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October 30, 1998

Mr. Philip G. Waite, P.E.
Project Manager
NYSDEC - Region 6
Division of Environmental Remediation
State Office Building
317 Washington Street
Watertown, NY 13601

SUBJECT: Bechtel Job No. 20384, Reynolds Metals Company,
St. Lawrence Reduction Plant Site Remediation Project
REV. 1 CHANGES TO NORTH YARD COMPLETION REPORT; Subject Code 1305

Dear Mr. Waite:

Bechtel Associates Professional Corporation-NY is making this submittal on behalf of Reynolds Metals Company (RMC) and in accordance with the Order on Consent, Index #A6-0291-92-12, effective date March 1, 1993.

Changes to the *Area-Specific Completion Report for Remediation of the North Yard* are attached. Please remove the indicated items from the Revision 0 copy (transmitted on July 31, 1998), and insert the attached Revision 1 items. NYSDEC comments from the September 25 letter have been resolved and incorporated. Changes from Revision 0 are identified by a revision bar in the right-hand margin.

This information is being transmitted to recipients of the Revision 0 report. Distribution of the final document will be completed under a separate letter.

If you have any questions on this matter, please call Jeff Grindstaff, Bechtel Project Engineering Manager, at (423)220-2374, or Dave Bence, RMC Project Manager, at (315)764-1996.

Very truly yours,

Jeffrey W. Grindstaff

A. Yazdi, Program Manager
Private Environmental Projects

AY/jwg
Attachments: List of changes for North Yard Completion Report
Rev. 1 changes for North Yard Completion Report (4 copies)

cc: K. Jock, Akwesasne Mohawk Nation, w/1

List of Changes to
Area-Specific Completion Report for Remediation of the North Yard

Item	Description of Change	No. Pages
Cover sheet for binder, Volume I (red color)	Changed date and revision number.	1
Cover sheet for binder, Volume II (red color)	No changes. (Sheet is included for consistency with the Volume I cover.)	1
Inside title sheet	Changed date and revision number.	1
PE certification and seal	Changed revision number.	1
Executive Summary, p. iii (green color)	Revised per 9/25/98 NYSDEC comments to show that GAC filtration is no longer needed for North Yard stormwater.	1
Text, p. 6	Revised per 9/25/98 NYSDEC comments to refer to source for additional information.	1
Text, p. 22	Revised per 9/25/98 NYSDEC comments to better address residuals in partial grids.	1
Table 3, p. 37	Clarified title and added grid locations to heading.	1
Table 4, p. 38	Added description for the "N" qualifier.	1
Table 5, pp. 39 and 40	Clarified title and added superscripts to refer to footnotes.	2

AREA-SPECIFIC COMPLETION REPORT FOR REMEDIATION OF THE NORTH YARD

AT THE

REYNOLDS METALS COMPANY
ST. LAWRENCE REDUCTION PLANT
MASSENA, NEW YORK

VOLUME I

BY

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION
NEW YORK

FOR

BECHTEL ENVIRONMENTAL, INC.
OAK RIDGE, TENNESSEE

REVISION 1

OCTOBER 1998

CERTIFICATION OF PROFESSIONAL ENGINEER

DOCUMENT TITLE: **Area-Specific Completion Report for Remediation of the North Yard at the Reynolds Metals Company St. Lawrence Reduction Plant, Massena, New York, Revision 1**

To the best of my knowledge, information, and belief, the information, conclusions, and recommendations contained in this document are factual, represent my understanding of conditions and circumstances at the subject area, represent my engineering judgment, comply with applicable or relevant and appropriate requirements, and demonstrate sound engineering practices and principles to protect public health and the environment.

STATE OF NEW YORK
JEFFREY W. GRINDSTAFF
No. 0706…
LICENSED PROFESSIONAL ENGINEER

10/29/98

EXECUTIVE SUMMARY

The construction crews on the North Yard remediation project completed the job without a single injury. This remarkable accomplishment was possible only because of the constant attention and focused efforts of all the people who planned and executed the work. The task of keeping everyone safe was not easy. Work areas were crowded with excavating machines and dump trucks, and other hazards such as deep holes, high-voltage electrical lines, hot pipelines, and railroad traffic made the work specially dangerous. Every person on the project—including laborers, truck drivers, equipment operators, technicians, surveyors, supervisors, managers, designers, and inspectors—contributed to this remarkable safety achievement: a true integrated project team effort.

The North Yard remediation presented the project team with many unique challenges. Plant operations could not be interrupted. Structure foundations could not be undermined by adjacent deep excavations. Soils with the highest concentrations of PCBs to be found anywhere on the Reynolds site had to be safely excavated and properly managed. When it rained, stormwater had to be captured before it could run off the remediation site; water was vacuumed from the sumps and puddles and treated through carbon filters. On dry days, water trucks sprayed to control dust.

In all, 45,000 yd^3 of soil containing PCBs exceeding remediation goals was removed from the North Yard; most of which was replaced to original grade with clean material.

In early 1995, NYSDEC held public hearings and issued an amendment to the ROD. The amendment voided the original requirement for onsite incineration of soils with PCB levels at or above 50 ppm, requiring instead that all such excavated material go to an offsite secure landfill. In eliminating the requirement for onsite incineration, NYSDEC resolved a matter of considerable public concern.

The amendment also included a Design Change to facilitate the North Yard remediation in areas crowded with aboveground and underground structures. The ROD required a combination of excavation and capping; the Design Change defined and clarified these requirements so that shutdowns of plant processes could be kept to very short intervals or avoided altogether. The change established boundaries for the section of the North Yard where there were structural or operational constraints on excavation. This constrained area, later designated "Area 1" in the Remedial Design, consisted of the railroad track area and the area near the Carbon Plant buildings.

The original ROD required that the entire North Yard be remediated to residual levels of less than 25 ppm PCBs. The Design Change retained this requirement for Area 1 only, but the change also established circumstances under which residual PCB levels could exceed 25 ppm in that smaller area. This relief was used sparingly, however, and remedial excavation in most excavation grids in Area 1 also accomplished the more rigorous goals established by the Design Change for the rest of the North Yard. This tighter goal of "less than 10 ppm" increased the total area and volume to be excavated. The expanded North Yard remediation area outside Area 1 was defined in the Remedial Design as Area 2. By the time the North Yard remediation was finished, all of Area 2 was verified clean to below the ROD goals.

The Design Change also eliminated—but only in Area 1—two requirements related to sampling at the excavation depth limit. The first relief was that backfilling could be started immediately after the design depth in each grid was reached, without waiting for laboratory analysis of the final samples. The second was that independent validation of the laboratory analyses of these depth limit samples was not required.

The North Yard was the scene of many early remediation initiatives, beginning in 1988 when PCBs were found in impounded water at the pitch and fuel oil storage facilities. Immediate responses to this discovery included placing heavy plastic sheeting over large areas to stop soil erosion. Water from the impoundments was filtered through portable granular activated carbon (GAC) filters and stored until lab test results proved the water clean. Later initiatives increased the amount of North Yard stormwater that was collected and filtered through activated carbon. Eventually, all of Area 1 and much of Area 2 were covered with plastic or blacktop pavement, which remained until excavated according to the Remedial Design requirements. The combination of remedial excavation and structural capping has eliminated the need for GAC filtration of stormwater at the North Yard site. However, the GAC Filter Plant, built in 1990–91 to remove PCBs from North Yard stormwater, continues to filter water discharged from the Pitch Pumphouse and from other remediation areas on the Reynolds site.

