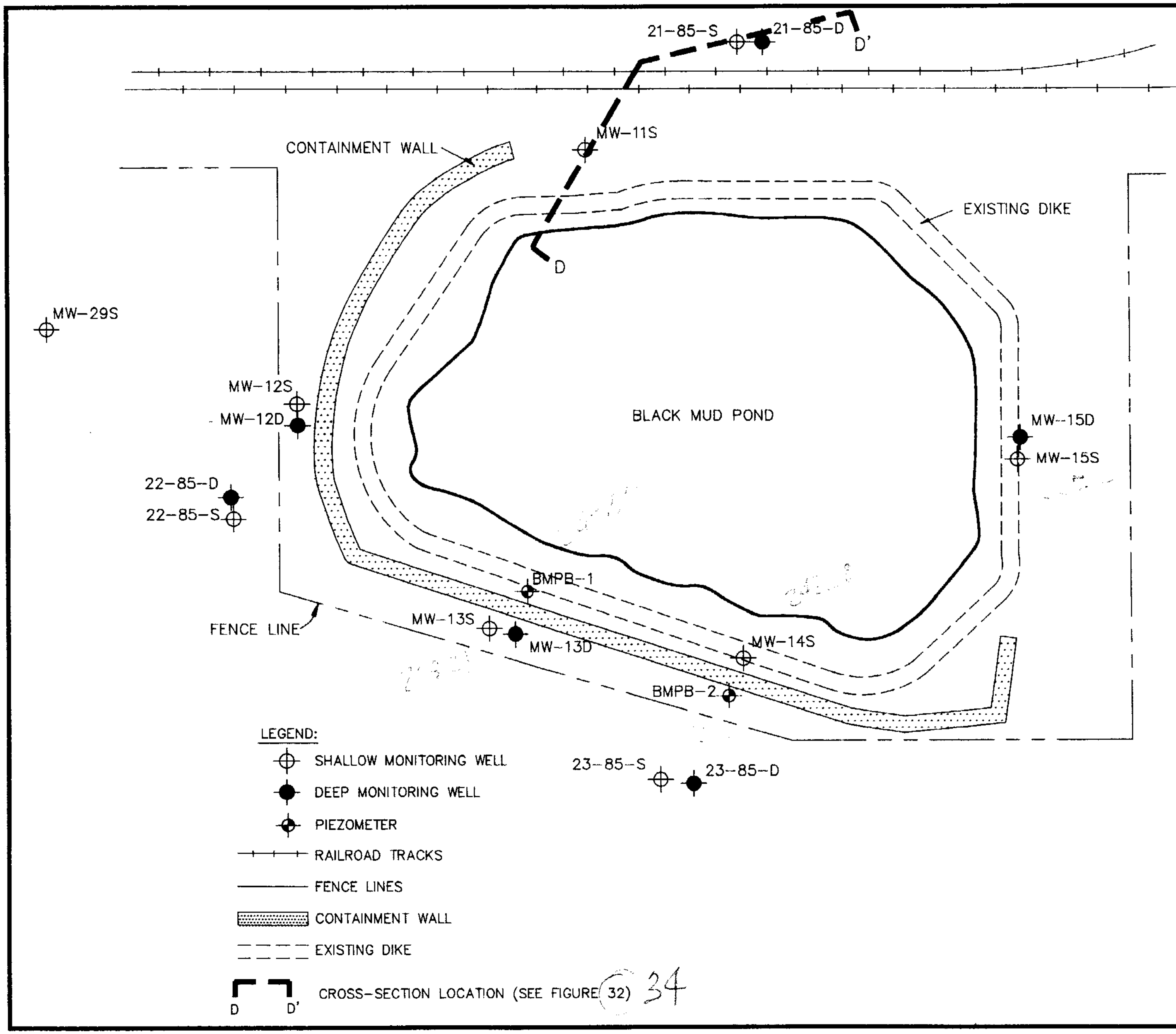
METALS:	WS-9 (ppm)	WS-11 (ppm)	WS-10 (ppm)	WS-Dup1 (ppm)	WS12 (ppm)
Aluminum	47,000	25,000	38,000	30,000	27,000
Arsenic	80	35	37	26	100
Calcium	55,000	18,000	19,000	23,000	31,000
Chromium	38	25	44	23	26
Cobalt	14	4.8	8.8	5.0	3.5
Iron	25,000	14,000	19,000	12,000	14,000
Magnesium	22,000	5800	8800	7000	7640
Nickel	38	10	19	12	< 18
Sodium	47,000	14,000	13,000	24,000	23,000
Vanadium	99	33	53	45	44
OTHER ANALYSES:					
Cyanide	91	38	13	7.1	68
Fluoride	20,000	11,000	9200	11,000	13,000
Sulfate	1900	< 50	470	690	< 100
Phenolics	7.7	2.8	1.1	12	27
PCBs	6.4	0.27	0.89	1.0	8.2

TABLE 4-17
(continued)

METALS:	WS-14 (ppm)	WS-13 (ppm)	WDS-1 (ppm)	WCAS-1 (ppm)	WDS-2 (ppm)
Aluminum	29,000	35,000	20,000	17,000	16,000
Arsenic	38	26	16	7.4	8.1
Calcium	21,000	49,000	8200	4300	5800
Chromium	28	37	28	23	22
Cobalt	5.0	7.6	6.0	5.9	6.3
Iron	14,000	22,000	16,000	16,000	15,000
Magnesium	7800	12,000	5200	3800	3900
Nickel	14	25	14	11	12
Sodium	8100	4000	600	460	760
Vanadium	47	67	33	32	28
OTHER ANALYSES:					
Cyanide	31	12	1.9	< 1	27
Fluoride	2900	1000	370	< 20	220
Sulfate	270	430	< 50	< 40	< 40
Phenolics	1.0	0.9	1.9	17.2	40
PCBs	1.3	19.0	5.6	< 0.14	7.5

TABLE 4-17
(continued)

METALS:	EDS-2 (ppm)	EDS-1 (ppm)	WSDup-2 (ppm)
Aluminum	17,000	76,000	33,000
Arsenic	15	77	31
Calcium	5000	65,000	11,000
Chromium	25	57	32
Cobalt	8.5	20	7.7
Iron	16,000	40,000	17,000
Magnesium	4100	20,000	6400
Nickel	13	58	20
Sodium	610	15,00	4400
Vanadium	40	130	45
OTHER ANALYSES:			
Cyanide	< 1	15	21
Fluoride	180	5600	2100
Sulfate	< 40	< 100	< 40
Phenolics	< 0.2	1.0	0.6
PCBs	< 0.14	11.0	0.10



REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
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BLACK MUD POND AREA
BASE MAP

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 1
Scale: N.T.S.		

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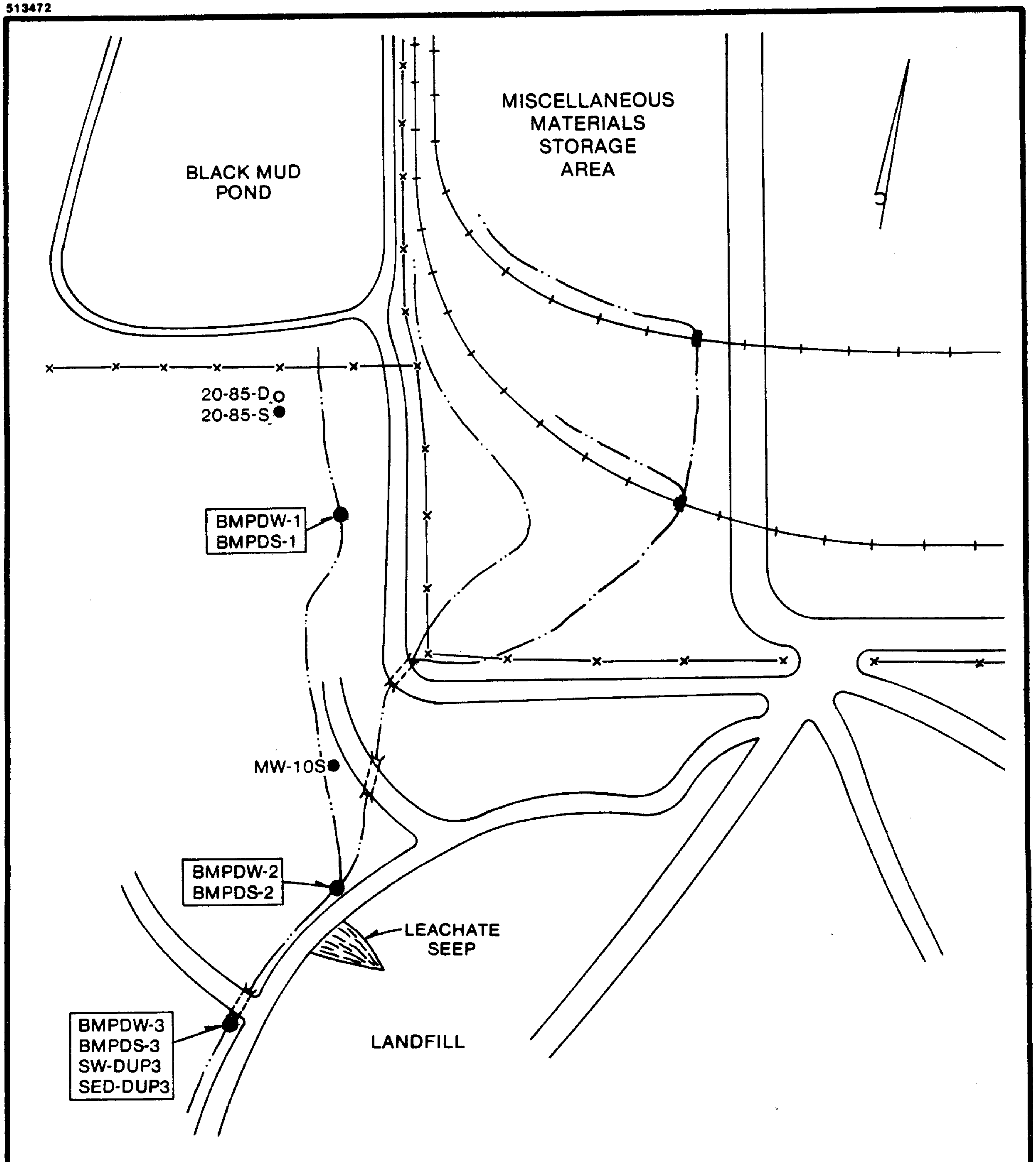


LEGEND:

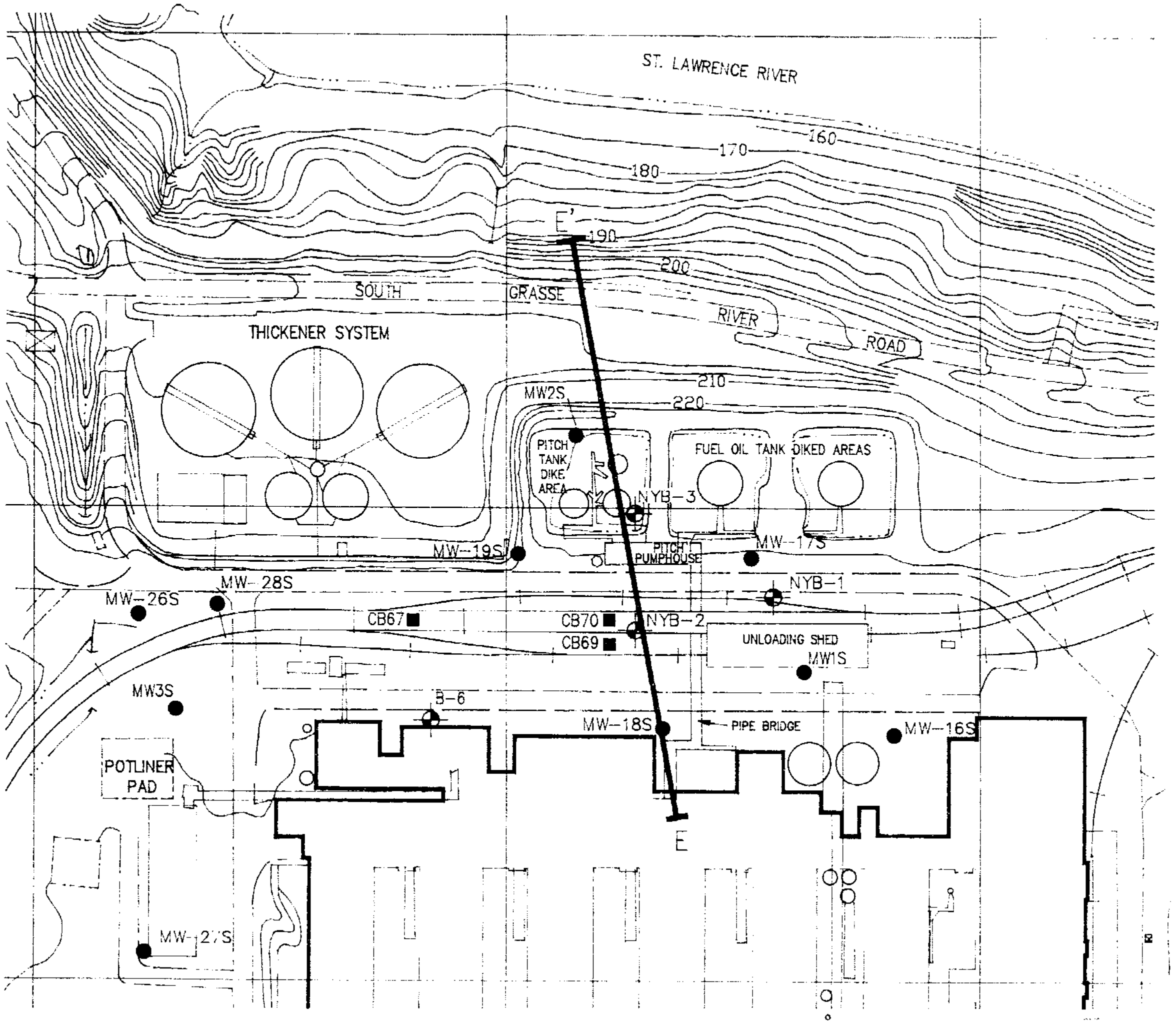
● SEDIMENT AND AQUEOUS SAMPLE LOCATIONS

• SHALLOW MONITORING WELL

○ DEEP MONITORING WELL

BLACK MUD POND DRAINAGE SURFACE WATER/SEDIMENT SAMPLE LOCATION MAP REYNOLDS METALS COMPANY MASSENA, NEW YORK		
Drawn by: J.C.	SCALE IN FEET	Date: 6/26/90
Checked by: P.R.J.	N.T.S.	Job: 89C2515A-3

FIGURE 2



LEGEND:

- ● SHALLOW MONITORING WELL
- ⌖ BORING LOCATION
- ■ STORMWATER CATCH BASIN

NOTE: See Figure 18 for Cross-Section E-E'

Rev. No.	Date	Type of Revision	Checked by:

NORTH YARD WELL, SOIL BORING AND
CATCH BASIN SAMPLING LOCATIONS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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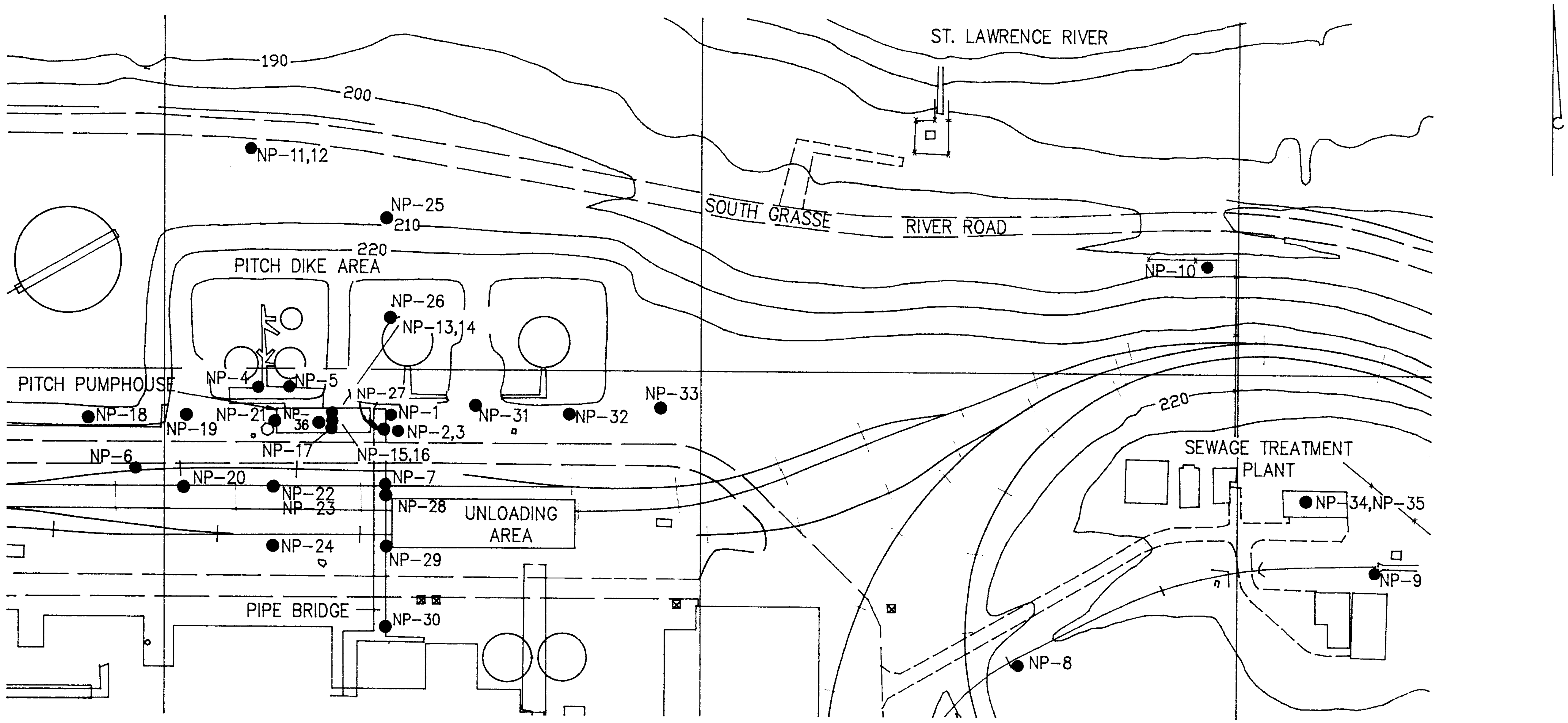
Job No.: 89C2515A-3	Drawing No. 95150600	Date: 6/26/90
Drawn by: T.P.	Checked by: M.K.	FIGURE 3
Scale: 0 — 100 FEET		



LEGEND:

- NP-30 ● – PHASE II PCDF / PCDD SAMPLE LOCATION (NP-18 THROUGH NP-37)
- NP-7 ● – PHASE I PCDF / PCDD SAMPLE LOCATION (NP-1 THROUGH NP-17)
- NP-13 ● – SAMPLES NP-13, 14 REPRESENT HTM OIL SAMPLED FROM A VALVE IN THE PITCH PUMPHOUSE
- NP-16 ● – SAMPLES NP-15, 16 REPRESENT FLOOR SCRAPING FROM THE LOWER LEVEL OF THE PITCH PUMPHOUSE
- NP-17 ● – SAMPLE NP-17 REPRESENTS A COMPOSITE FLOOR SCRAPING FROM THE EASTERN END OF THE PITCH PUMPHOUSE
- NP-36 ● – NP-36 IS A SAMPLE OF HTM FLUID FROM A FORMER STORAGE VESSEL
- NP-37 ● – SAMPLE NP-37 IS A BACKGROUND SAMPLE FROM A LOCATION WEST OF THE PLANT
- ● PHASE I PCDF/PCDD SAMPLE LOCATION
- ● PHASE II PCDF/PCDD SAMPLE LOCATION

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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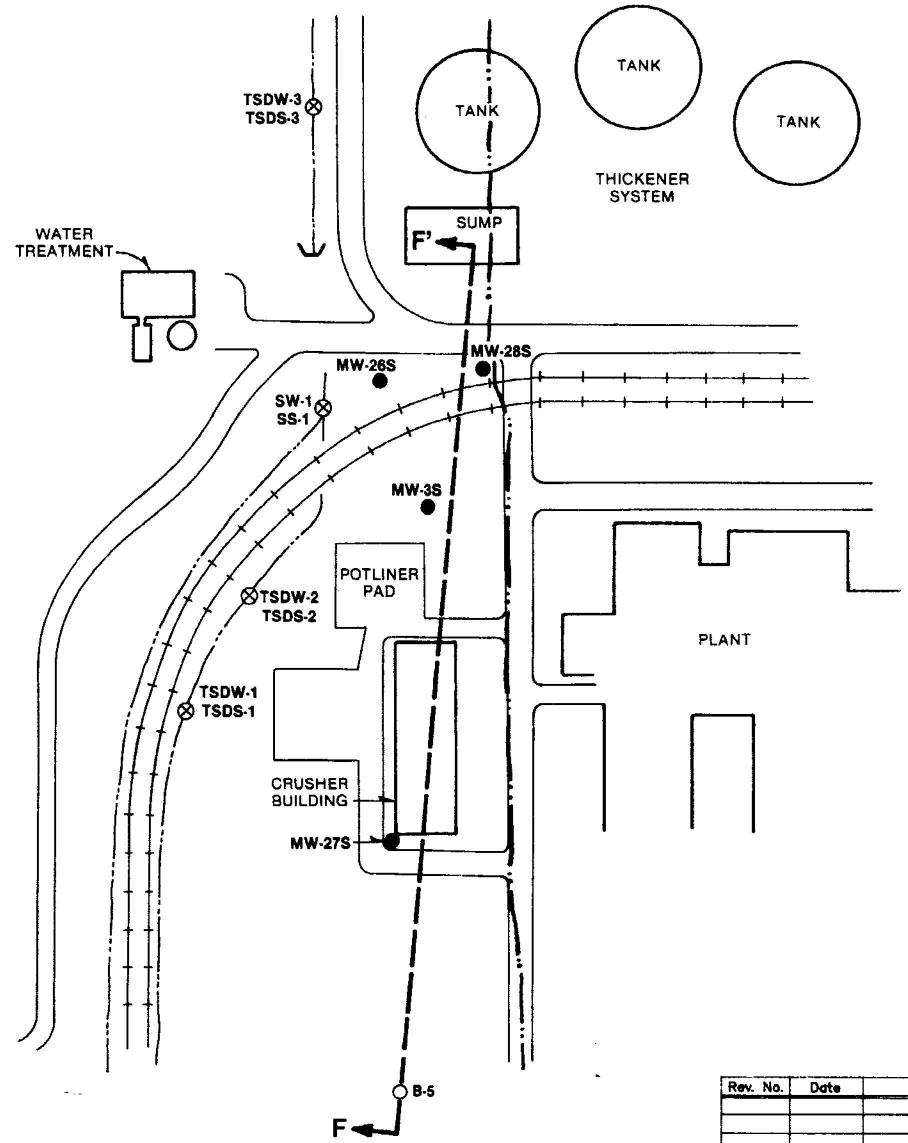
PCDF / PCDD
SAMPLE LOCATION MAP

Job No.: 89C2515A-3	Drawing No. 95150070	Date: 6/26/90
Checked by: G.W.C.	Rev. No.:	FIGURE 4
Scale: 0 — 100 FEET		



LEGEND:

● SHALLOW MONITORING WELL

⊗ SURFACE WATER AND SEDIMENT SAMPLE LOCATION

○ BORING LOCATION

—·· FORMER STREAM BED

Rev. No.	Date	Type of Revision	Checked by:

POTLINER PAD AREA
SURFACE WATER/SEDIMENT SAMPLE
LOCATION MAP
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
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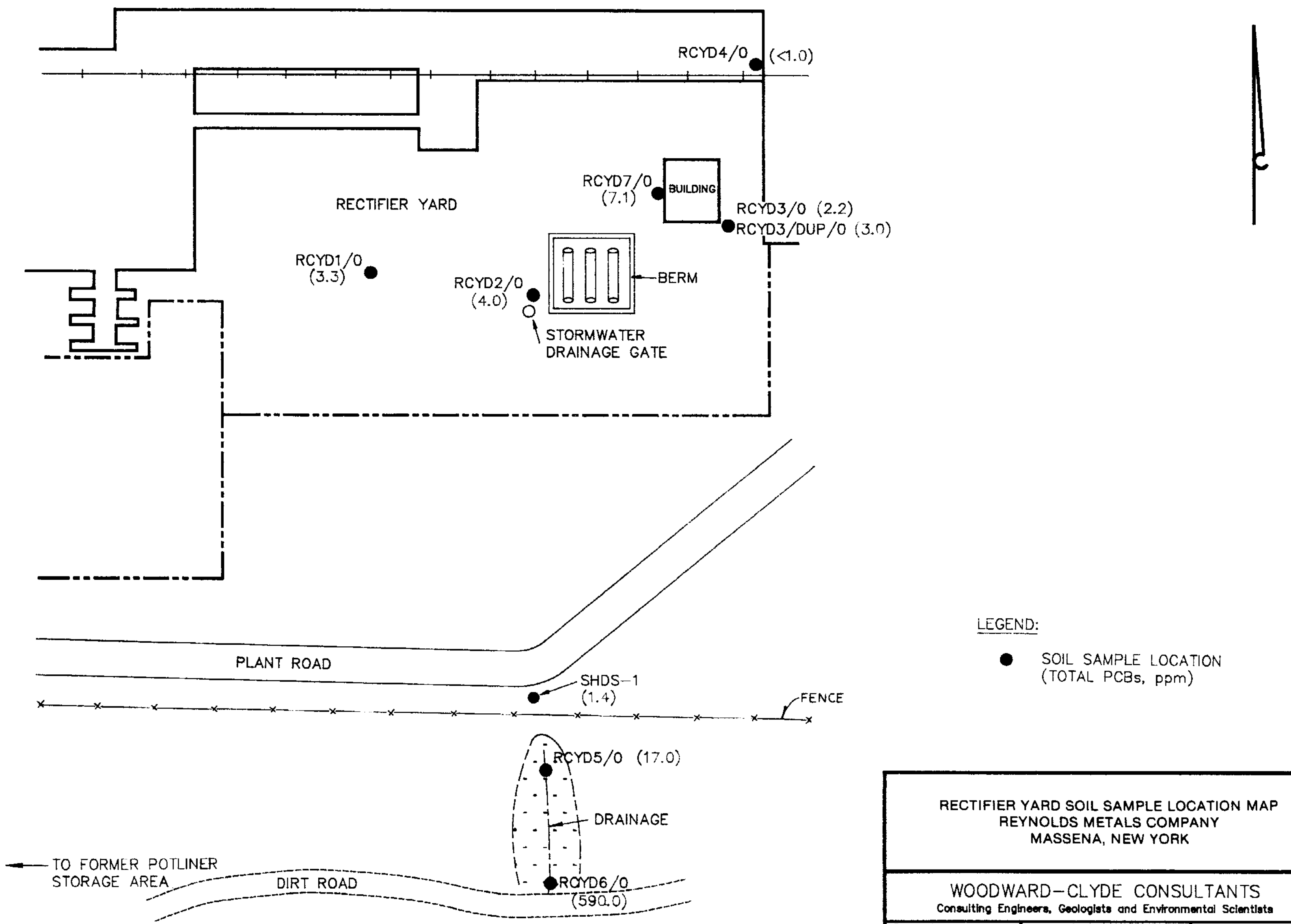
Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: M.M.K.	FIGURE 5
Scale: 0 100'		



RECTIFIER YARD SOIL SAMPLE LOCATION MAP
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
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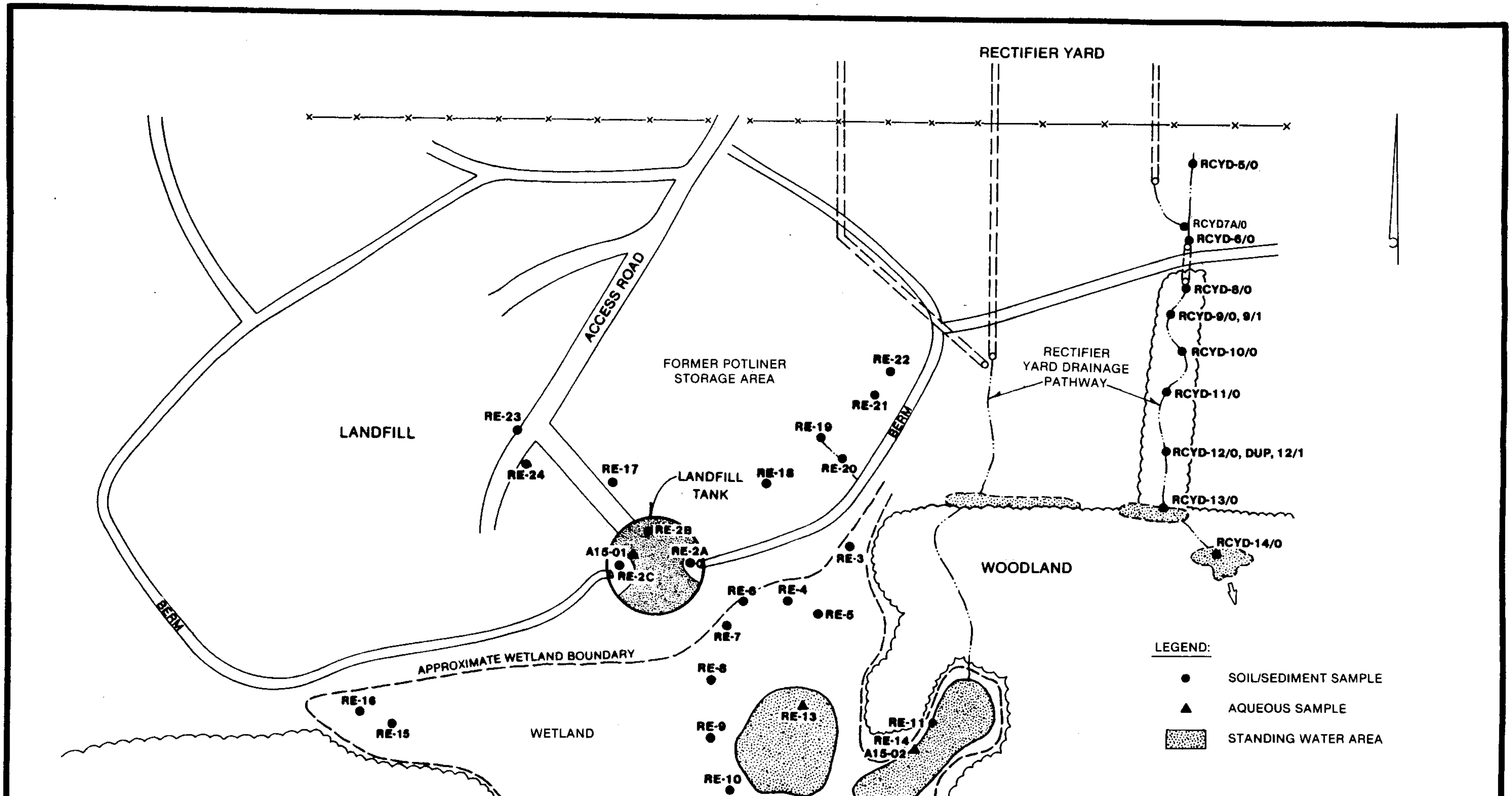
Drawn by: T.P.	Scale in Feet	Date: 6/26/90
Checked by: P.R.J.	NTS	Job No.: 89C2515A-3

FIGURE 6



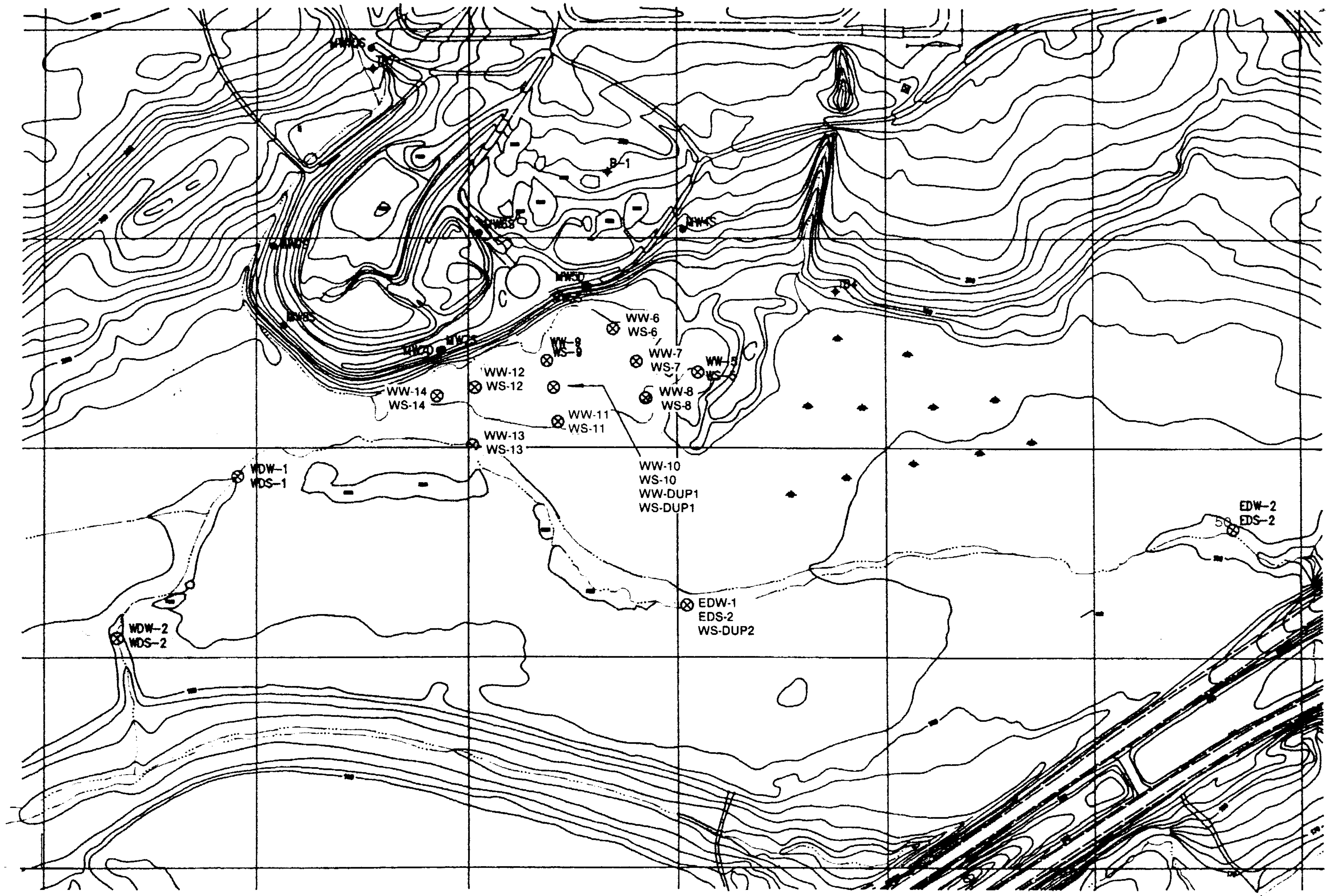
LOCATION MAP OF RECTIFIER YARD DRAINAGE SAMPLES
AND FORMER POTLINER STORAGE AREA/
WETLAND NYSDEC SAMPLE SPLITS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by J.C.	SCALE IN FEET	Date 6/26/90	
Checked by P.R.J.	N.T.S.	Job 89C2515 A-3	

FIGURE 7



LEGEND:

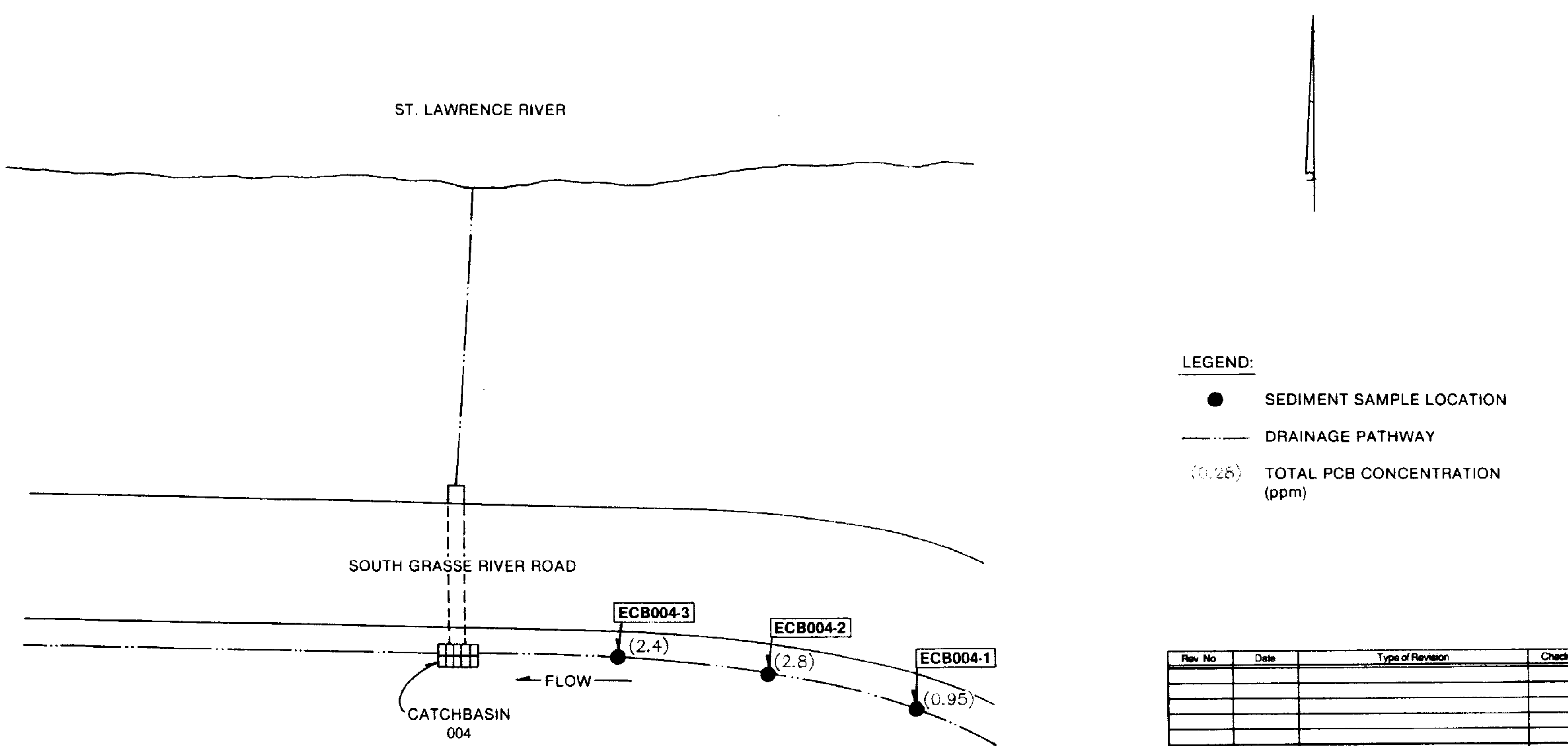
⊗ AQUEOUS AND SEDIMENT SAMPLE LOCATION

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

WETLANDS SAMPLE LOCATIONS

Job No.: 89C2515-1	Drawing No. 95150270	Date: 6/26/90
Checked by: P.R.J.	Rev. No.:	FIGURE 8
Scale: 0 — 300 FEET		