Among the many resourceful techniques that made it possible to perform massive excavation in busy areas of the operating plant, three stand out. The first was to select a unique backfill material. When the field laboratory's analysis showed that an excavated area met cleanup goals, a slurry of sand, cement, and flyash was poured into the hole until the desired grade was restored. This innovative material, simply called "flowable fill" by the supplier, was used to fill holes as deep as 23 ft in a single day with no need for workers to enter the hole. Rail track installation then followed immediately. The real benefit was not that flowable fill was less expensive, but rather that restoration work was safer for the workers and much faster than conventional backfill methods. The days saved against the schedule were then available as needed for additional sampling and excavation to ensure that ROD cleanup goals were reached.

The second was to implement a thorough sampling plan involving the use of drill rigs to obtain samples from the deep subsurface soils. This aggressive action allowed the project team to see that deep excavations would be necessary in several places, some of which were dangerously close to buildings or to equipment foundations. The considerable expense of the drill rig sampling was recovered during the excavation phase, when work proceeded rapidly because there was no need to wait for progressive sampling and analysis in the open excavations. Both the disposal site option and the depth of excavation required within each grid were known before equipment was set up each day.

The third innovation involved the evaluation and development of a rapid field method for PCB analysis called *immunoassay* analysis. This emerging technology was tested and approved for widespread use on the project in 1994. It was approved for characterization sampling (i.e., to determine whether PCB levels exceeded cleanup goals and excavation was therefore necessary); and it was approved for making disposal decisions (i.e., whether the excavated material would be placed in the onsite landfill or sent to the hazardous waste disposal facility at Model City, New York). Using this method further improved the effectiveness of the remediation effort because field laboratory technicians were able to provide results so quickly that crews could deepen the excavation if PCB levels at the final design depth were not as low as indicated by the results from the drill rig sampling.

All of the elements of the Remedial Design were accomplished without deficiency. The design did not require the removal of structures, foundations, or active underground piping, and it was not practical to obtain samples from under them. This was recognized in the ROD, which required that much of the North Yard be capped to reduce the mobility of PCBs that might remain in association with these items. Concrete caps were installed near the pumphouse, Carbon Plant, and pitch storage tanks and in areas where vehicular traffic must be accommodated. The railroad track area was capped with heavy reinforced plastic geomembrane under a geonet composite (fabric bonded above plastic mesh) that improves drainage. These materials were then covered with crushed stone of standard railroad ballast specifications, leaving the cap hidden and protected 2 ft below the surface so that regular railroad maintenance would not harm the cap. For the underground drain pipe run just north of the Carbon Plant, groundwater intercepts were put at the low points of the runs; water collected at the two intercept points is filtered through the GAC units before discharge.

Most of Area 1 of the North Yard remains under intensive management control. The post-remedial Operations, Monitoring, and Maintenance Plan requires regular inspections of capped areas. Groundwater chemistry in several wells is analyzed four times a year. Should any excavations be necessary for plant construction or maintenance, the integrity of the remediation will first be examined. Considerations include cap preservation or repair, residual soil chemistry, and disposal of excess spoil. These post-remedial constraints are expected to continue for as long as the plant operates. Post-remedial sampling results, inspections, maintenance, and related information are published in the quarterly reports.

The North Yard remediation was accomplished under strict quality control programs. In most excavation grids, the soil disposal requirement—onsite or offsite—changed at least once as the depth of excavation was advanced. Survey and sampling crews were onsite full time while excavation was under way. The field engineer's staff verified that every excavation grid was properly laid out and identified, and the superintendent for the excavation contractor further verified the grid identity and characteristics each time equipment was moved. Above all this, the project's Construction Quality Assurance (CQA) manager was personally onsite throughout the work. The CQA manager observed construction, verified delivery and flow of information to construction and quality control personnel, and reviewed the progression of the work within the framework of the approved design requirements. The CQA function made a positive contribution to ensuring the success of the North Yard remediation.

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APPENDIXES

FIGURES

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TABLES

ACRONYMS AND INITIALISMS

ARAR	applicable or relevant and appropriate requirement
ASP	Analytical Services Protocol
ATL	Atlantic Testing Laboratories
CB	catch basin
CCN	communication control number
CLSM	controlled low-strength material
CQA	construction quality assurance
DOT	Department of Transportation
EPA	Environmental Protection Agency
ESI	Environmental Standards, Inc.
FCN	field change notice
FCR	field change request
GAC	granular activated carbon
HDPE	high-density polyethylene
HTM	heat transfer medium
IRM	interim remedial measure
L/FPS	Landfill/Former Potliner Storage
NYSDEC	New York State Department of Environmental Conservation
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-P-dioxins
PCDF	polychlorinated dibenzofurans
QC	quality control
RD/RA	remedial design/remedial action
RMC	Reynolds Metals Company
ROD	Record of Decision
SPDES	State Pollutant Discharge Elimination System
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
W&C	Woodward & Curran Consultants
WWC	Woodward-Clyde Consultants

UNITS OF MEASURE

µg	microgram
ft	foot
gal	gallon
gpm	gallons per minute
h	hour
in.	inch
kg	kilogram
lb.	pound
m	meter
mg	milligram
mi	mile
MSL	mean sea level
ppm	parts per million
psi	pounds per square inch
yd	yard

1.0 INTRODUCTION

1.1 OVERVIEW

This report describes environmental remediation activities conducted in the North Yard of the Reynolds Metals Company (RMC) St. Lawrence Reduction Plant in Massena, New York.

The North Yard comprises the raw materials, receiving, storage, and distribution center for the entire reduction plant. Located north of the plant process buildings, the North Yard is surrounded by other onsite remediation areas: the Potliner Storage Pad to the west, the West Ditch Outfall to the northwest, the Area North of Haverstock Road to the north, and the 002 Diversion Area to the east (Figure 1).

The North Yard is the site of the heat transfer medium (HTM) system that maintains the fluidity and temperature of the coal tar pitch for anode and cathode manufacturing. The HTM system equipment is located in the Pitch Pumphouse, in the central portion of the North Yard; the HTM piping extends northward to the Pitch Tanks and southward to the Carbon Plant. Before RMC initiated a replacement program in the 1970s, the HTM fluid contained polychlorinated biphenyls (PCBs). Soil analyses conducted during the remedial investigation (WCC 1990) and additional data collected by Bechtel showed that before remediation the highest concentrations of PCBs on the Reynolds site were found near the HTM system.

During remedial investigations of the North Yard, approximately 360 soil samples were taken from 240 locations, often at various depths at a given location (WCC 1988 and 1990; Bechtel 1991a, 1991b, and 1992a). Results showed PCBs, polynuclear aromatic hydrocarbons (PAHs), polychlorinated dibenzofurans (PCDFs), and polychlorinated dibenzo-P-dioxins (PCDDs). The Record of Decision (ROD) for the RMC facility subsequently designated the North Yard as a remediation area (NYSDEC 1992).

The remedial effort faced the challenge of performing massive excavations in the center of congested production facilities without impairing plant operations. To this end, detailed design was preceded by an intensive sampling program during which critical excavation areas were sampled at depth on a 25-ft grid. The sampling effort defined PCB concentrations with such precision that the horizontal and vertical limits of excavation for much of the North Yard could be determined before excavation began.