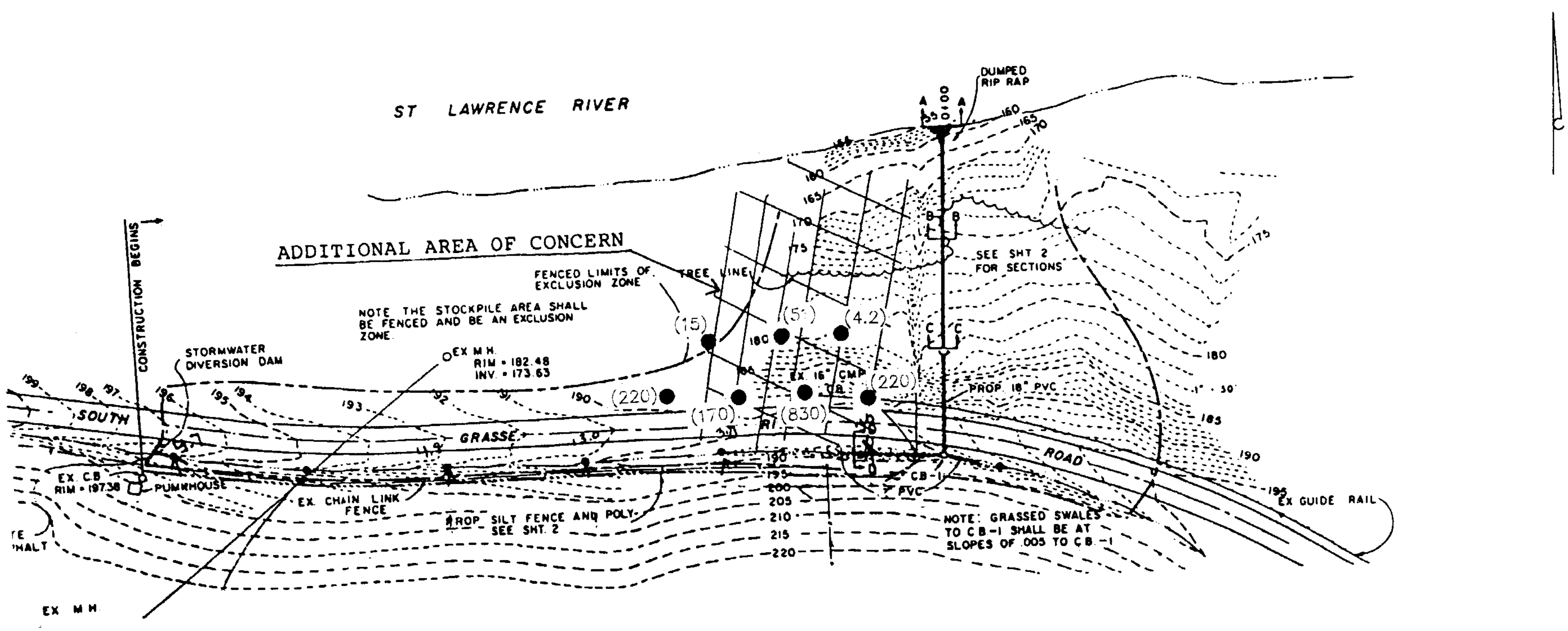


Rev No	Date	Type of Revision	Checked By:

CATCHBASIN 004 AREA SEDIMENT
SAMPLE LOCATION MAP
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

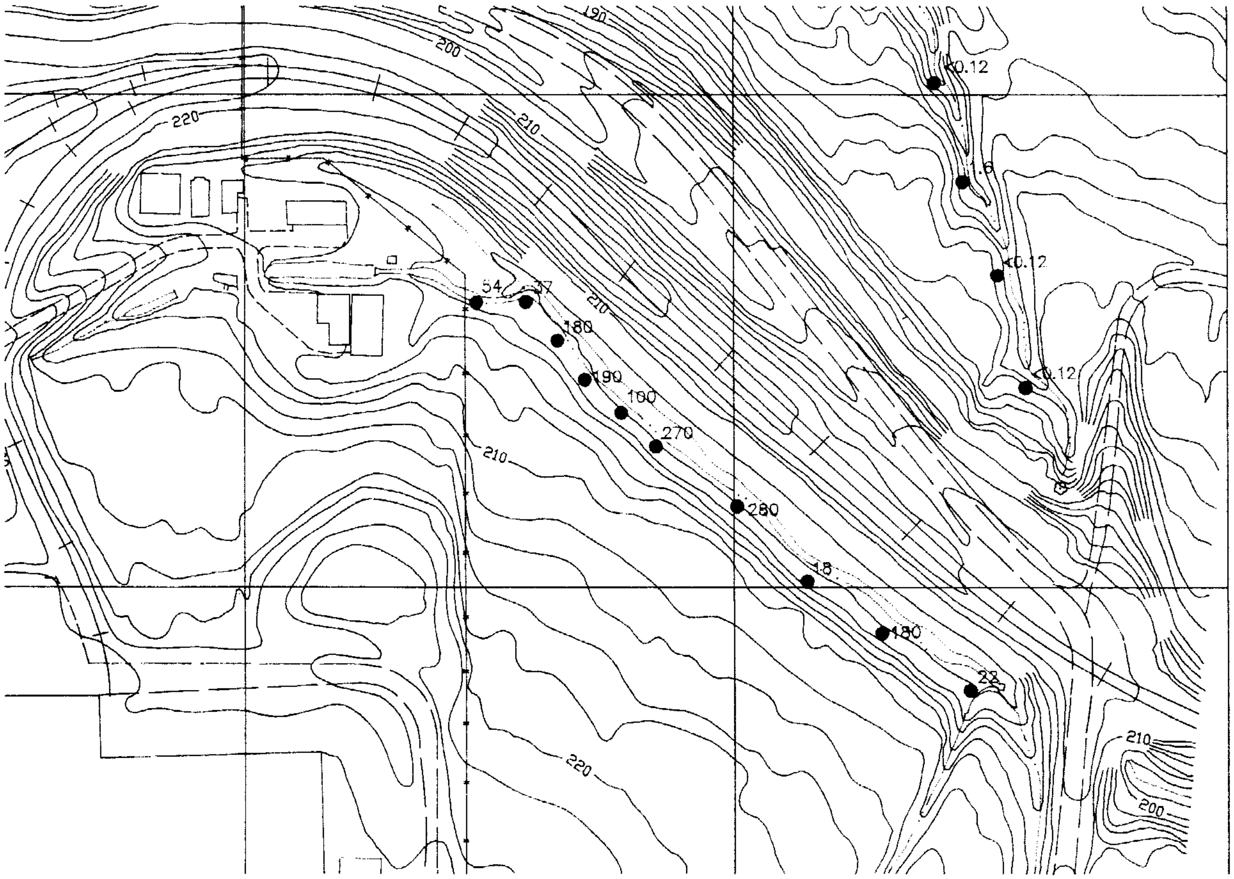
Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: P.R.J.	FIGURE 9
Scale: NOT TO SCALE		



LEGEND

- EXISTING GRADE
- EXISTING SWALE
- PROPOSED SWALE
- PROPOSED SILT FENCE
- PROPOSED CATCH BASIN, STORM SEWER & END SECTION
- ● SOIL SAMPLE LOCATION
- (15) TOTAL PCB CONCENTRATION (ppm)

REYNOLDS METALS COMPANY MASSENA, NEW YORK		
WOODWARD-CLYDE CONSULTANTS Consulting Engineers, Geologists and Environmental Scientists		
SOIL SAMPLE LOCATION AREA NORTH OF SOUTH GRASSE RIVER ROAD		
Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90
Checked by: P.R.J.	Rev. No.:	FIGURE 10
Scale: 50 0 50 100		



LEGEND:

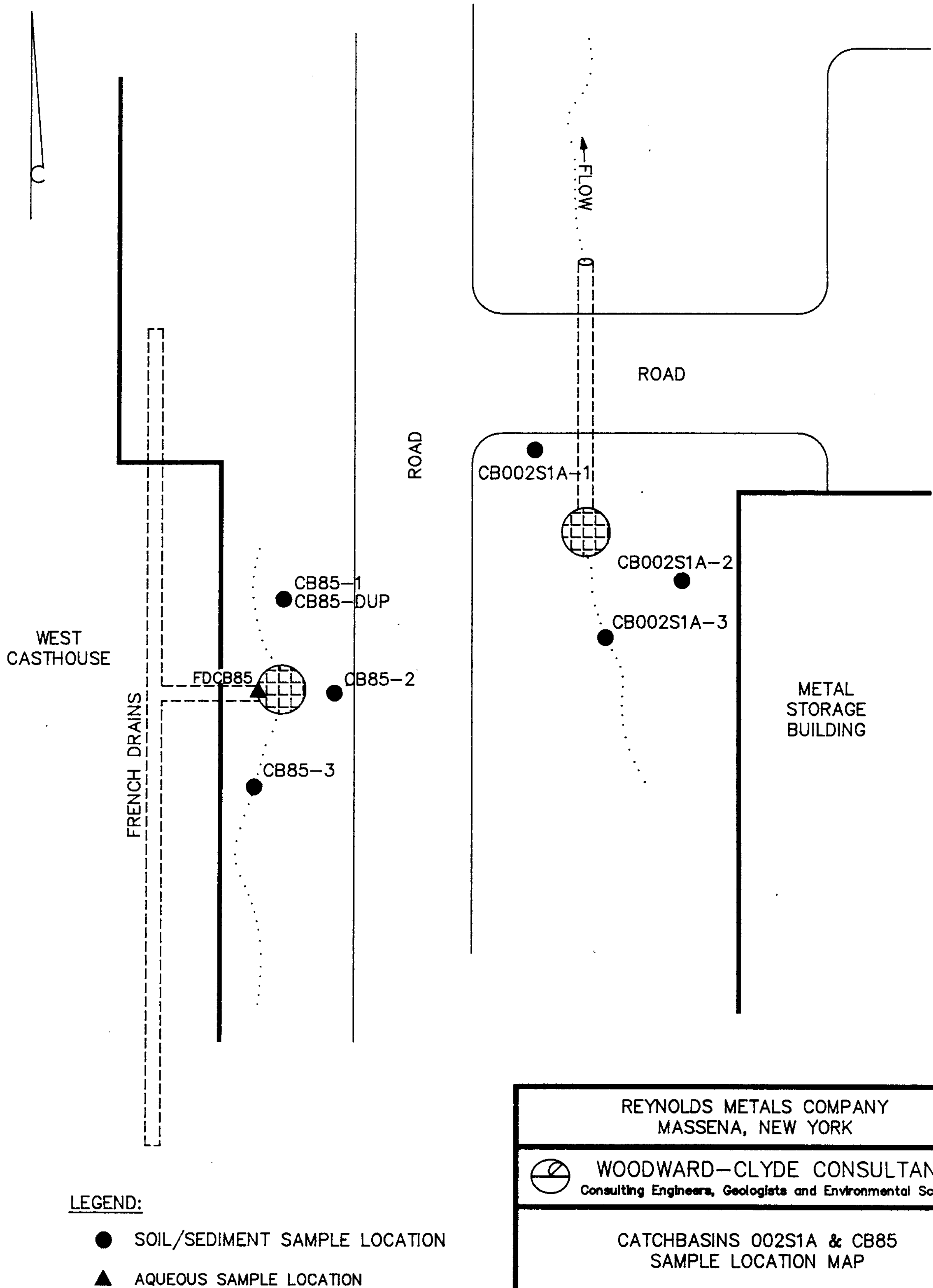
● 11/21/89 SAMPLE LOCATION AND ANALYTICAL RESULT (TOTAL PCBs, ppm)

Rev. No.	Date	Type of Revision	Checked by:

002 DITCH
SAMPLE LOCATION MAP
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515	Drawing No. 95150300	Date: 6/26/90
Drawn by: TFP	Checked by: GWC	FIGURE 11
Scale: 0 — 200'		



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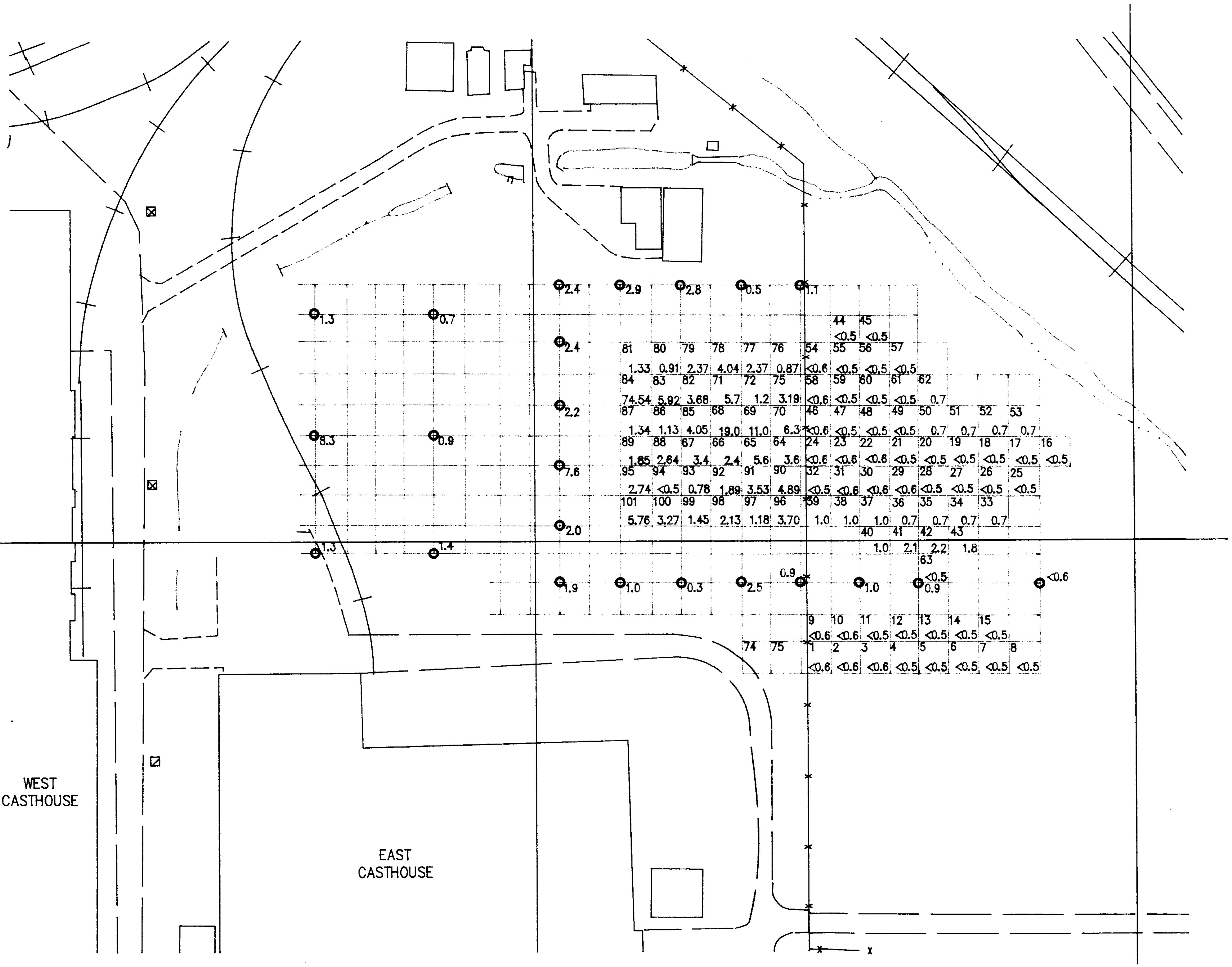
CATCHBASINS 002S1A & CB85
SAMPLE LOCATION MAP

Job No.: 89C2515-1	Drawing No. 95150060	Date: 6/26/90
Checked by:	Rev. No.:	FIGURE 12
Scale: NTS		



LEGEND:

25 — OBG GRID NUMBER

<0.5 — SOIL SAMPLE PCB CONCENTRATION (ppm)

o 11/21/89 SAMPLE LOCATION (PCB CONCENTRATION IN PPM)

NOTE: GRIDS COMPRISING A COMPOSITE SAMPLE ARE LISTED WITH THE COMPOSITE ANALYTICAL RESULT.

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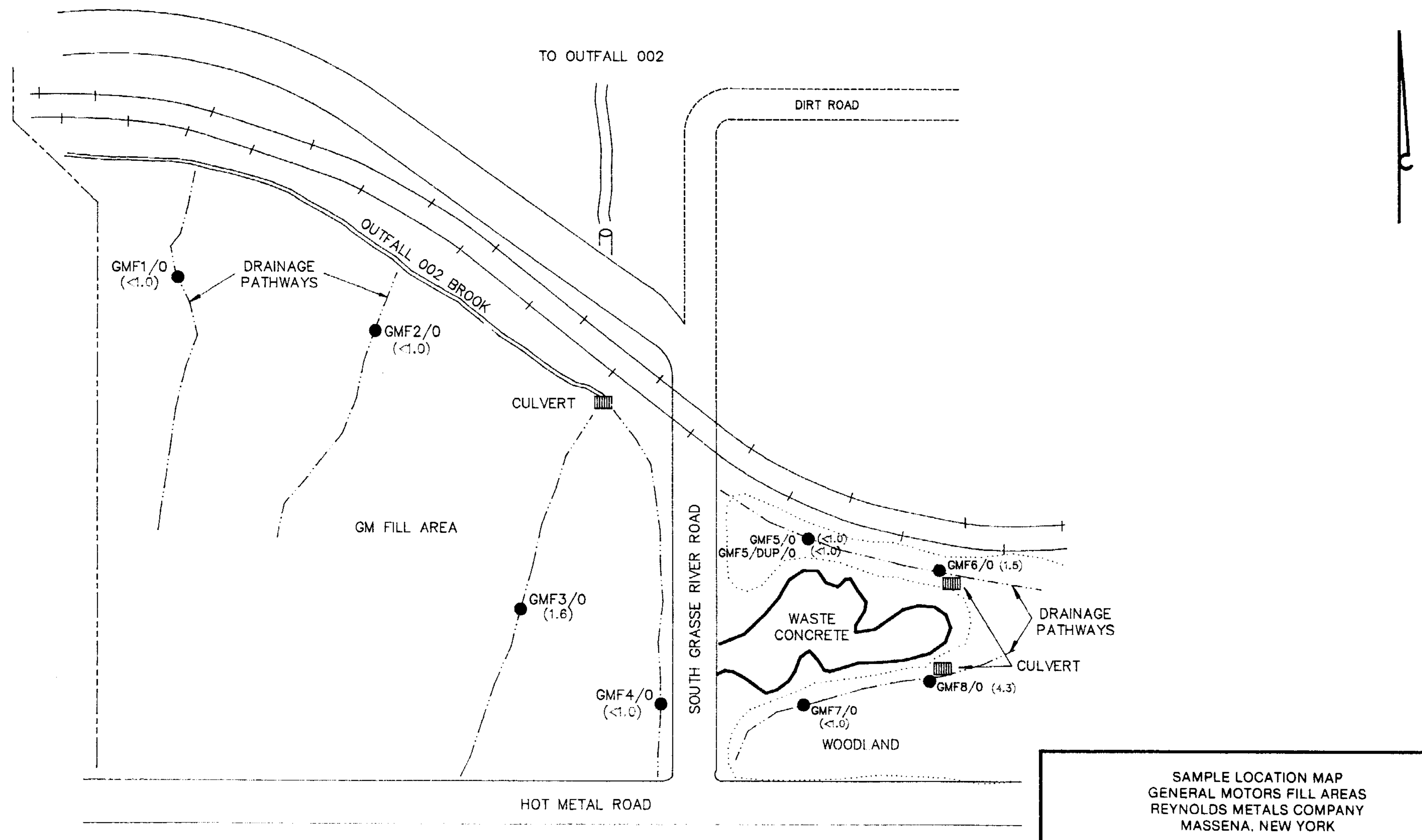
SOIL SAMPLE LOCATION MAP
AREA OF OUTFALL 002 DIVERSION

Job No.: 89C2515	Drawing No. 95150011	Date: 6/26/90
Checked by: P.R.J.	Rev. No.:	FIGURE 13
Scale: 0 — 100 FEET		

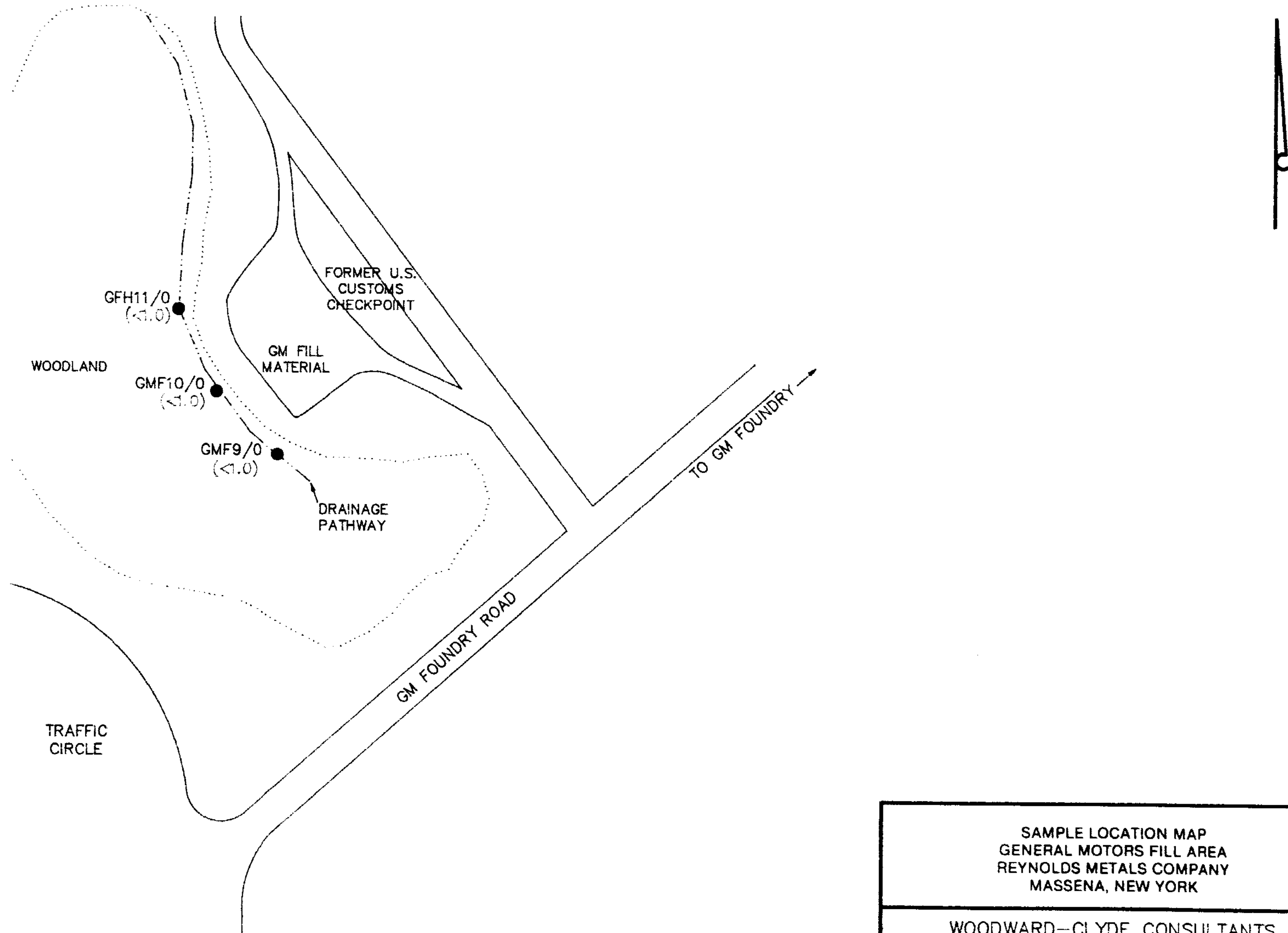


SAMPLE LOCATION MAP
GENERAL MOTORS FILL AREAS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD–CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

Drawn by: T.P.	Scale in Feet	Date: 6/26/90
Checked by: P.R.J.	NTS	Job No.: 89C2515A-3

FIGURE 14

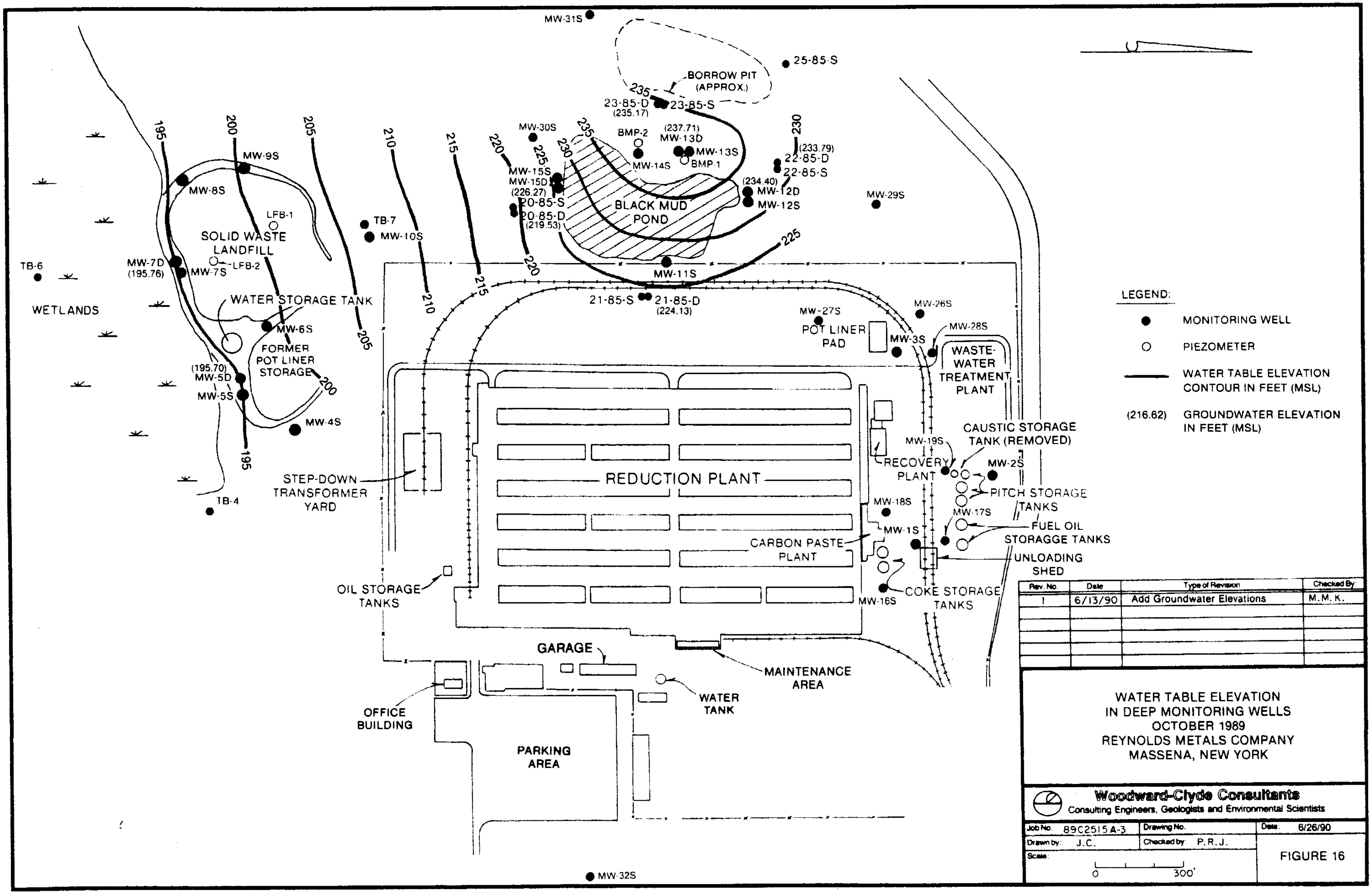


SAMPLE LOCATION MAP
GENERAL MOTORS FILL AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

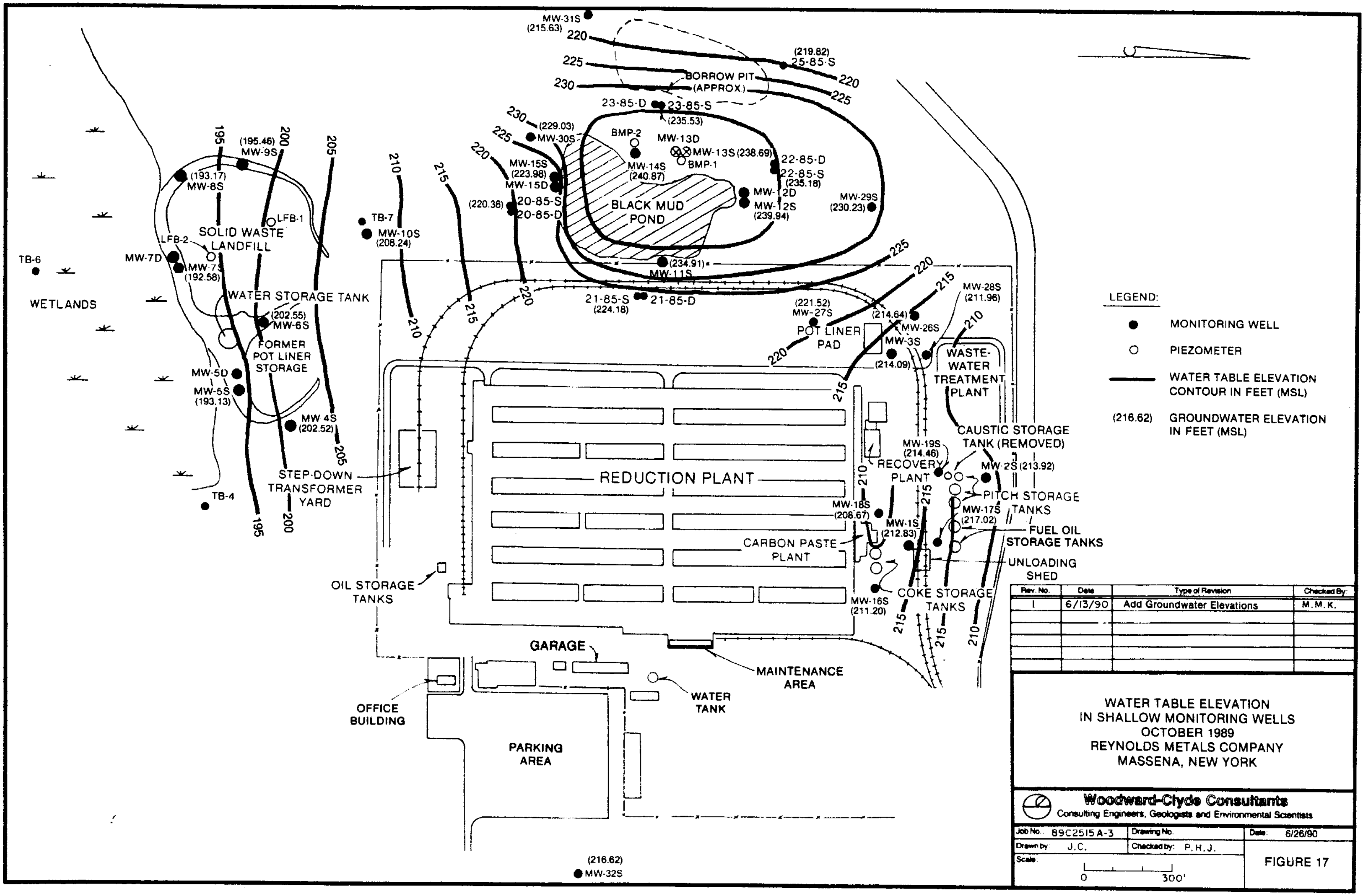
WOODWARD–CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

Drawn by: T.P.	Scale in Feet	Date: 6/26/90
Checked by: P.R.J.	NTS	Job No.: 89C2515A-3

FIGURE 15



LEGEND:
MONITORING WELL
PIEZOMETER
WATER TABLE ELEVATION CONTOUR IN FEET (MSL)
(216.62) GROUNDWATER ELEVATION IN FEET (MSL)
BORROW PIT (APPROX.)
BLACK MUD POND
SOLID WASTE LANDFILL
WATER STORAGE TANK
FORMER POT LINER STORAGE
WETLANDS
STEP-DOWN TRANSFORMER YARD
REDUCTION PLANT
OIL STORAGE TANKS
GARAGE
OFFICE BUILDING
PARKING AREA
WATER TANK
MAINTENANCE AREA
CARBON PASTE PLANT
COKE STORAGE TANKS
UNLOADING SHED
FUEL OIL STORAGGE TANKS
PITCH STORAGE TANKS
CAUSTIC STORAGE TANK (REMOVED)
RECOVERY PLANT
WASTE-WATER TREATMENT PLANT
POT LINER PAD
MW-31S
25-85-S
23-85-D (235.17)
23-85-S
MW-30S
BMP-2
(237.71) MW-13D
MW-13S
BMP-1
MW-14S
(233.79) 22-85-D
22-85-S
(234.40) MW-12D
MW-12S
MW-29S
MW-15S
MW-15D (226.27)
20-85-S
20-85-D (219.53)
MW-11S
21-85-S
21-85-D (224.13)
MW-27S
MW-26S
MW-28S
MW-3S
MW-9S
MW-8S
LFB-1
LFB-2
TB-7
MW-10S
TB-6
MW-7D (195.76)
MW-7S
MW-6S
(195.70) MW-5D
MW-5S
MW-4S
TB-4
MW-19S
MW-2S
MW-17S
MW-18S
MW-1S
MW-16S
MW-32S
195
200
205
210
215
220
225
230
235
| Rev. No. | Date | Type of Revision | Checked By |
| 1 | 6/13/90 | Add Groundwater Elevations | M. M. K. |
WATER TABLE ELEVATION
IN DEEP MONITORING WELLS
OCTOBER 1989
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Job No. 89C2515A-3
Drawing No.
Date 6/26/90
Drawn by: J.C.
Checked by: P.R.J.
Scale:
0
300'
FIGURE 16

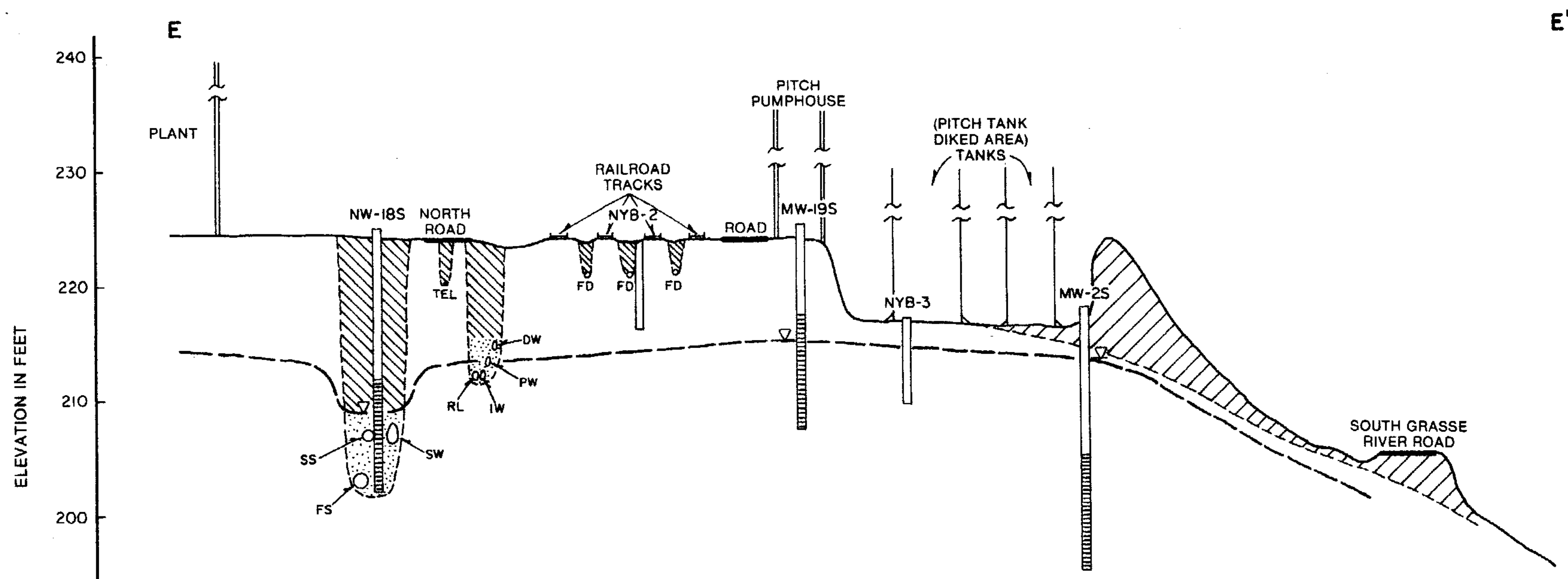


Rev. No.	Date	Type of Revision	Checked By
1	6/13/90	Add Groundwater Elevations	M.M.K.

WATER TABLE ELEVATION
IN SHALLOW MONITORING WELLS
OCTOBER 1989
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No. 89C2515A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: P.H.J.	FIGURE 17
Scale: 0 — 300'		



LEGEND:

FD	FRENCH DRAIN
FS	FUME SCRUBBER
DW	DOMESTIC WATER
IW	IMPINGEMENT WATER
PW	PROGRESS WATER
RL	FUME SCRUBBER RECYCLE LIQUOR
SS	SANITARY SEWER
SW	STORM WATER
TEL	TELEPHONE
▽	MEASURED GROUNDWATER LEVEL (5/90)
— —	ESTIMATED WATER TABLE
(hatched)	BACKFILLED TILL
(stippled)	MED-COARSE SAND UTILITY TRENCH BACKFILL
(hatched)	CONSTRUCTION FILL

NOTES:

1) Approximate depth to till in all areas of the North Yard except those noted above is 2 to 4 feet.