The Remedial Design (RD) for the North Yard (Bechtel 1995b) was prepared to remediate the North Yard in the shortest practical time without disrupting the plant's nonstop production. To satisfy ROD requirements, the work scope included excavating contaminated soils, disposing of the excavated material in controlled and managed units, backfilling with clean materials, capping areas with residual PCBs ≥10 ppm, and conducting long-term monitoring. Remediation was divided into two distinct areas:

- Area 1, the south-central portion of the North Yard, was defined as the area where remediation work would interfere with essential plant operations. The design required excavating to established limits (i.e., horizontally within the ≥100-ppm PCB footprint and vertically to <25 ppm PCBs) and installing a low-permeability cap over all areas with residual PCB levels ≥10 ppm.

- Area 2 was defined as the operationally noncritical portions of the North Yard, including the remaining portions of the North Yard outside of Area 1. The design for this area was similar to that for other onsite remediation areas—excavation of soils exceeding the PCB cleanup goal (≥10 ppm PCBs), followed by restoration.

Remedial excavation in accordance with the RD began in July 1995 and was completed by September 1996; some related work continued through November 1997. Including pre-ROD interim remedial measures (IRMs), approximately 45,000 yd^3 of soil was removed from the North Yard and disposed of in controlled and managed units. Disturbed areas were restored following remediation.

The New York State Department of Environmental Conservation (NYSDEC), Region 6, had regulatory responsibility for remedial activities. NYSDEC reviewed and approved project documents and monitored all activities to ensure compliance with the ROD and appropriate regulations.

1.2 DOCUMENTATION

Before remediation began, an Area-Specific Work Plan (Bechtel 1995a) was prepared to specify the activities necessary to define the excavation limits and remediate the North Yard.

The RD (Bechtel 1995b) provided the technical specifications, design drawings, and other information needed to execute the remediation. The RD also defined requirements for post-excavation sampling; this included Area 1 sampling to document post-remedial conditions and Area 2 sampling per the Verification Sampling Plan (Bechtel 1995f) which included a statistical model to evaluate compliance with cleanup goals established in the ROD. Finally, the RD defined the restoration requirements to be implemented following remediation and the long-term commitments such as post-remedial inspections and monitoring.

This Completion Report provides a record of the remedial activities performed in the North Yard. Pre-ROD IRMs are described along with the activities pursuant to the ROD.

Post-remedial monitoring reports will be submitted to NYSDEC regularly to document inspections, monitoring, maintenance, and other related activities in the North Yard.

Appendix A of this Completion Report provides documentation of approved field changes and as-built drawings showing the limits of excavation, backfilling, and restoration. Appendix B is a chronological listing of the documents involved in the approval cycle for the complete North Yard remedial effort.

Documentation related to the remediation is kept in the project files. In accordance with established administrative procedures, all project documents are chronologically logged and filed by the Project Document Control Center at Bechtel's office in Oak Ridge, Tennessee. Project files will be preserved for 7 years, and safety and health documentation will be preserved for 75 years after completion of the project.

1.3 ROD REQUIREMENTS

The ROD (NYSDEC 1992) set forth the following requirements for the North Yard effort (some of these requirements were modified via a 1995 amendment, as described later in this section):

Summary of the Government's Decision (ROD pp. 40–41)

All the soils in the North Yard with 25 ppm PCBs or above will be excavated. The soils will be treated in an on-site treatment unit and the treated residuals may be used as backfill. The use of the treated residuals may include utilization at the Black Mud Pond as the foundation for construction of the cap, and fill for site grading prior to final restoration. Once excavation is complete, the remaining area where PCBs exceed 10 ppm in soils will be graded and capped to provide proper drainage and reduce infiltration and migration of PCBs. The existing surface water and shallow groundwater collection system will be modified and enhanced and/or a new surface water and shallow groundwater collection and treatment system will be installed and long term monitoring of surface water and groundwater will be performed. The capacity and effectiveness of the GAC (granular activated carbon) system will be evaluated and approved by the Department. If necessary, a pretreatment system will be installed. Discharge requirements will conform with current SPDES (State Pollutant Discharge Elimination System) permit conditions.

The onsite treatment technology evaluated in the Feasibility Study is the infrared thermal treatment system. However, this does not preclude further evaluation and consideration of alternate treatment technologies, including solvent extraction, prior to the implementation of the remedial action at the North Yard. RMC may submit additional treatability studies, during the remedial design phase, for additional alternate treatment technologies not already addressed in the Revised Final Feasibility Study.

Cleanup Goals (ROD p. 23):

Recommended Soil Organic Contaminants	Cleanup Goal (ppm)
Benzo(b)fluoranthene	0.330
Benzo(k)fluoranthene	0.330
Chrysene	0.330
Fluoranthene	19.0
Pyrene	6.5
PCBs (Area Within Groundwater and Surface Water Management Areas)	10.0
Dibenzo-P-dioxins (PCDD)	0.0005
2, 3, 7, 8 TCDD	0.0005

Remedial Action Objectives (ROD pp. 25–26):

Affected Media	Remedial Action Objective
Soils:	Prevent direct contact by site workers. Prevent adverse impacts on groundwater and surface water. Insure conformance with SPDES discharge requirements.
Groundwater:	Prevent further migration of contaminants and remediate existing contamination. Insure conformance with SPDES discharge requirements.
Surface Water:	Prevent exceedance of water quality standards in downstream surface water. Insure conformance with SPDES discharge requirements. Prevent bio-accumulation in biota.

Amendment to the Record of Decision

The ROD (NYSDEC 1992) was amended based on a request by RMC in January 1995. Appendix C provides a copy of the ROD amendment (NYSDEC 1995), which made the following key changes:

- Eliminate the requirement for onsite treatment.
- Allow soils containing ≥50 ppm PCBs to be shipped offsite for disposal.
- Allow soils containing <50 ppm PCBs to be consolidated in the onsite Landfill.

As part of the ROD amendment, a design change was implemented that effected the following additional changes.

For areas where remediation may affect daily plant operations (designated Area 1):

- Establish a defined horizontal limit of excavation based on a surface soil PCB concentration of 100 ppm.
- Excavate within that horizontal limit to a defined depth based on a target removal goal of 25 ppm PCBs.
- Consider further excavation if preferential pathways for vertical migration are identified.
- Install a low-permeability cap (e.g., asphaltic pavement or equivalent) over areas where post-remedial PCB levels are ≥10 ppm.

For areas where remediation will not affect daily plant operations (designated Area 2):

- Excavate soils to attain a cleanup goal of 10 ppm PCBs.

1.4 SUMMARY OF INTERIM REMEDIAL MEASURES

Before work under the ROD, IRMs were conducted to prevent releases of PCBs to the environment. IRMs began in 1988 and were initiated immediately after detection of PCBs in impounded water at the pitch and fuel oil storage facilities. The IRMs included capping affected nontraffic areas with thick polyethylene liner and isolating these areas with fencing; capping high-usage areas with asphalt to provide durable, low-maintenance cap and water barrier; setting up portable granular activated carbon (GAC) filters; and rerouting storm drainage flow to the GAC filter plant for treatment. Several excavation projects are described, along with the IRMs listed above, in Section 2.0.