2) Refer to Figure 3 for Cross-Section location.

Rev. No.	Date	Type of Revision	Checked by:

CROSS-SECTION E-E'
NORTH YARD AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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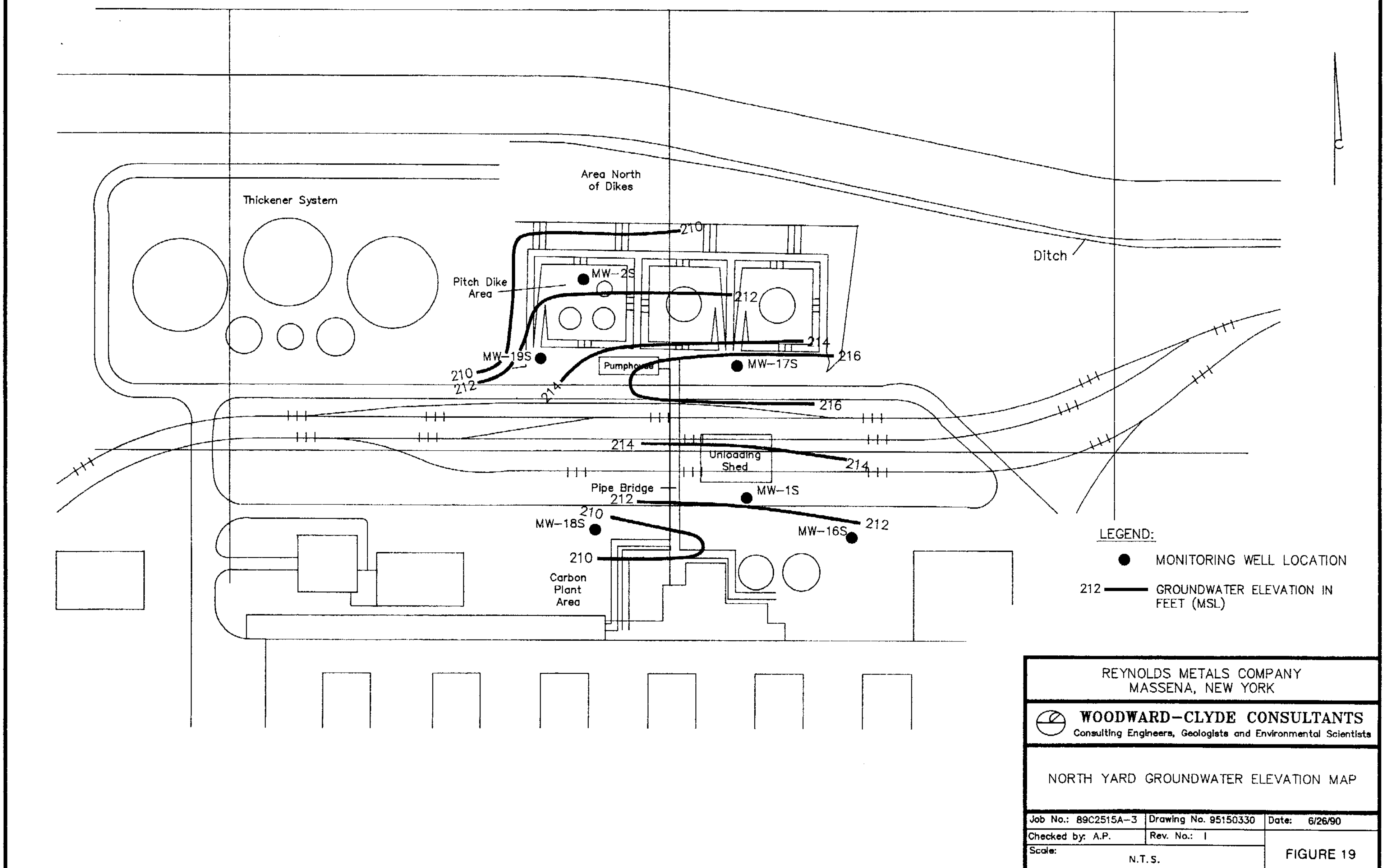
Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: P.R.J.	FIGURE 18
Scale: 0 — 50'		



REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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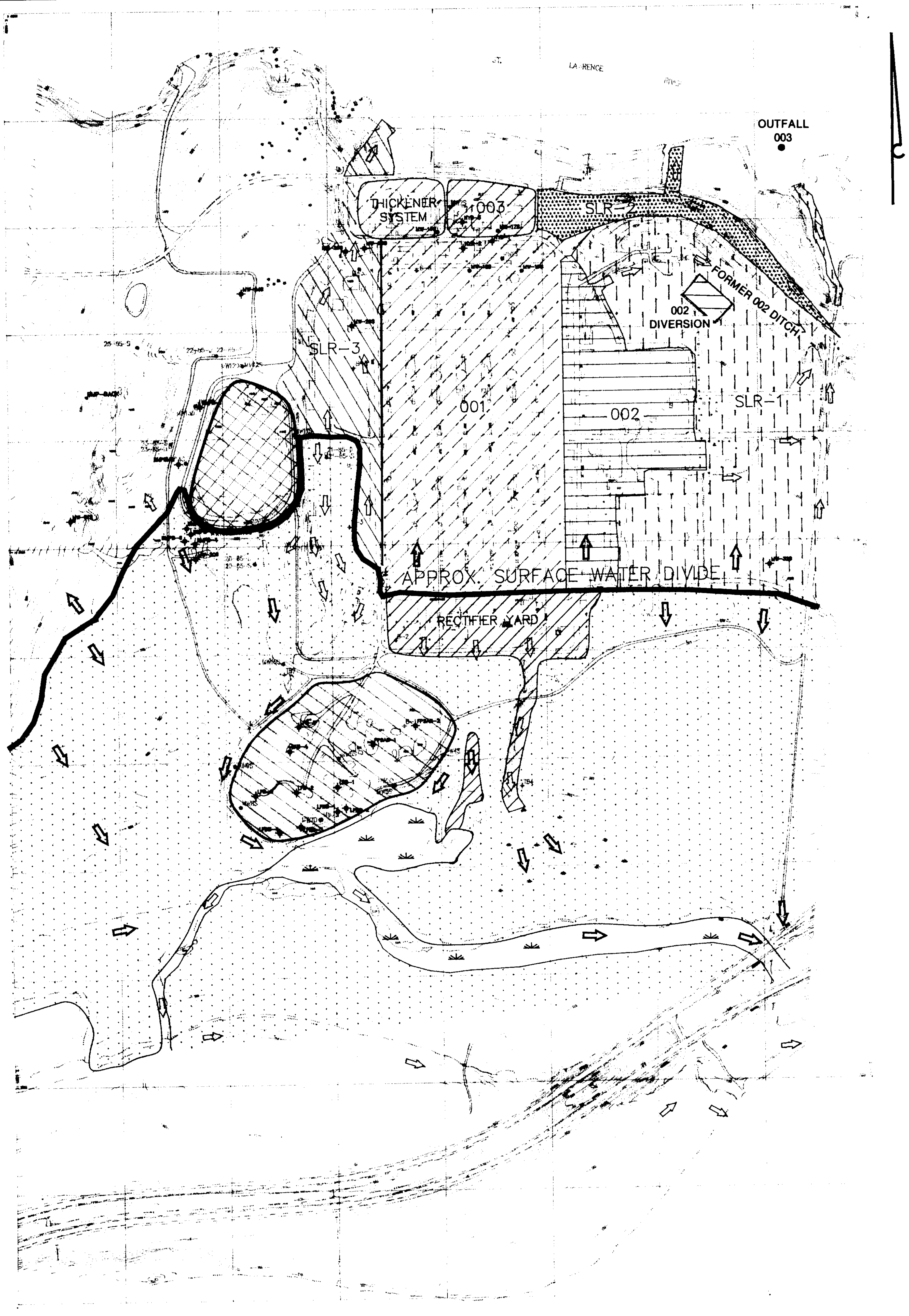
NORTH YARD GROUNDWATER ELEVATION MAP

Job No.: 89C2515A-3	Drawing No. 95150330	Date: 6/26/90
Checked by: A.P.	Rev. No.: 1	FIGURE 19
Scale: N.T.S.		



REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
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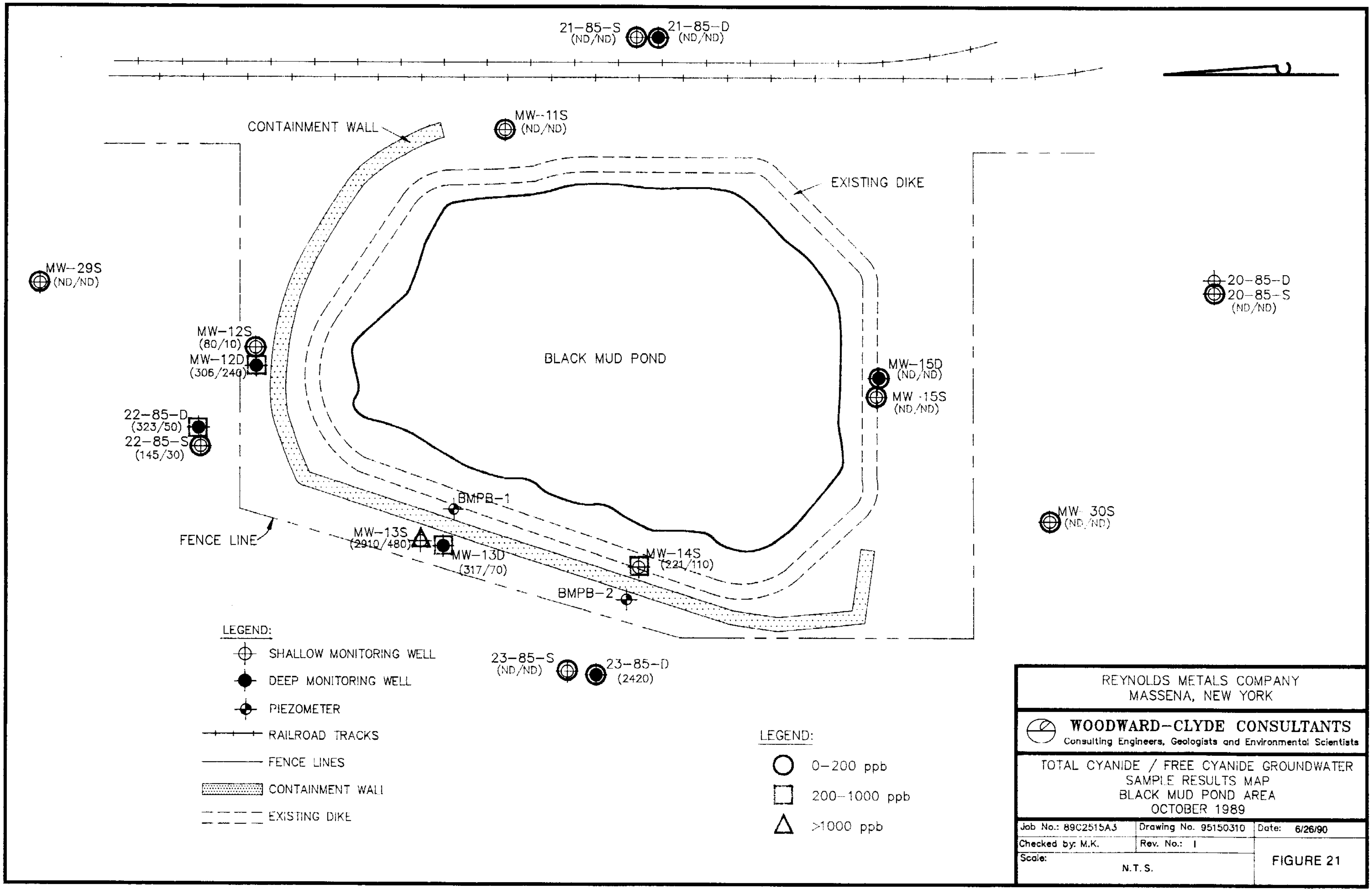
SITE SURFACE WATER DRAINAGE AREA MAP

Job No.: 89C2515-A3	Drawing No.	Date: 6/26/90
Checked by: PRJ	Rev. No.:	FIGURE 20
Scale: 0 200 400 FEET		



REYNOLDS METALS COMPANY
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WOODWARD-CLYDE CONSULTANTS
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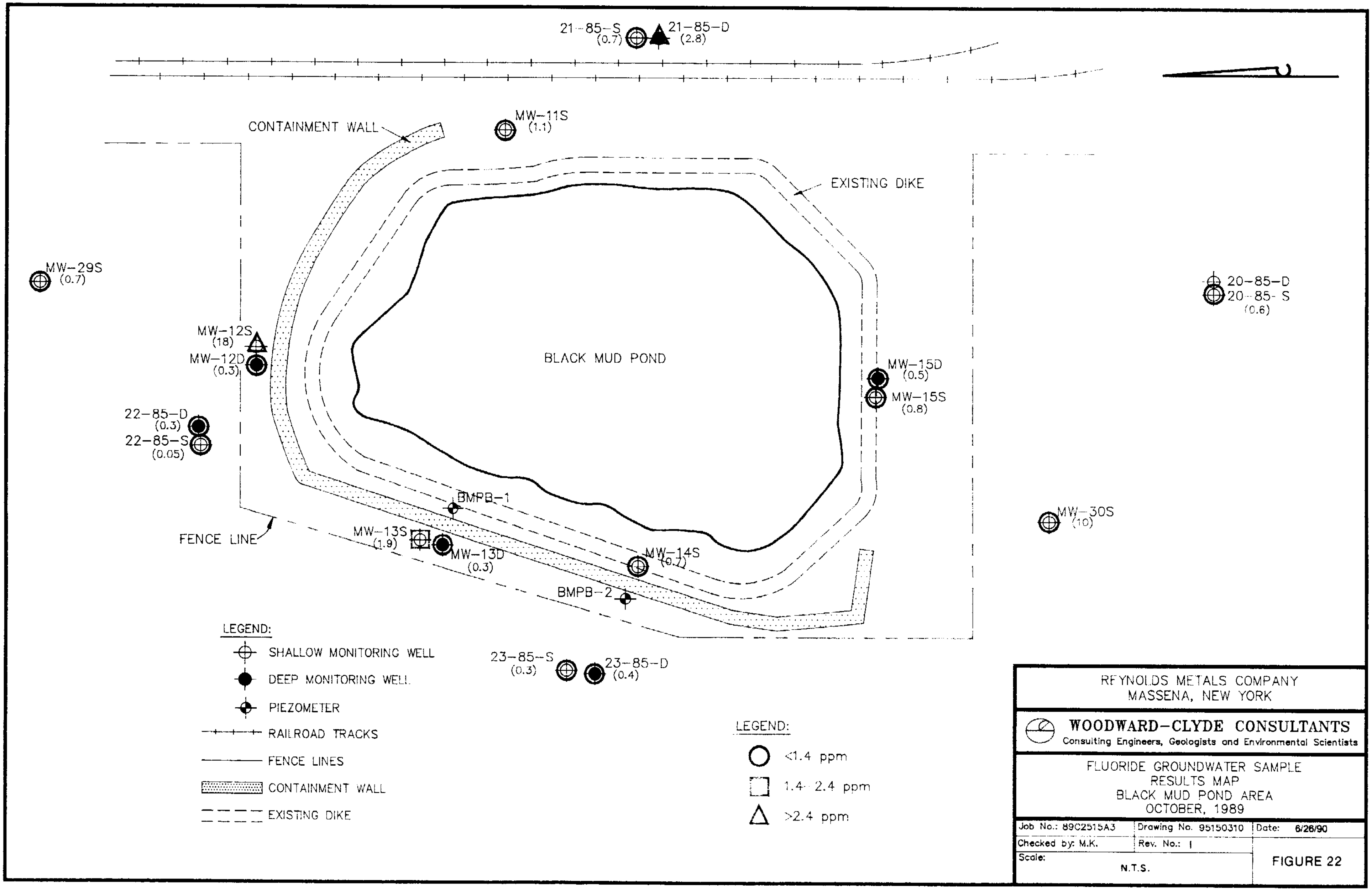
TOTAL CYANIDE / FREE CYANIDE GROUNDWATER
SAMPLE RESULTS MAP
BLACK MUD POND AREA
OCTOBER 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 21
Scale: N.T.S.		



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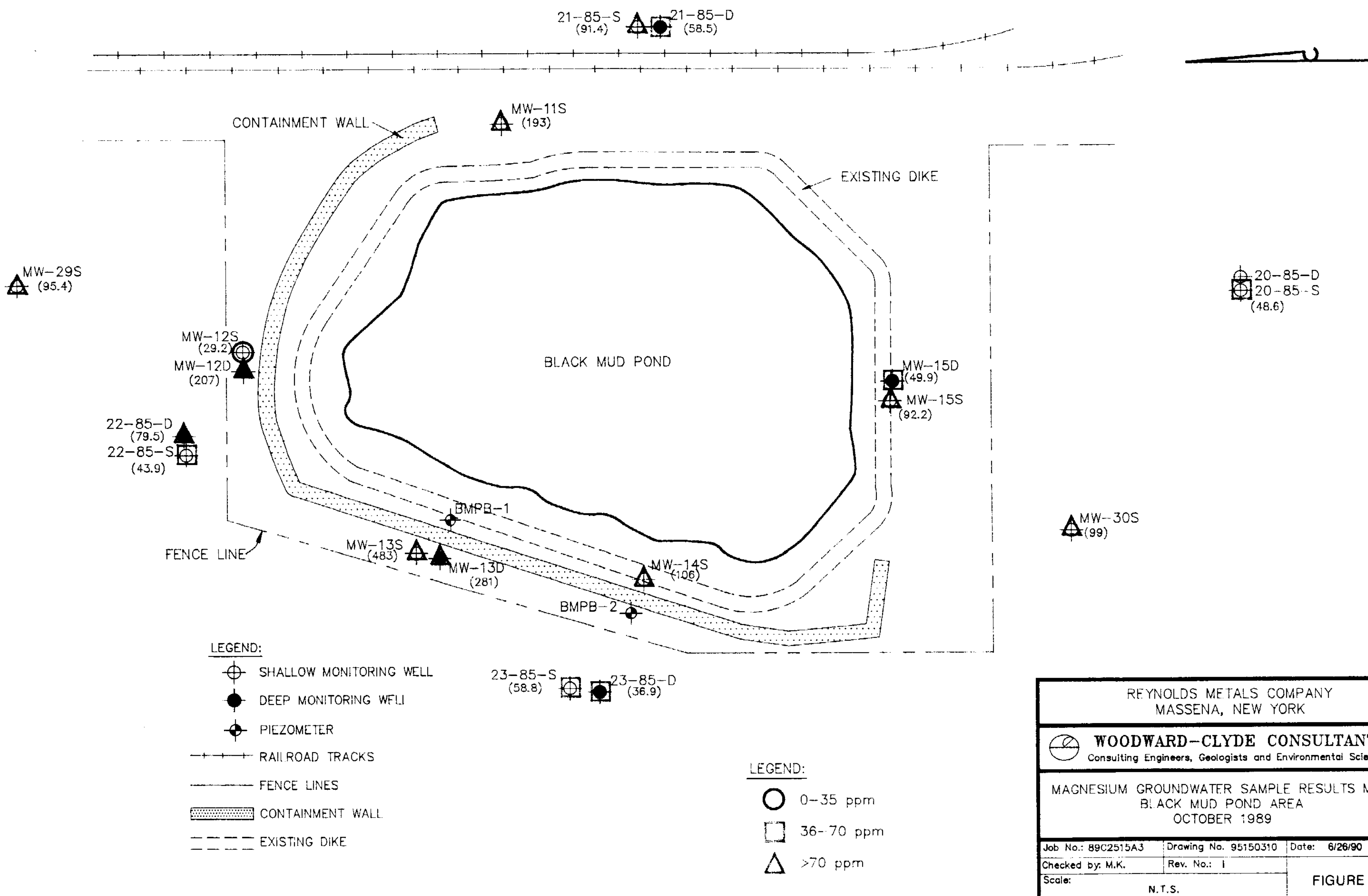
FLUORIDE GROUNDWATER SAMPLE
RESULTS MAP
BLACK MUD POND AREA
OCTOBER, 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 22
Scale: N.T.S.		

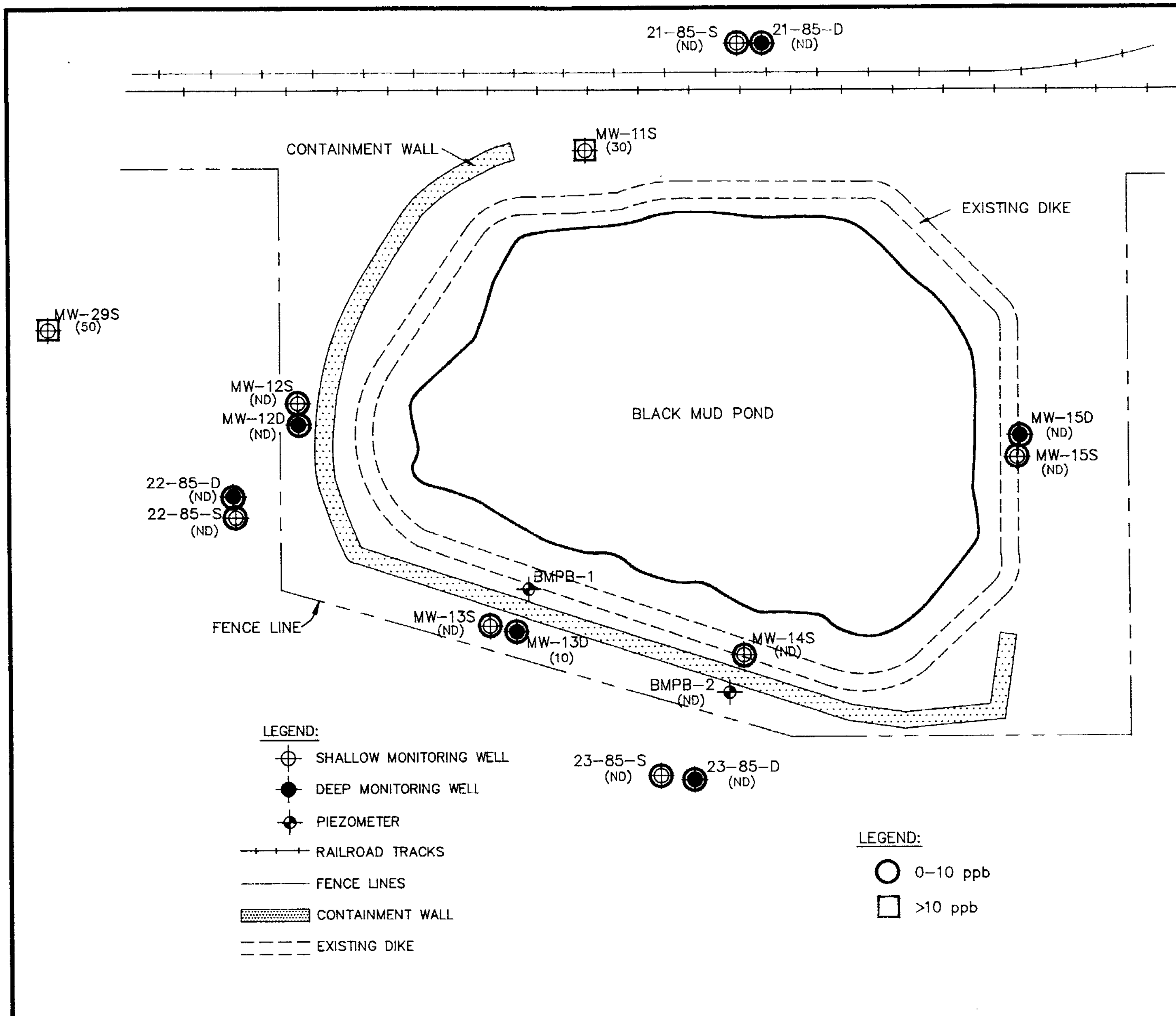


REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

MAGNESIUM GROUNDWATER SAMPLE RESULTS MAP
BLACK MUD POND AREA
OCTOBER 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 23
Scale: N.T.S.		

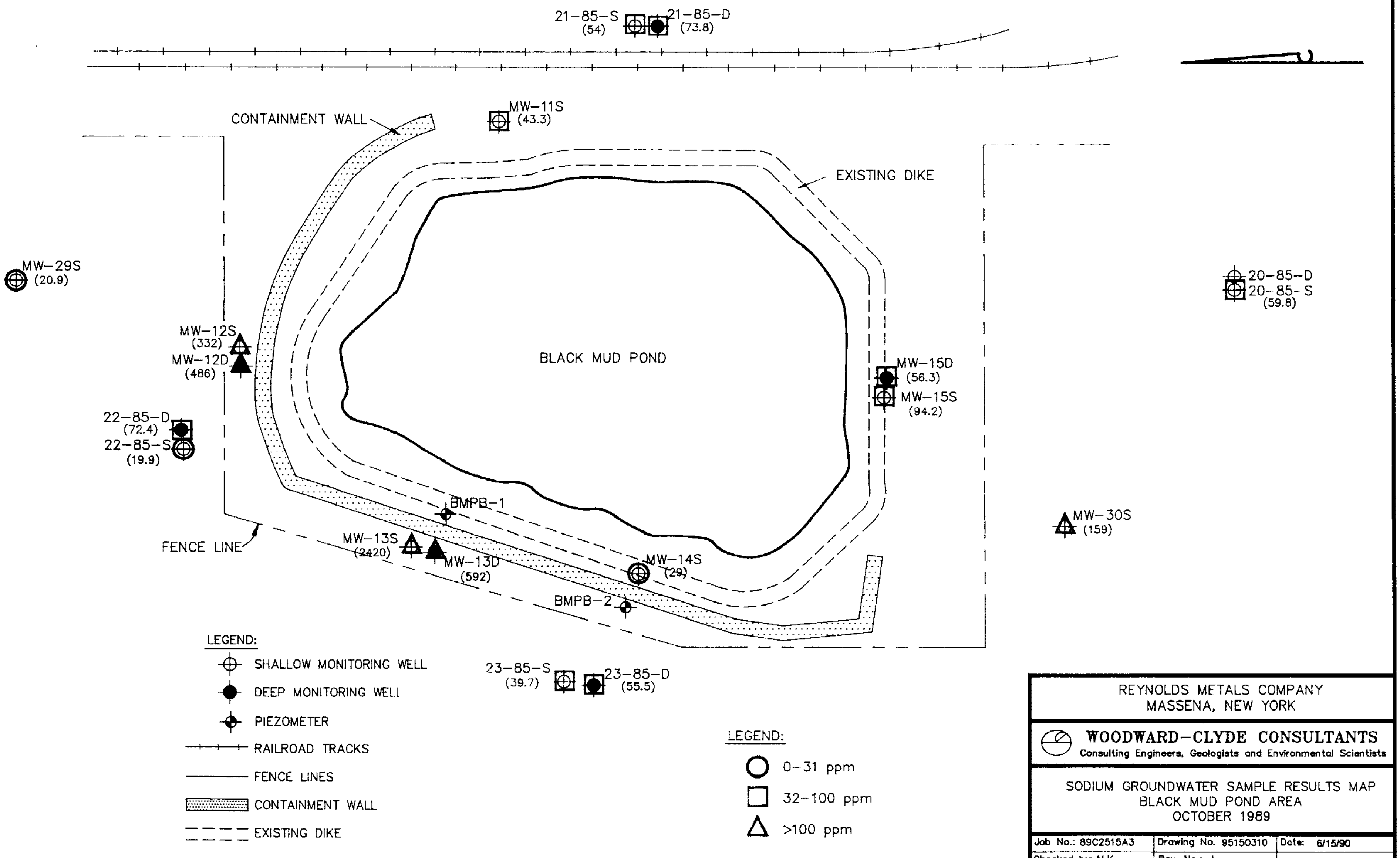


REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

TOTAL RECOVERABLE PHENOL GROUNDWATER
SAMPLE RESULTS MAP
BLACK MUD POND AREA
OCTOBER, 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 24
Scale: N.T.S.		



REYNOLDS METALS COMPANY
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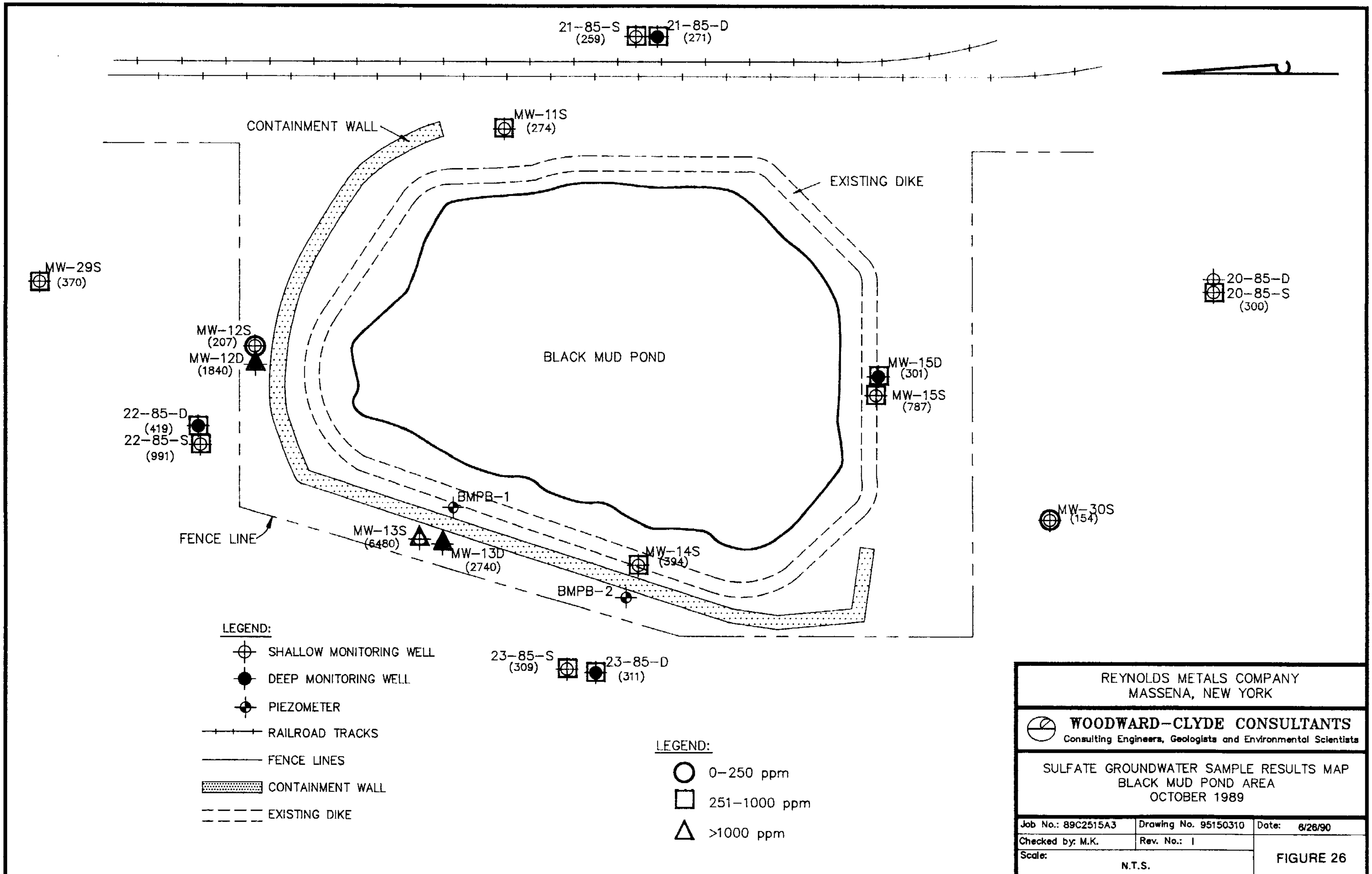
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

SODIUM GROUNDWATER SAMPLE RESULTS MAP
BLACK MUD POND AREA
OCTOBER 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/15/90
Checked by: M.K.	Rev. No.: 1	FIGURE 25
Scale: N.T.S.		

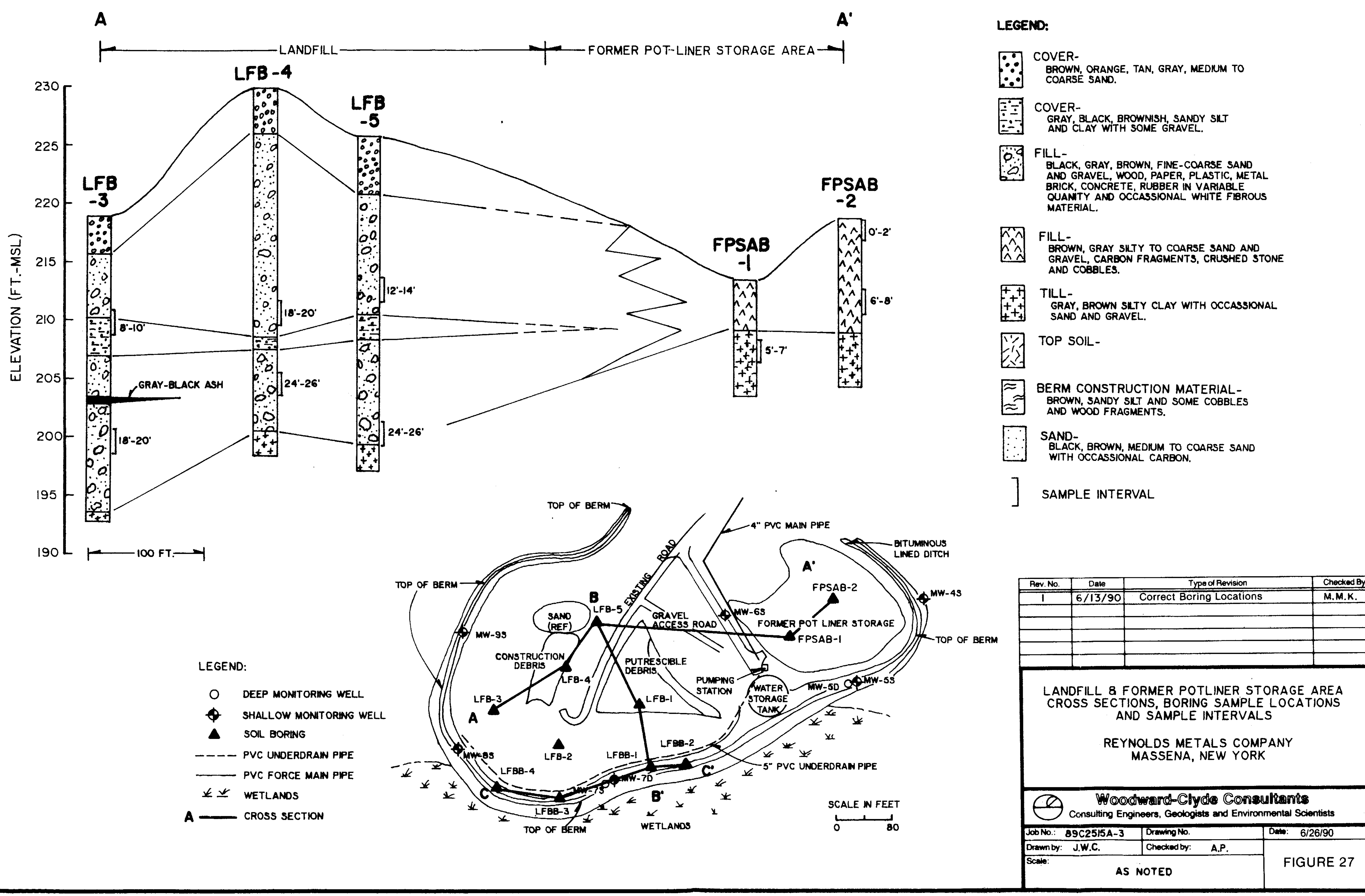


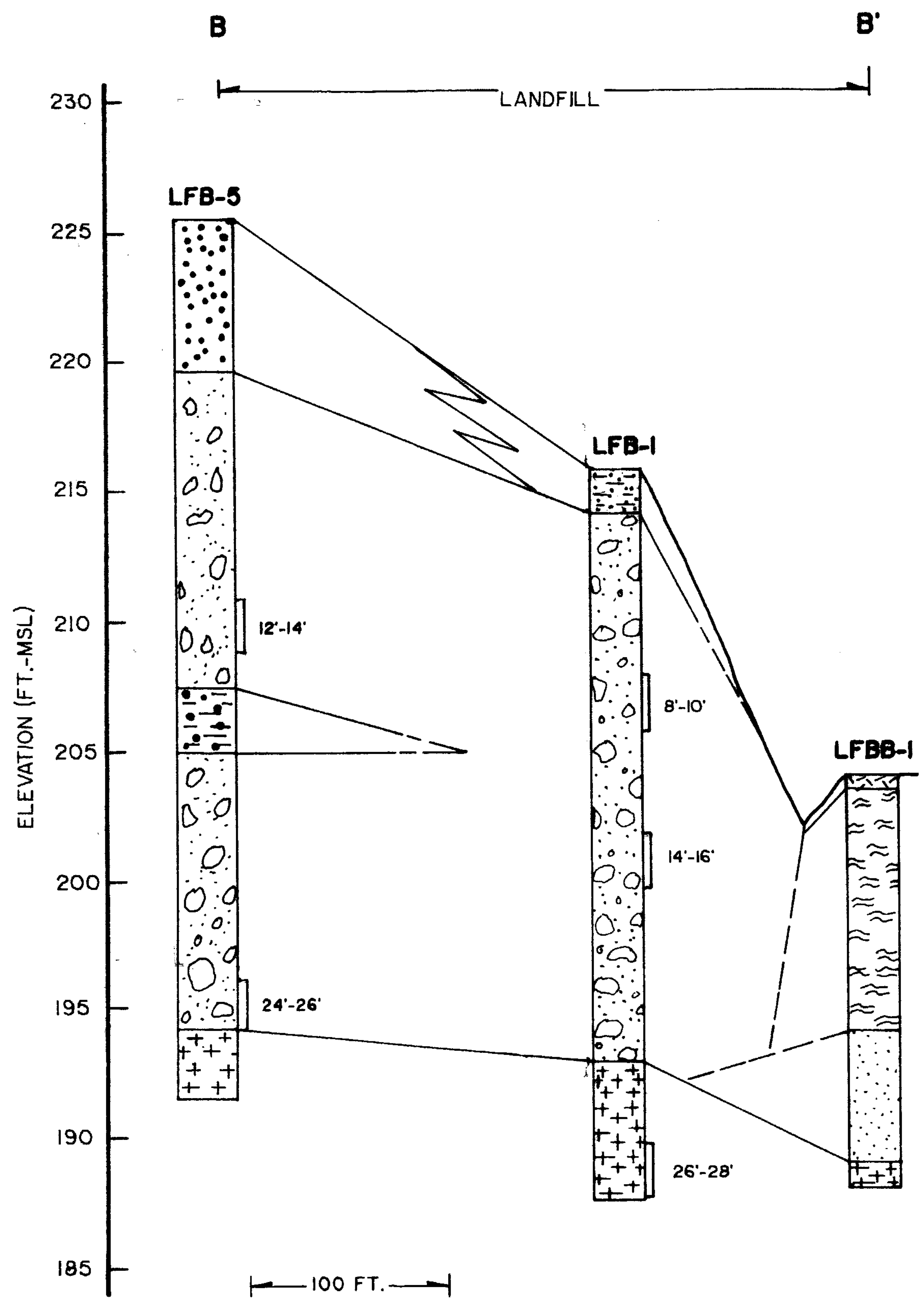
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