1.5 SUMMARY OF REMEDIAL ACTION

This section summarizes the remedial excavation of the North Yard. Additional information is presented in Section 3.0 and Appendixes D and I. The North Yard was excavated in accordance with the Remedial Design (Bechtel 1995b).

The North Yard was divided into two areas (Area 1 and Area 2), based on structural and operational constraints. Area 1 (the constrained area) included the central area with the Pitch Pumphouse, the rail yard, the Unloading Shed, and the pitch and fuel oil tank area. Area 2 included the remaining area of the North Yard. Based on a design change to replace the earth berms with concrete containment, the depth of excavations in the diked area was increased, and subsequently, the fuel oil tank area was included as part of Area 2.

Excavation limits were established based on an extensive sampling program conducted in 1994 and 1995. Samples were collected at depth on 25 ft centers; therefore, excavation boundaries (horizontal and vertical) and disposal requirements were known before excavation began. During excavation, Phase II samples were collected at the base of each excavation grid to determine whether the target cleanup goal had been met. Phase II samples were collected and analyzed in the field lab to guide the excavations, and if the target level was not met, the excavation continued. The rapid turnaround of these samples results proved extremely valuable during the remediation, allowing continued excavation without significant delay. The depth of excavation and the disposition of the spoils were continuously monitored by civil surveyors.

Excavation depths in the North Yard ranged from 3 to 23 ft. Although the ROD amendment allowed for residual levels (<25 ppm) of PCBs in Area 1, the remedial excavations in most of Area 1 met the same PCB clean up goal (<10 ppm) as for Area 2.

The remedial excavation removed approximately 45,000 yd^3 of soil from the North Yard, with the spoils disposed of based on PCB content. Soil with <50 ppm PCBs (25,332 yd^3) went in the onsite Landfill. All soil with ≥50 ppm PCBs, totaling 19,528 yd^3, was shipped offsite for disposal.

1.6 POST-REMEDIATION SAMPLING

Phase III samples were taken in Area 1 to document the residual PCB levels at the base of the excavation; Phase III samples were taken in Area 2 to verify that the cleanup goals had been met. The ROD specified excavation to achieve <25 ppm PCBs in Area 1 and <10 ppm PCBs in Area 2. Details are included in Section 3.5.

The approach to Area 1 included excavation to the ROD criterion of <25 ppm PCBs and if practical to the target level of < 10 ppm PCBs. Phase II samples were collected from the bottom of each remediated grid block within Area 1, and Phase III samples were collected in accordance with the Area 1 Verification Sampling Plan defined in Section 6.0 of the RD (Bechtel 1995b) and the supplemental Verification Sampling Plan for the Containment Dike Area [Field Change Request (FCR) 167]. With few exceptions, this approach allowed the grid blocks in Area 1 to be successfully remediated to the target level of <10 ppm PCBs while remaining within the original schedule.

In Area 1, the remediation efforts achieved the cleanup objectives except in portions of two grids—one in the rail yard (Phase III sample) and one north of the unloading shed (Phase II sample). Residual PCB concentrations in portions of these two grids did not meet the <25 ppm ROD criterion. The grids are in areas that were backfilled, capped with geomembrane, and then capped with crushed stone, isolating the residual PCBs from human contact and the environment. Additional information is given in Section 3.0.

The remedial excavation for Area 2 was evaluated to verify compliance with the ROD. Compliance verification included sampling for PCBs at 29 locations randomly selected in accordance with a statistical model based on Environmental Protection Agency (EPA) guidelines; sampling for PCBs at 2 additional biased locations; and sampling for PAHs at 6 locations. All samples for compliance verification were analyzed in an offsite laboratory, and the data were independently reviewed and validated using EPA guidelines. The rigorous compliance verification process determined that the North Yard Area 2 remediation satisfied all ROD requirements.

1.7 RESTORATION

This section summarizes the restoration of the remedial excavation areas in the North Yard. Details are included in Section 3.6.

The North Yard was restored following remedial excavation and verification sampling. Restoration in accordance with the RD (Bechtel 1995b) included backfilling, grading, placement of geomembrane, reconstruction of railroad, modification to the storm drain system, placement of concrete, topsoil and vegetation.

Soil for backfilling and general restoration came from the onsite borrow area; however, to expedite restoration in Area 1, flowable fill (technically known as "controlled low-strength material" or CLSM) was used in lieu of conventional backfill and compaction methods. CLSM was used for backfilling deep excavations around the pitch tank vault, throughout the rail yard area, beneath the pipe bridge tower, and in selected grids within the Pitch Storage and Fuel Oil Tank area. Two different cap designs were used in Area 1: one consisted of multiple layers of geosynthetic materials protected by a layer of crushed stone, and the other consisted of concrete. Concrete was placed in areas used for heavy loadings from plant operations and to rebuild the tank containments. The

CLSM was graded and shaped before installation of the cap. Railroad tracks were installed in preassembled 20-ft lengths.

The use of CLSM backfill, which greatly reduced the time required for backfill operations and provided a sturdy structural subbase, and the installation of preassembled lengths of railroad track were instrumental in quickly returning the North Yard to service.

Unpaved areas were graded, covered with topsoil, seeded, and mulched. Restoration of slopes included placement of netting over seeded areas as necessary to control erosion.

Post-remedial activities in the North Yard include inspections, monitoring, and maintenance to ensure that the completed remediation continues to perform as intended. As described in Section 4.0, resulting information is available in the published post-remedial reports.

1.8 CHRONOLOGY, CONTRACTORS, AND EQUIPMENT

Appendix D lists the contractors that performed the remediation activities and provides a chronology and description of major construction activities. Appendix E lists equipment and tools used for specific activities. Appendix F provides photographs of remediation highlights.

2.0 INTERIM REMEDIAL MEASURES

During 1987, Reynolds and NYSDEC were working under an Order on Consent (Index #3A6-0119-87-08, September 8, 1987) that included as one of its goals "to conduct a Property-wide evaluation to determine whether or not additional hazardous or industrial waste disposal sites are located on the Property." Reynolds had contracted Woodward-Clyde Consultants (WCC) to do the work required by the consent order.

In 1988, WCC conducted a four-phase PCB soil sampling program in the northern part of the plant to characterize the extent of PCBs (WCC 1988). The areas of study included the pitch and fuel oil tank diked areas, area north of the dikes, drainage ditch along Haverstock Road (also known as South Grasse River Road), areas by the Pitch Pumphouse, railroad tracks area, Carbon Plant area, and thickener system area. Additional soil sampling was conducted as part of the remedial investigation, and monitoring wells were installed to characterize groundwater quality. The results of the remedial investigation conducted by WCC are presented in the *Revised Final Remedial Investigation Report* (WCC 1990).

Concurrent with the WCC investigations and the receipt of the first PCB sample results during spring 1988, RMC implemented IRMs to prevent the spread of PCBs by surface runoff, airborne transport, or vehicular activity. The Pre-ROD IRMs included covering nontraffic areas with polyethylene sheeting and installing barriers such as temporary fencing; excavations along the 004 Outfall Drainage Area and installation of an interceptor ditch; installation of a GAC filter system and rerouting of storm drainage to this system; and installation of the North Yard Carbon Filtration Facility. These IRMs are described in the following sections. Excavated material from the pre-ROD IRMs was disposed of offsite at the Chemical Waste Management, Inc. hazardous waste disposal facility at Model City, New York.