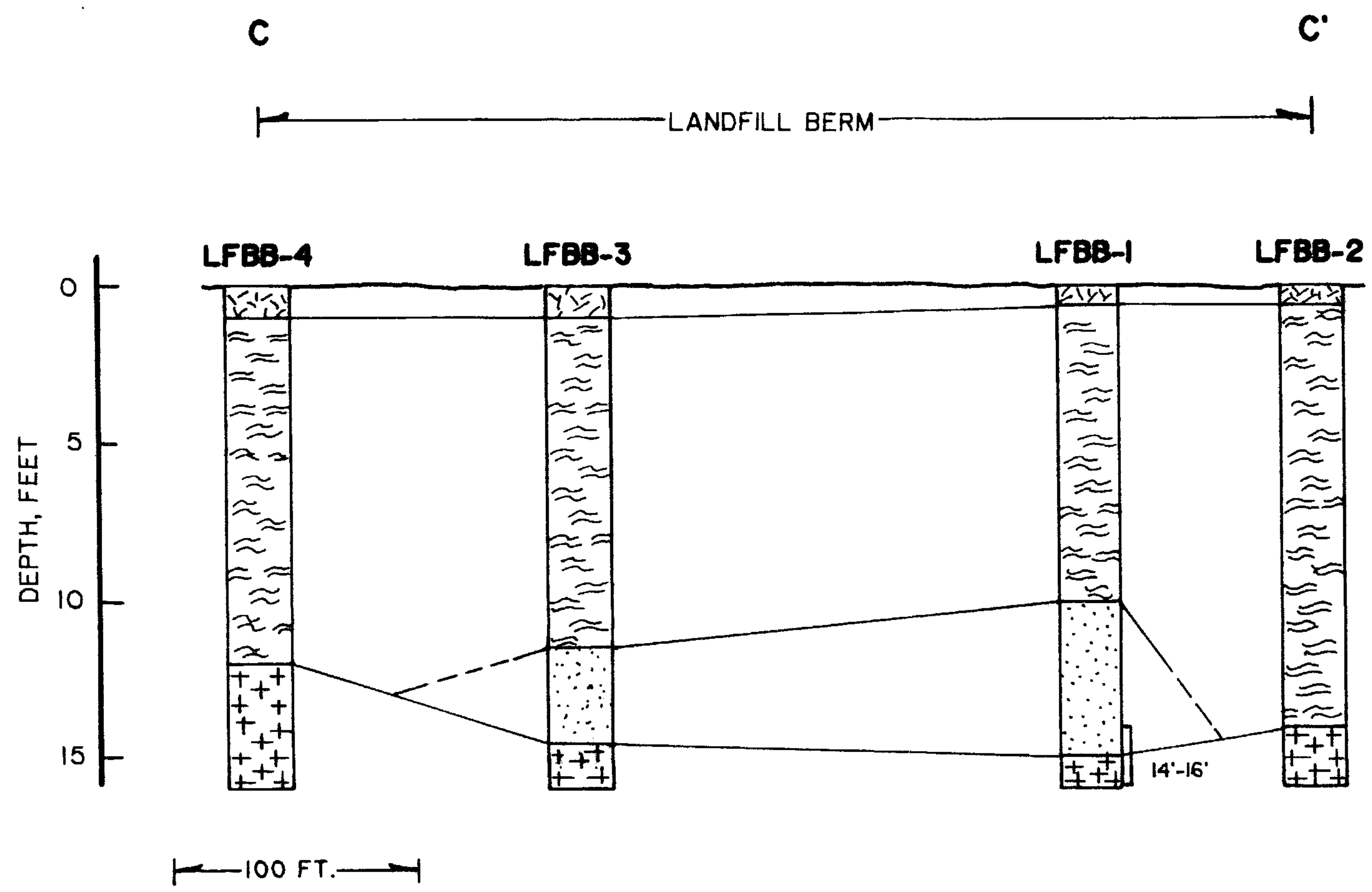
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

SULFATE GROUNDWATER SAMPLE RESULTS MAP
BLACK MUD POND AREA
OCTOBER 1989

Job No.: 89C2515A3	Drawing No. 95150310	Date: 6/26/90
Checked by: M.K.	Rev. No.: 1	FIGURE 26
Scale: N.T.S.		


A
A'
LANDFILL
FORMER POT-LINER STORAGE AREA
ELEVATION (FT.-MSL)
230
225
220
215
210
205
200
195
190
LFB -3
LFB -4
LFB -5
FPSAB -1
FPSAB -2
8'-10'
18'-20'
GRAY-BLACK ASH
18'-20'
24'-26'
12'-14'
24'-26'
5'-7'
0'-2'
6'-8'
100 FT.
LEGEND:
COVER- BROWN, ORANGE, TAN, GRAY, MEDIUM TO COARSE SAND.
COVER- GRAY, BLACK, BROWNISH, SANDY SILT AND CLAY WITH SOME GRAVEL.
FILL- BLACK, GRAY, BROWN, FINE-COARSE SAND AND GRAVEL, WOOD, PAPER, PLASTIC, METAL BRICK, CONCRETE, RUBBER IN VARIABLE QUANITY AND OCCASSIONAL WHITE FIBROUS MATERIAL.
FILL- BROWN, GRAY SILTY TO COARSE SAND AND GRAVEL, CARBON FRAGMENTS, CRUSHED STONE AND COBBLES.
TILL- GRAY, BROWN SILTY CLAY WITH OCCASSIONAL SAND AND GRAVEL.
TOP SOIL-
BERM CONSTRUCTION MATERIAL- BROWN, SANDY SILT AND SOME COBBLES AND WOOD FRAGMENTS.
SAND- BLACK, BROWN, MEDIUM TO COARSE SAND WITH OCCASSIONAL CARBON.
SAMPLE INTERVAL
TOP OF BERM
4" PVC MAIN PIPE
EXISTING ROAD
BITUMINOUS LINED DITCH
A'
FPSAB-2
MW-4S
TOP OF BERM
B
LFB-5
GRAVEL ACCESS ROAD
MW-6S
FORMER POT LINER STORAGE
FPSAB-I
SAND (REF)
MW-9S
CONSTRUCTION DEBRIS
LFB-4
PUTRESCIBLE DEBRIS
PUMPING STATION
WATER STORAGE TANK
MW-5D
MW-5S
LFB-3
A
LFB-I
LFB-2
LFBB-2
LFBB-I
MW-8S
LFBB-4
MW-7D
C'
5" PVC UNDERDRAIN PIPE
C
MW-7S
B'
LFBB-3
TOP OF BERM
WETLANDS
SCALE IN FEET
0
80
LEGEND:
DEEP MONITORING WELL
SHALLOW MONITORING WELL
SOIL BORING
PVC UNDERDRAIN PIPE
PVC FORCE MAIN PIPE
WETLANDS
A CROSS SECTION
Rev. No. | Date | Type of Revision | Checked By:
1 | 6/13/90 | Correct Boring Locations | M.M.K.
LANDFILL & FORMER POTLINER STORAGE AREA CROSS SECTIONS, BORING SAMPLE LOCATIONS AND SAMPLE INTERVALS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Job No.: 89C2515A-3
Drawing No.
Date: 6/26/90
Drawn by: J.W.C.
Checked by: A.P.
Scale: AS NOTED
FIGURE 27





LEGEND:

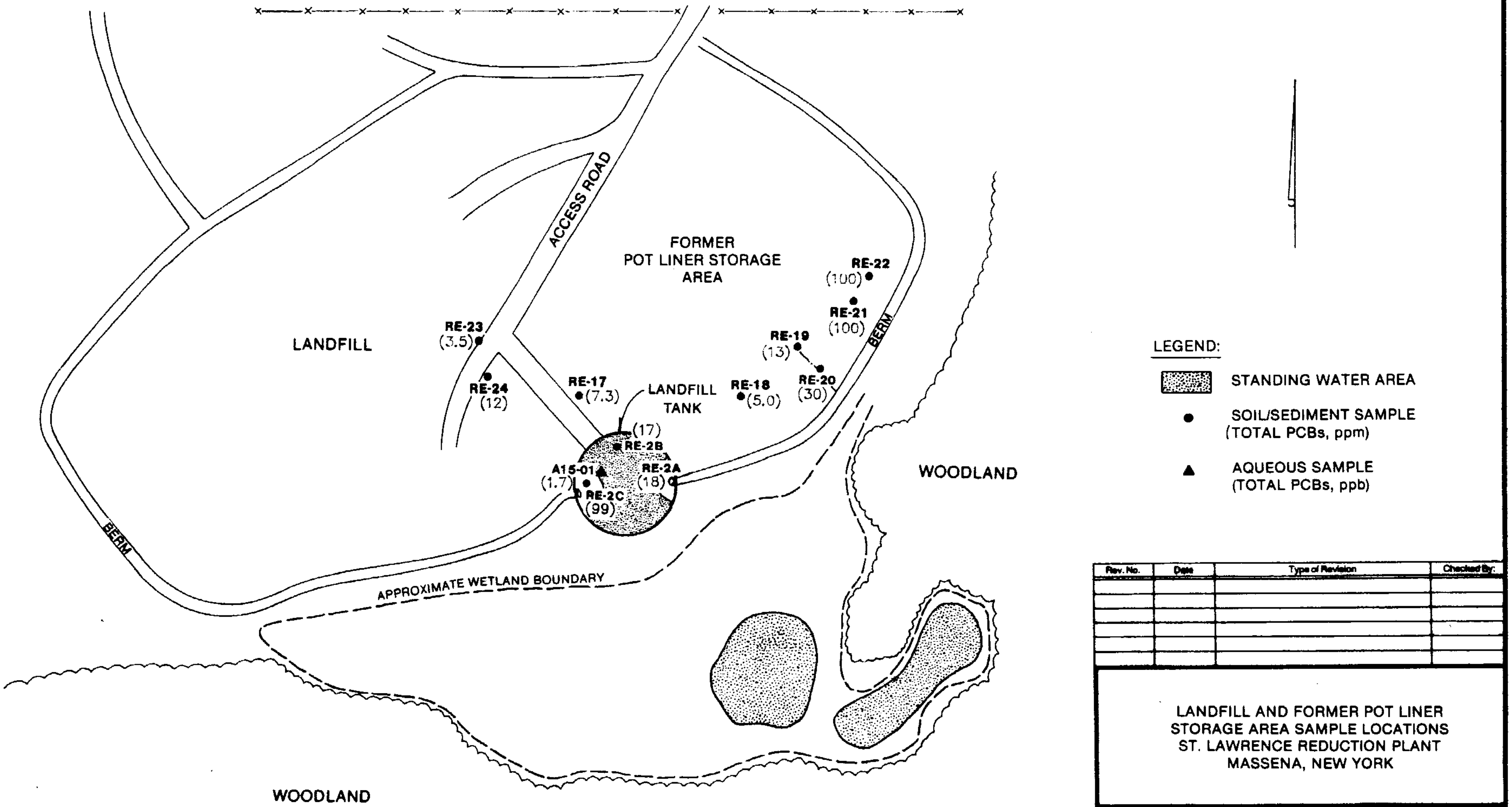
- COVER- BROWN, ORANGE, TAN, GRAY, MEDIUM TO COARSE SAND.
- COVER- GRAY, BLACK, BROWNISH, SANDY SILT AND CLAY WITH SOME GRAVEL.
- FILL- BLACK, GRAY, BROWN, FINE-COARSE SAND AND GRAVEL, WOOD, PAPER, PLASTIC, METAL BRICK, CONCRETE, RUBBER IN VARIABLE QUANITY AND OCCASSIONAL WHITE FIBROUS MATERIAL.
- FILL- BROWN, GRAY SILTY TO COARSE SAND AND GRAVEL, CARBON FRAGMENTS, CRUSHED STONE AND COBBLES.
- TILL- GRAY, BROWN SILTY CLAY WITH OCCASSIONAL SAND AND GRAVEL.
- TOP SOIL-
- BERM CONSTRUCTION MATERIAL- BROWN, SANDY SILT AND SOME COBBLES AND WOOD FRAGMENTS.
- SAND- BLACK, BROWN, MEDIUM TO COARSE SAND WITH OCCASSIONAL CARBON.
-] SAMPLE INTERVAL

Rev. No.	Date	Type of Revision	Checked By:
1	6/13/90	Correct Boring Locations	M.M.K.

LANDFILL AND LANDFILL BERM
CROSS-SECTIONS AND BORING SAMPLE INTERVALS
(SEE FIGURE 27 FOR LOCATIONS)
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90	
Drawn by: J.W.C.	Checked by: A.P.		
Scale: AS NOTED		FIGURE 28	

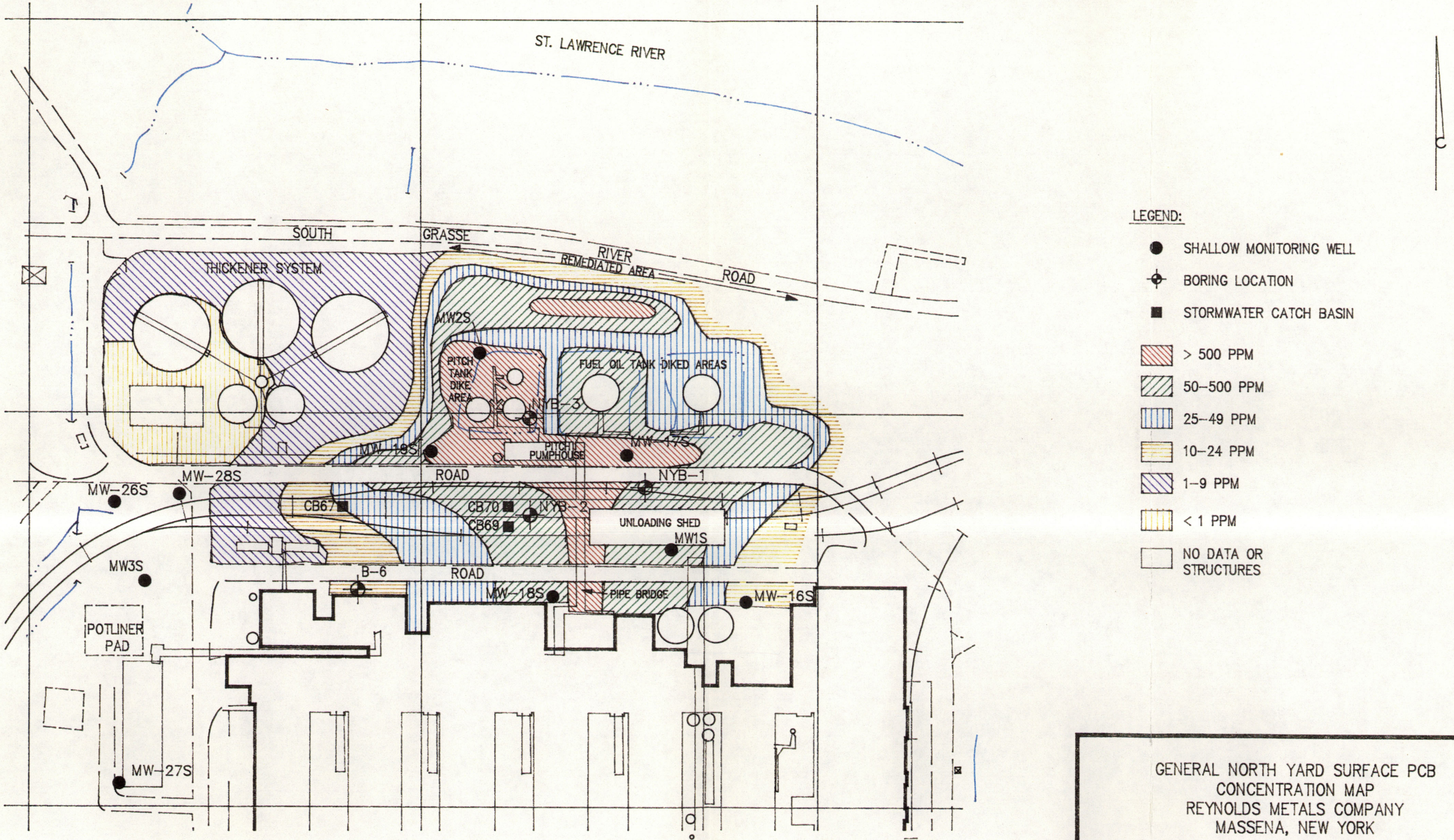


Rev. No.	Date	Type of Revision	Checked By:

LANDFILL AND FORMER POT LINER STORAGE AREA SAMPLE LOCATIONS
ST. LAWRENCE REDUCTION PLANT
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515 A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: P.R.J.	FIGURE 29
Scale: NOT TO SCALE		