The ROD was issued in January 1992, and NYSDEC approved the RD in July 1995. Remedial actions performed during that interval are also classified as IRMs and are described in this section. Excavated material was disposed of in accordance with the ROD.

2.1 GROUNDCOVER

In 1988, when PCBs were detected in surface soil samples from various areas in the North Yard, Fourth Coast installed plastic sheeting over the affected areas. Work began on June 4, 1988, and continued intermittently through 1990. Plastic sheeting was spread, weighted down, and edge-anchored in the areas near the storage tank impoundments. After the impoundments were drained, the basins were lined and the plastic weighted to prevent "float-up" when stormwater accumulated. Other areas covered with plastic included the level area between the fence along Haverstock Road and the northern outer slopes of the impoundments, the area near the carbon plant, and most of the rail track area affected by PCBs.

In November 1988, Fourth Coast applied a latex-based erosion prevention compound (Soil Seal®) to the rest of the unpaved North Yard area. The material crusted over the ground surface and provided adequate soil stability in areas of little or no foot or vehicular traffic.

The plastic groundcover was diligently maintained until it was removed during the remedial excavation in 1995 and 1996. The early plastic cover was a transparent material that soon decomposed from exposure to ultraviolet radiation from the sun. By the end of July 1988, 6-mil-thick black polyethylene resistant to ultraviolet radiation was being used as the initial cover. Clear plastic placed during June and July was covered with the 6-mil material before winter. Most of the plastic-covered areas were re-covered with 30-mil-thick plastic sheeting in 1991; this material remained in place and needed only occasional minor repairs until 1996, when it was removed for the full-scale remedial excavation. Areas covered with plastic were also bordered with 4-ft-high orange plastic fencing and marked as hazardous, restricted areas. Two areas subject to traffic were paved with blacktop in 1990—the area near the Carbon Plant and the area between the storage tanks and the northern plant road.

2.2 FORMER OUTFALL 004

Four separate IRMs (Phases I through IV) involving excavations for PCB removal were conducted along the stormwater runoff pathway from the storage tank impoundments to the St. Lawrence River. The IRM work started in 1988 and ended in 1992. The area, including the impoundments and the area north to Haverstock Road and east to the culvert under the road, was identified in Work Plans as the 004 Outfall Drainage Area. [Note: These IRM phases are unrelated to sampling phases or construction phases for the ROD remediation.]

Phases I and II. IRMs implemented in 1988 to reduce PCB discharges to Outfall 004 (later designated as Outfall 006) included installing a lined ditch to intercept surface runoff north of the pitch and fuel oil tanks and excavating a portion of the ditch along the southern side of Haverstock Road (WCC 1989). The bottom of the surface water intercept ditch, which was lined with a longitudinally cut metal pipe (half-pipe) that formed a trough, ran along the southern side of the plant fence to a catch basin and sump northeast of the fuel oil diked area. Starting in October 1988, stormwater collected by the intercept ditch was pumped to the eastern fuel oil diked area and from there to the 003 system (sewage treatment plant) for treatment.

The western (upstream) length of approximately 500 ft was remediated in October 1988 (WCC 1989). This roadside ditch remediation involved excavating 6 to 12 in. of soil between the edge of Haverstock Road and the plant security fence, followed by confirmation sampling and placement of crushed stone and asphalt pavement. Phase II, completed in October 1989 (O&G 1989), included re-excavation of about 40 ft of the initial phase to remove residual PCBs, excavation of the downstream eastern portion of the southern ditch along Haverstock Road, and excavation from the southern side of Haverstock to the St. Lawrence River (former Outfall 004). After a new catch basin and culvert were installed across the road and a ditch (east of the original culvert and ditch) was built to the river (designated Outfall 006), the original catch basin and culvert were removed, and remedial excavation was completed on the ditch north of the road. Most of the final confirmation results along both the roadside ditch and the ditch north of the road were <1.0 ppm PCBs; all were <10 ppm.

It should be noted that the area on the northern side of Haverstock Road is not in the North Yard area. The interim remediation work completed in this area is presented here because it was completed with the North Yard work and is not included in the Completion Report for the Area North of Haverstock Road (Bechtel 1995c).

Soil excavated during this work was stockpiled on polyethylene sheeting in a level area north of the pitch dike area; the stockpile was kept covered, and runoff was controlled. After RMC obtained the necessary approvals, the stockpiled material was shipped offsite for disposal, which was completed by November 1989.

During the ROD remediation work (Section 3.0), the asphalt and crushed stone installed in 1989 were removed from the ditch. The exposed surface was covered with an 8-in.-thick layer of clay topped with geotextile and a 4-in.-thick layer of crushed stone.

Phase III. Additional IRMs were performed north of the dikes in 1991 to further reduce the possibility of erosion and transport of PCBs (Bechtel 1991c). A french drain, consisting of a 12-in.-diameter perforated polyethylene pipe and a trench filled with crushed stone, was installed along the plant fence to the catch basin and sump that had been installed in 1988 (Figure 2). The french drain, which serves as a groundwater intercept, replaced the half-pipe trough installed in 1988 (Phases I and II); the half-pipe trough was removed and disposed of offsite. A 30-mil, high-density polyethylene (HDPE) liner with welded seams was installed between the toe of the dikes and the french drain, covering the existing plastic cover from 1988. In addition, a new, short subsurface water collection trench (french drain) was installed across the downstream end of the pavement (placed in the Haverstock Road south ditch during Phase I). The two drains remained in service until the North Yard remedial action was completed during fall 1996.

Phase IV. The final IRM for the northern area and drainage pathways from the North Yard was performed in 1992, and again involved the open ditch from Haverstock Road to the river (Bechtel 1992c). The new pathway for the ditch, built as the final part of Phase II work during fall 1989, was excavated after continued detections of PCBs at the sampling station. An underground storm drain was installed from the end of the culvert under Haverstock Road to the shoreline, with a new sampling station built at the top of the cliff at the river edge. The drain line was installed at a uniform gentle slope, and a splash block with rip-rap runout was installed at the shoreline. The Corps of Engineers issued a permit for this work.

During the ROD remediation (Section 3.0), several improvements were made to the previous IRMs. The catch basin and sump installed in 1988 were cleaned and abandoned. The french drain installed in 1991 was removed, and the area was backfilled and restored. A new french drain was installed in the eastern portion of the ditch, discharging to the new 001 Sediment Basin System. Spoils were disposed of in the onsite Landfill.

2.3 GRANULAR ACTIVATED CARBON FILTER INSTALLATION

In 1988, Fourth Coast Pollution Control, under contract to Reynolds for spill response, installed a portable GAC filter system to treat the water from the spill impoundments at the pitch and fuel oil storage tanks. The complete system included a pre-filter, two carbon filter modules, pumps, meters, and hoses. Two storage tanks (20,000 gal and 30,000 gal) were also installed so that treated GAC effluent could be analyzed and verified free of PCBs before it was released to the St. Lawrence River. The system operated 24 h/day until the impoundments were emptied and all water had been treated.

From May 16 through August 10, 1988, the filter system processed 208,000 gal of water. From startup to mid-July, the filtration was accomplished in batches, and each batch of GAC effluent was stored in the tanks until sample results proved that PCBs had been successfully removed. On July 19, NYSDEC approved Reynolds' request to run the system continuously with direct discharge to the storm drains feeding to 001 Outfall. After this change, all treated water was delivered via hose and pipeline to a catch basin just east of the fuel tanks, and the 20,000-gal and 30,000-gal storage tanks were decontaminated and removed from the site.

In the meantime, Reynolds installed a GAC filtration system at the Sewage Treatment Plant (Facility 63C). This system had a 150-gpm effective treatment rate—much larger than the 15-gpm portable system. Although it was initially intended to be used to filter only sewage effluent, there was enough reserve capacity to also filter the steady 15 gpm from the impoundments. The impoundments were again full in October 1988, and the water was treated by pumping directly to the sewage treatment plant for filtration by its GAC filter system; none of Fourth Coast's equipment used in the preceding spring was needed. NYSDEC allowed this mode of operation under a "temporary permit" until January 7, 1989. Reynolds and NYSDEC then negotiated an agreement allowing continued treatment of the water, and the system was operated from March 10, 1989, until early 1991 when the North Yard GAC system was built.

2.4 NORTH YARD CARBON FILTRATION FACILITY AND RELATED ACTIVITIES

In preparation for the construction of the North Yard water filtration facility, locations selected for the surge tank, treatment plant, and nearby utility routes were sampled in September 1990. Sample results from 12 of the 13 locations were <10 ppm PCBs, and the other result was 14 ppm PCBs. Results are shown on Drawing 061-CDD-017 (Bechtel 1991d).

In September 1990, Woodard & Curran Consultants (W&C) submitted a design plan for filtration of North Yard stormwater (W&C 1990) that included a surge tank to receive incoming flows, a pump station for transferring influent, and a new treatment plant with two 20,000-lb-capacity GAC filter units for removing PCBs. The storm drain system in the railroad track area was modified to reroute surface runoff to the new surge tank instead of directly to Outfall 001. Existing storm drains leaving the railroad track area were plugged to prevent area runoff from entering the storm drain network of the 001 system, and a new drain line was installed to intercept the flow from the plugged lines and convey it to the new surge tank. Excavated storm drain system soils were disposed of offsite.

Soil sampling data, management of excavated soils, and pipe installation for the North Yard storm sewer intercept work were documented in a letter from Bechtel to NYSDEC (Bechtel 1991b). Temporary pumps and aboveground header piping were installed so that water collected in the pitch and fuel oil diked areas and water intercepted north of the dikes (see Section 2.1) could be pumped to the new GAC filter plant system. Discharge piping from the GAC filter plant system was installed so that the treated effluent could be pumped to the 001 drain network or be used in the plant fume control system.

Installation of the modified storm drain system and header piping was completed in December 1990, and the new GAC filter plant system was put into service in January 1991. Since then, the treated effluent from the GAC filter plant system has been monitored and reported per NYSDEC's requirements. Results show that the system is consistently effective in removing PCBs.

In October 1990, the area by the Carbon Plant was covered with asphalt pavement, replacing a portion of the 1988 interim polyethylene sheeting and providing a better working surface for plant operations. All temporary asphalt pavement and all remaining plastic sheeting were removed during the ROD remediation.

2.5 OTHER INTERIM REMEDIAL MEASURES

Decontamination of Pitch Pumphouse, 1989

In 1989, Fourth Coast Pollution Control decontaminated floors, walls, piping exteriors, and other exposed surfaces in the Pitch Pumphouse. Floors, walls, and surfaces of insulated pipes were then painted.

Installation of Storage Tank, 1990

During spring 1990, RMC began installing a storage tank with secondary containment northeast of Coke Silos 22D and 22E. Sampling and analysis indicated PCB levels from nondetect to 5.1 ppm in the proposed excavation area. Soil (22 yd^3) excavated for the foundation was transported to the Soil Stockpile and later to the onsite Landfill for final disposal.

Storm Drain Cleaning, 1992

The storm drain lines connected to 001 drain network were cleaned by Op-Tech Environmental Services during spring 1992 and again during fall 1992. The areas adjacent to two catch basins (CB54 and CB64) near the Carbon Plant were excavated to remove soil with elevated PCBs. Three completion or status reports on the work on the 001 system were issued (Bechtel 1992b and 1993a; W&C 1992).

Transformer Foundations, 1994

Excavation work for new foundations for transformer replacements at two North Yard facilities was conducted in spring 1994. The PCB transformers at Facility 22 (Carbon Plant) and Facility 80 (Cryolite Recovery Plant) were to be replaced with dry transformers of the same electrical capacity but physically larger. To accommodate the larger transformers, the concrete foundations were modified. Approximately 60 yd^3 of soil from the Facility 22 excavation for three transformer foundations was shipped offsite to the Model City landfill, and 10 yd^3 from the Facility 80 excavation was eventually placed in the onsite Landfill. Reports on the work were included in two letters (RMC 1994a and 1994b).

Concrete Slab for Trackmobile, 1994

During fall 1994, a small area was excavated for placement of a concrete slab for a heavy vehicle parking area. The concrete slab (approximately 25 ft by 25 ft) was placed immediately southwest of the Unloading Shed. Approximately 30 yd^3 of soil was removed, sampled, and disposed of in the onsite Landfill (RMC 1994d).

Roaster Stack, 1994

During fall 1994, material was removed from beneath the roaster stack and sampled; the PCB results were 26 ppm. This material was placed at the storage pad with other materials ≥ 25 and < 50 ppm PCBs and was later disposed of in the onsite Landfill (RMC 1994c).

Rail Car Puller Foundation, 1995

In March 1995, a small area was excavated for a rail car puller foundation (RMC 1995). Approximately 90 yd^3 of material was removed, sampled, and disposed of in the onsite Landfill.

3.0 REMEDIAL ACTION

This section addresses remedial actions taken pursuant to the ROD. Remedial actions before the ROD are addressed in Section 2.0.

3.1 APPROACH FOR REMEDIATION OF THE NORTH YARD

3.1.1 Overall Remediation Approach

The course of action needed to effectively accomplish the remediation was developed based on the ROD and RD. The ROD and its subsequent amendment established the overall requirements for remediation of the North Yard, while the RD provided the detail to execute the remediation within the regulatory framework.

The RD takes into account the potential for North Yard remediation to interrupt production at the St. Lawrence Reduction Plant. Consequently, the North Yard was divided into Areas 1 and 2 (Figure 1), based on how critical each was to plant operations. Requirements appropriate for each area were included in the RD.

Area 1 consisted of areas where remediation and plant operations had to be planned and scheduled to minimize interference. This led to several important measures:

- Intensive up-front sampling to define the precise horizontal and vertical limits of excavation.
- Stockpiling of raw materials needed for plant production.
- Coordination and planning with plant operations and production personnel.
- Innovative construction practices, especially for backfilling excavations and replacing rail lines.

Area 2 consisted of portions of the North Yard where remediation could be accomplished without interfering with operations. The approach for Area 2 was, therefore, much like that for the other onsite remediation areas.

3.1.2 Sampling Approach

The sampling approach was based on the Sampling and Analysis Plan and Field Sampling Plan included in the Remedial Design/Remedial Action (RD/RA) Work Plan for the Record of Decision Remediation Activities (Bechtel 1993b). In accordance with the Sampling and Analysis Plan, a three-phased sampling program supported remediation:

- Phase I sampling delineated the horizontal and vertical distribution of PCBs and provided the basis for the excavation plans. Phase I samples were analyzed in the field using immunoassay (EPA Method 4020) techniques or sent to the offsite laboratory for gas chromatography (EPA Method 8080) analyses.