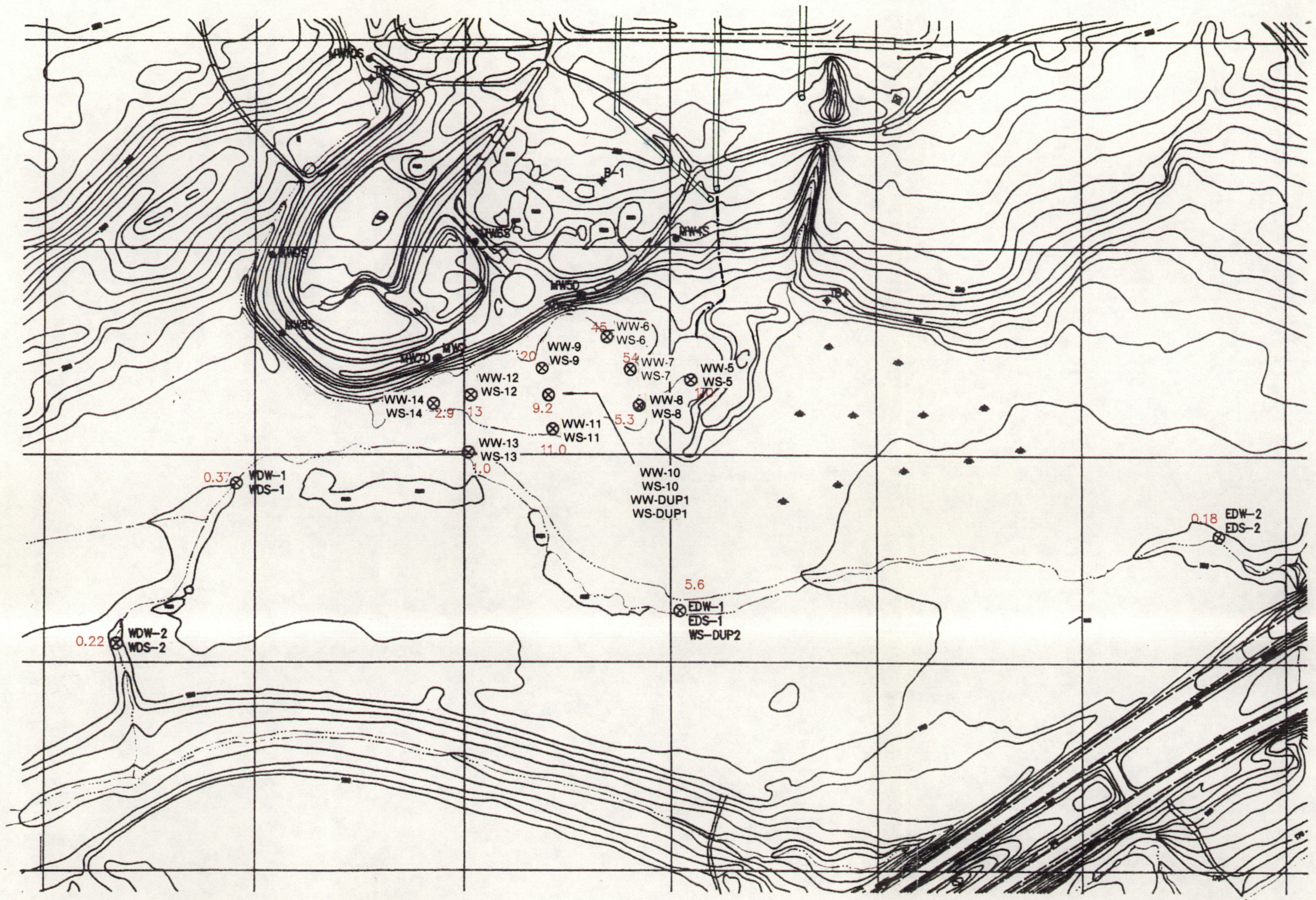


GENERAL NORTH YARD SURFACE PCB
CONCENTRATION MAP
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Rev. No.	Date	Type of Revision	Checked by:

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-3	Drawing No. 95150510	Date: 6/26/90
Drawn by: T.P.	Checked by: M.K.	FIGURE 30
Scale: 0 — 100 FEET		



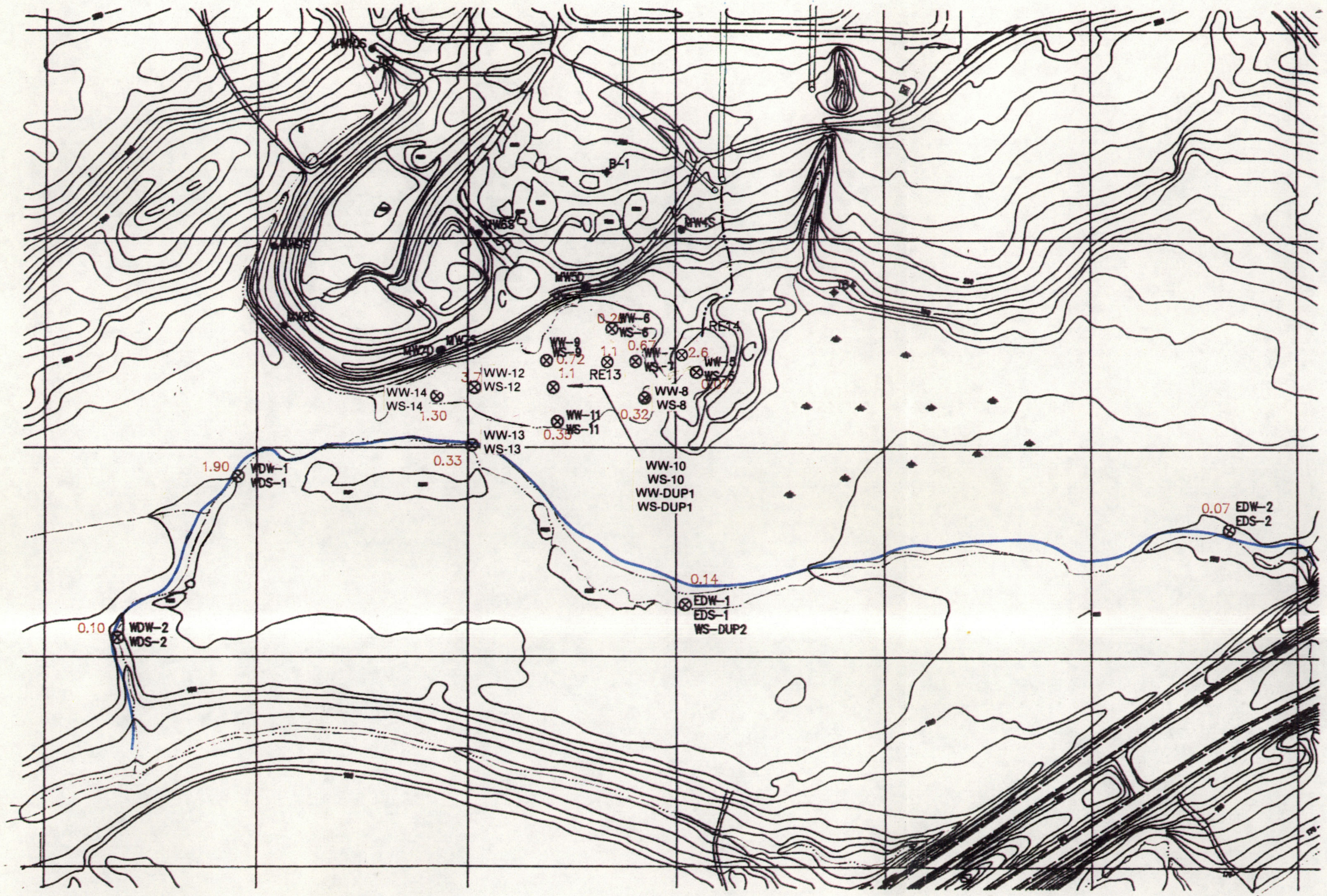
LEGEND:

⊗ AQUEOUS AND SEDIMENT SAMPLE LOCATION

10 FLUORIDE CONCENTRATION (ppm) X 1000 – **JUNE 1989**

RECTIFIER YARD DRAINAGE PIPE

REYNOLDS METALS COMPANY MASSENA, NEW YORK		
WOODWARD-CLYDE CONSULTANTS Consulting Engineers, Geologists and Environmental Scientists		
WETLANDS SEDIMENT SAMPLE LOCATIONS		
Job No.: 89C2515A-3	Drawing No. 95150270	Date: 6/26/90
Checked by: P.R.J.	Rev. No.: 1	FIGURE 31
Scale: 0 — 300 FEET		



LEGEND:

⊗ AQUEOUS AND SEDIMENT SAMPLE LOCATION
WW – JUNE 1989
RE – AUGUST 1989

10 PCB CONCENTRATION (ppb)

WETLAND STREAMS

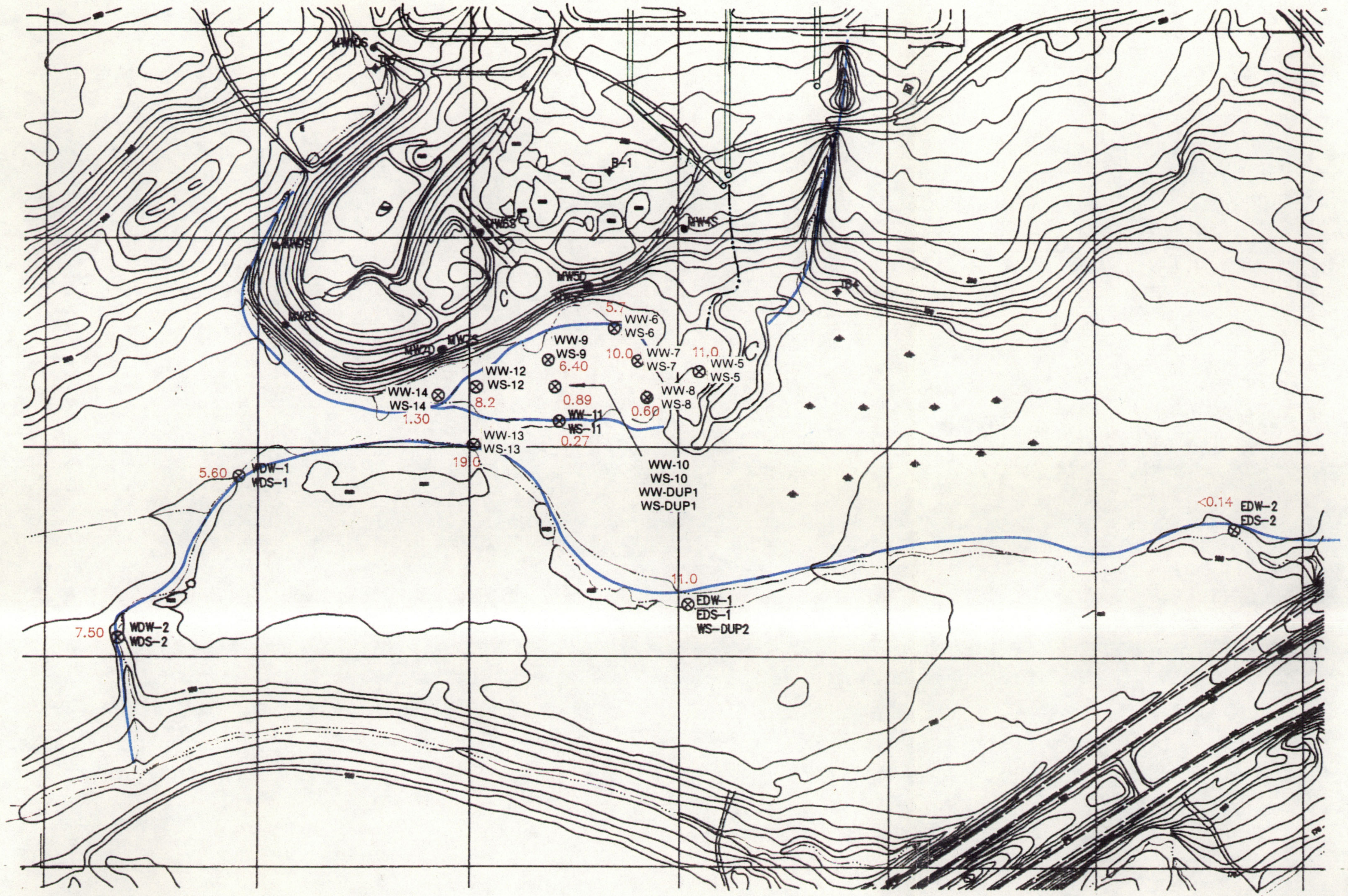
RECTIFIER YARD DRAINAGE PIPE

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

WETLANDS SURFACE WATER
SAMPLE LOCATIONS

Job No.: 89C2515A-3	Drawing No. 95150270	Date: 6/26/90
Checked by: P.R.J.	Rev. No.: 1	FIGURE 32
Scale: 0 — 300 FEET		



LEGEND:

⊗ AQUEOUS AND SEDIMENT SAMPLE LOCATION

10 PCB CONCENTRATION (ppm) JUNE 1989

WETLANDS STREAMS

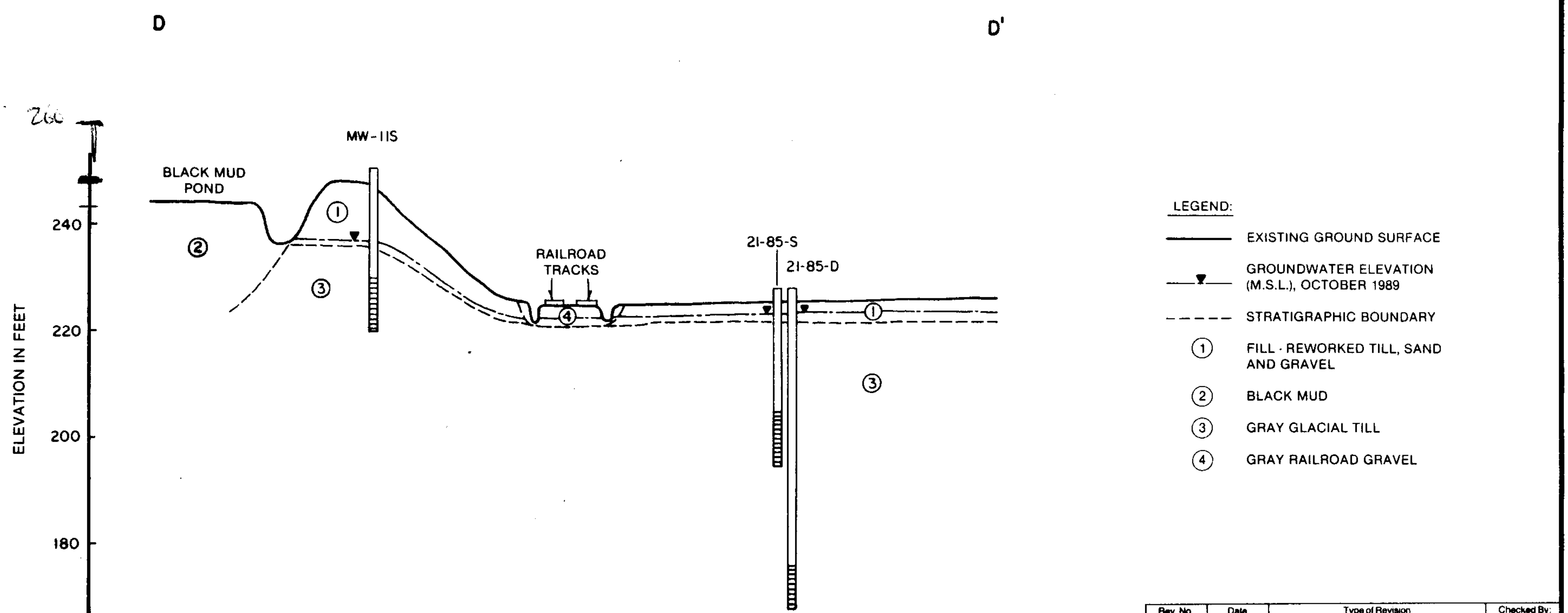
RECTIFIER YARD DRAINAGE PIPE

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

WETLANDS SEDIMENT SAMPLE LOCATIONS

Job No.: 89C2515A-3	Drawing No. 95150270	Date: 6/26/90
Checked by: P.R.J.	Rev. No.: I	FIGURE 33
Scale: 0 300 FEET		



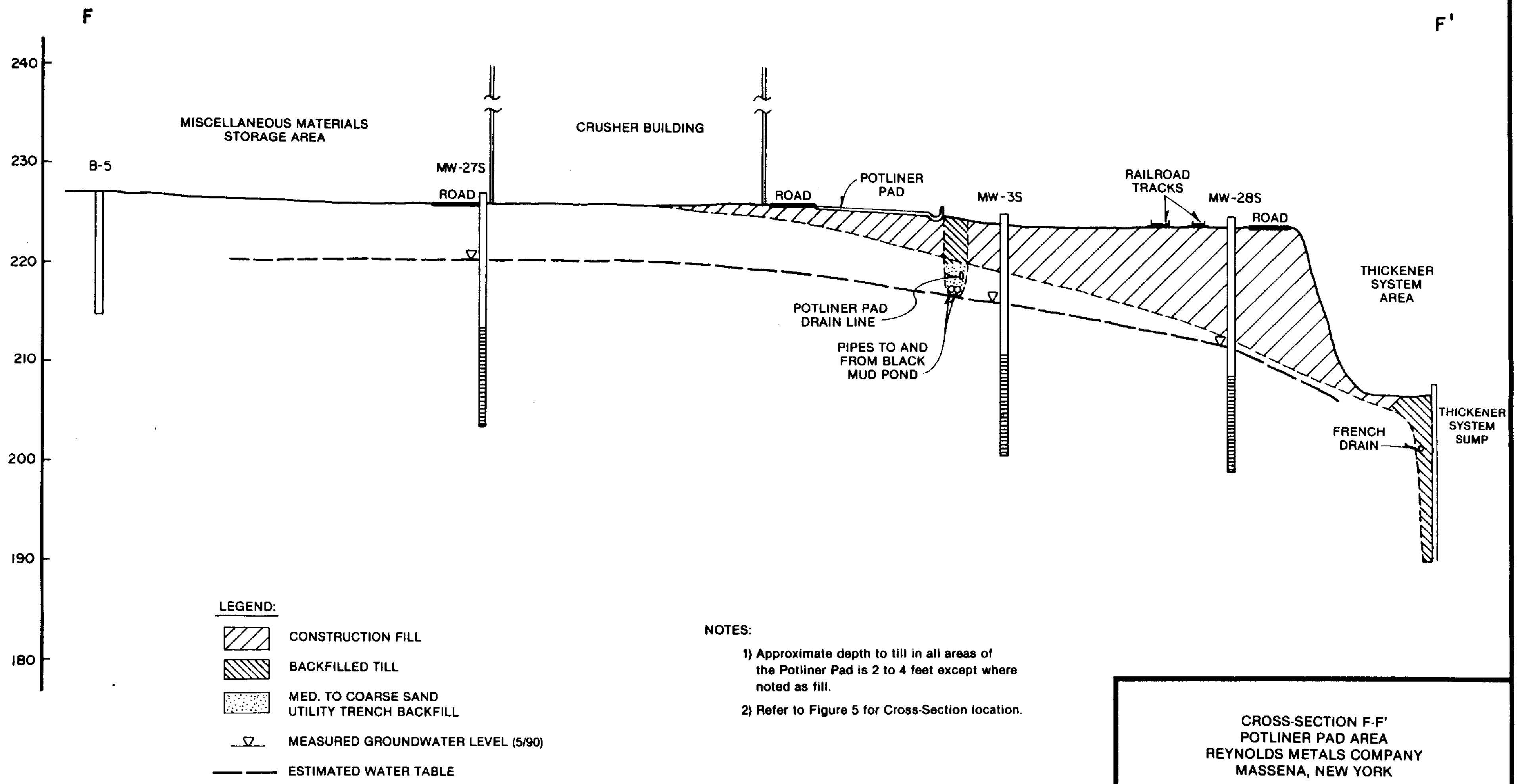
Rev. No	Date	Type of Revision	Checked By:

GENERALIZED STRATIGRAPHIC CROSS-SECTION D-D'
EAST SIDE OF BLACK MUD POND
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No: 89C2515A-3 | Drawing No: | Date: 6/26/90
Drawn by: J.C. | Checked by: P.R.J.
Scale: 0 — 50'

FIGURE 34



NOTES:

1) Approximate depth to till in all areas of the Potliner Pad is 2 to 4 feet except where noted as fill.

2) Refer to Figure 5 for Cross-Section location.

Rev. No.	Date	Type of Revision	Checked by:

CROSS-SECTION F-F'
POTLINER PAD AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-3	Drawing No.	Date: 6/26/90
Drawn by: J.C.	Checked by: P.R.J.	FIGURE 35
Scale: 0 — 50'		