- Phase II sampling supported the excavation effort by providing rapid PCB analyses, thus allowing real-time decisions regarding the need for additional excavation. Phase II samples were analyzed in the field using immunoassay techniques; a minimum of 10 percent of the samples were sent for offsite laboratory analysis to provide a quality control (QC) check on the immunoassays.

- Phase III samples were used to document post-remedial conditions (Area 1) or verify that cleanup goals had been achieved (Area 2). In Area 1, Phase III sampling was conducted to document residual concentrations of PCBs, PAHs, PCDDs, and PCDFs at the bottom of the excavation. In Area 2, Phase III samples were collected and analyzed for PCBs and PAHs to verify that cleanup goals had been attained. Phase III verification samples were sent for offsite laboratory analysis by EPA Method 8080 for PCBs, EPA Method 8270 for PAHs, and EPA Method 8280 for PCDDs and PCDFs. Phase III sample analyses for Area 1 and Area 2 were reported in Analytical Services Protocol (ASP) Category B format; results from Area 1 were verified, and results from Area 2 were verified and validated.

Excavation and disposal decisions were conservatively based on samples with the highest PCB concentrations for that grid block. In other words, analytical results indicating relatively high concentrations of PCBs dictated excavation and disposal requirements even when other samples in the immediate area might have indicated much lower concentrations. For example, if two boreholes in the same grid block were sampled at the same depth interval and the PCB concentrations were 5 ppm and 100 ppm, respectively, the 100 ppm result prevailed, and the material was shipped offsite for disposal.

3.2 CONSTRUCTION PRECAUTIONS

The North Yard was the remediation area most congested with workers, process activities, aboveground infrastructure, and buried utilities; consequently, construction precautions were especially critical.

3.2.1 Access Controls

Control and exclusion zones were established before excavation began. Within the perimeter fences of the controlled areas, exclusion zones defining the excavation limits were marked with yellow rope.

Contamination reduction zones were established just outside exclusion zones so that personnel and small equipment and tools could be decontaminated before leaving the work area. Decontamination stations were roofed wood sheds mounted on skids for easy transport and positioning. Drinking water, small tools, protective clothing and gloves, and detergent for wash tubs were stored inside the sheds; tubs for washing contaminated boots and small tools were kept outside.

3.2.2 Utilities and Plant Interferences

Utilities and plant interferences in the North Yard included roadways, driveways, equipment foundations, unloading stations for rail cars and tanker trucks, overhead high-voltage power lines, railroad tracks, storage tanks, buildings, underground process piping, aboveground pipe, and pipe supports. These features limited some work areas, necessitating the use of small machines or hand excavation. During remediation and restoration, project and plant personnel coordinated lockouts/tagouts on sections of the power lines and process piping; this advance planning promoted safety and prevented impacts on either plant operations or the remediation efforts.

3.2.3 Prevention of Cross-Contamination

Cross-contamination was prevented by:

- Gross decontamination of the trackhoe bucket before it was moved to another area.
- Placing plastic sheeting along the "dribble path" from the trackhoe bucket to the haul truck to collect spillage.
- Protecting truck exteriors with wood-framed geotextile curtains.
- Inspecting truckbeds and tailgate gaskets to ensure watertight conditions.
- Using dump ramps with wheel stops and steel plate shields to prevent contaminated soils from collecting on tires or undercarriages during offloading.
- Placing silt fencing to protect cleaned areas from areas not yet excavated, or to protect areas with lower levels of contamination from areas with higher levels of contamination.
- Placing geotextile fabric on vertical cut surfaces at the borders of excavations to protect new backfill.

3.2.4 Decontamination

At the heavy equipment decontamination facility on the eastern side of the plant, a pressure washer/ steam cleaner was used to remove soil, which was disposed of offsite. Washwater was collected in a sump and transported by vacuum truck to the surge tank at the GAC filter plant system for treatment. The decontamination facility was operated and maintained in accordance with Appendix B of the RD/RA Work Plan (Bechtel 1993b).

3.2.5 Water Management

Stormwater and surface water were managed in accordance with the facility-wide Water Management Plan (Bechtel 1995d). Stormwater runoff from any unremediated surfaces was diverted to sumps, removed by vacuum truck, and taken to the GAC filter plant; approximately 650,000 gal was treated during 1995 and 1996. Sumps in the excavation areas and silt boxes around catch basins in adjacent areas controlled the movement of sediment.

3.3 PHASE I SAMPLING AND DELINEATION CROSS SECTIONS

Phase I delineation sampling and the excavation pattern in the North Yard was based on a relatively small grid size (25-ft by 25-ft grid). This grid size provided good definition of gradations in PCB concentrations and proved to be manageable with respect to excavation and disposal options. Grid size was particularly useful when defining areas with higher PCB concentrations requiring additional excavation or offsite disposal. Additional Phase I samples included concrete from the North and South roads; results from these samples were used to determine disposal requirements.

Phase I delineation samples were collected from October 1994 through early April 1995 and again during April and May 1996. Approximately 2,700 samples were collected from 450 locations in 1994 and 1995, and approximately 200 samples from 30 locations were collected in 1996.

Detailed cross sections through each grid block were prepared to help guide remedial excavation; the sections are shown on Figures 30 through 68 of the RD (Bechtel 1995b). These cross sections showed PCB concentrations versus depth using data collected by WCC (WCC 1990) and Phase I delineation sampling results through 1995. The cross sections clearly illustrated the excavation depths necessary to meet remediation goals, and provided a reliable means for estimating excavation, haul truck, and labor requirements.

During remedial excavation (Section 3.4), RMC explored the possibility of remediating Area 1 to <10 ppm PCBs to reduce the need for additional remediation upon eventual plant closure. Additional delineation samples were collected between January and April 1995 and analyzed in an offsite laboratory, and the grid block cross sections were updated with the additional data. The ensuing evaluation considered depth versus PCB concentrations; equipment, schedule, and soil disposal requirements; and backfill materials. It was deemed prudent in most areas to increase the excavation depth to achieve a target level of <10 ppm PCBs. This effort was field directed and excavations were revised accordingly.

In March 1996, design changes were made for the pitch and fuel oil storage tank area (FCR 155), and the remedial excavation plan was updated (FCR 163). During April and May 1996, additional drilling and Phase I sampling were conducted to support deeper excavations in this area and soil disposal requirements. These data were incorporated into the cross sections and evaluated, leading to FCR 167 (May 1996) which included a verification plan to supplement existing plans.

3.4 EXCAVATION AND PHASE II SAMPLING

3.4.1 Excavation Phases

Extensive planning went into the design to ensure that work in the North Yard went as smoothly as possible. Excavation was divided into separate construction phases. [Note: Construction phases and sampling phases are not related.] The layout and sequence of phases considered excavation logistics and the need to work with small units so that interference with daily plant operations would be manageable. Ultimately, six construction phases were defined, as shown on Drawing Y-NYY-003 in the RD (Bechtel 1995b) and Figure 3.

Phase I, which is within Area 1, contains the area between the Carbon Paste Plant and South Road and a small portion of South Road itself. Approximately half of this area is within the 100-ppm footprint.

Phase II extends to the north and east of the Unloading Shed. The western portion of Phase II is in Area 1, and the eastern portion is in Area 2. Approximately half of Phase II is within the 100-ppm footprint.

Phase III, all within Area 1, is west of the Unloading Shed and north of South Road and includes the southern portion of the rail yard. More than half of this area is within the 100-ppm footprint.

Phases IV and V were combined into a single construction phase based on construction logistics. This area is bordered on the north by North Road and covers the northern portion of the rail yard. All of the Phase IV area and most of the Phase V area is within the 100-ppm footprint.

Phase VI, the final construction phase, covered the remainder of the North Yard area and included the North Road along the northern edge of the rail yard, areas west and east of the Pitch and Fuel Oil Pumphouse, pitch and fuel oil storage tank areas, and open areas to the plant fence along Haverstock Road. Approximately one-third of the Phase VI area is within the 100-ppm footprint.

3.4.2 Excavation

Excavation was performed based on Drawing Y-NYY-006, "Grid Excavation Summary," and the grid cross sections (Figures 30 through 68 of the RD), which captured most of the soil sample results from the North Yard. To avoid cross-contamination and maximize efficiency, excavation followed the same 25-ft by 25-ft grid pattern established for sampling. Efforts were made to avoid damage to existing facilities and disruption of plant operations.

Work started in July 1995. Phase II, which covered the eastern portion of the rail yard, was excavated and restored first. Work then proceeded simultaneously on Phases I and III. After Phases I and III were restored, the rest of the rail yard was excavated and restored in one phase (Phase IV/V). Work then started on Phase VI in October 1995 and was completed in 1996.

Because most of the excavation was in glacial till, the sidewalls along excavation phase interfaces and adjacent to existing pavement and foundations could be nearly vertical. This allowed maximum removal of the material and provided a clear distinction between construction phases.

The grid blocks south of the Coke Storage Silos were the first to be excavated in Phase I. Excavations in this area were up to 15 ft deep, and access was very limited; both conditions required paying extra attention to safety. Tight working quarters necessitated that equipment back out of the excavation site instead of turning around to exit. Excavation proceeded from east to west, starting from the grid blocks between the South Road and the Carbon Paste Plant. The shallower excavations, which were still difficult to access, were completed using hand tools.

Phases II, III, and IV/V included the Unloading Shed and rail yard, bordered on the north and south by plant roads and extending to the east beyond the eastern plant road (FCR 146 relocated the northern border to correspond with the southern edge of the north road). The eastern portion of the rail yard was excavated in one phase (Phase II); the western portion was then excavated in two phases (Phases III and IV/V). Before excavation, the steel rail and hardware were removed and stored for reuse. The railroad ties were loaded onto transporters for offsite disposal; ballast and underlying soil were excavated and disposed of as shown in Drawing Y-NYY-006.

Phases IV/V contained another area of deep excavations along the southern side of the North Road; the area approximately 100 ft east and west of the Underground Pitch Vault was excavated to depths ranging from 10 to 23 ft. The area was open and accessible, but both underground and aboveground utility locations were obstacles.

In Phase VI, considerable preparation preceded excavation in the containment dike areas. Pitch and fuel oil piping were drained and removed, and the pipe and its contents were disposed of properly. Temporary piping was installed in the pitch tank area to keep the system operational during excavation. Tank 67A (fuel oil storage tank) was emptied, cleaned, demolished, and disposed of offsite in December 1995. Phase VI excavations also included the areas east and west of the pitch pump house. Hand tools were required for much of the work in these areas because of underground pipe banks (western side) and footings for the pipe bridge tower (eastern side).

3.4.3 Phase II Sampling and Analysis During Excavation

Phase II immunoassay sampling provided a tool to help guide excavation. As design excavation depths were reached in a grid block, samples were collected and analyzed using immunoassay procedures that provided rapid field determinations of PCB content in soil. The almost immediate availability of the immunoassay results frequently allowed remediation management to decide to continue excavation deeper than design limits to achieve the ROD goal of <10 ppm. The rapidity of the immunoassay procedure allowed the remediation to be completed on schedule in spite of the additional excavation.

Grid blocks were often sampled at multiple locations when logistics dictated that those grid blocks be excavated in stages. For example, when obstructions (e.g., a railroad track or crucial section of paved road) split a grid, soil adjacent to the obstruction was excavated, sampled, and backfilled; then the remaining portion was excavated, sampled, and backfilled.

The key decision point for PCB content in soil was 50 ppm; soil with <50 ppm PCBs could be disposed of in the onsite Landfill, and soil with ≥50 ppm PCBs needed to be shipped offsite for disposal. Layers of soil with ≥50 ppm PCBs were sometimes sandwiched between layers of lower concentrations within a grid block. The grid cross sections showed these layers by concentration and depth, allowing a layer with <50 ppm PCBs to be efficiently removed without being combined with soil having greater PCBs. The excavation depths and cut thicknesses were constantly monitored via civil surveys.

Area 1 Phase II Sampling and Analysis. The RD did not require Phase II sampling in Area 1 unless obvious areas of residual contamination such as oil-stained soils were observed, in which case additional action was to be considered. In such cases, affected areas were excavated and resampled until PCB levels were <25 ppm. However, based on the decision by RMC to increase the excavation depth to achieve <10 ppm PCBs in most of Area 1, Phase II samples were collected from the bottom of each remediated grid block within the 100-ppm footprint. After excavation to the design depth, each grid block was sampled and analyzed using immunoassay techniques to determine whether the target level of <10 ppm PCB had been achieved. If not, excavation and immunoassay testing of the grid block usually continued. When immunoassay testing indicated that the target level had been met, Phase III samples were sent to the laboratory in accordance with the Area 1 Verification Sampling Plan given in Section 6.0 of the RD (Bechtel 1995b). With few exceptions, this approach allowed the grid blocks within the rail yard west of the Unloading Shed and all of the grid blocks within the pitch tank area to be successfully remediated to <10 ppm PCBs within the original schedule.

Post-excavation sampling was not required for the grid blocks outside the 100-ppm footprint in Area 1. However, after the excavation (for paving) was completed in this area, additional excavation was performed based on the delineation sampling results. This additional excavation was done at grid blocks B35, E20, F37, F26, G22, G23, G35, G37, D28, and D33 north of the main plant building to depths where the delineation sample results indicated <25 ppm PCBs. This was also done in several grid blocks west of the Unloading Shed.

Area 2 Phase II Sampling and Analysis. In Area 2 where there were no schedule constraints related to shutdown of essential plant facilities, each grid block was sampled after excavation to determine whether the cleanup goal of <10 ppm PCBs had been met. If the results were not <10 ppm, the grid block was excavated further and resampled. When the immunoassay tests indicated that the cleanup goal had been met, verification samples were sent to the laboratory for analyses in accordance with the Area 2 Verification Sampling Plan (Bechtel 1995f).

Other Phase II Sampling and Analysis. Because of restricted space, several areas around foundations and footings were excavated with small equipment and hand tools. Phase II and Phase III samples were also collected at the base of these locations.

3.4.4 Disposal

Soil with PCB levels ≥50 ppm was shipped offsite to a licensed disposal facility. The transport trailers were specifically designed to haul waste over public roadways and were driven by trained operators licensed by the Department of Transportation (DOT). Offsite haul vehicles were weighed on RMC plant scales, and weights were recorded on manifests to comply with hazardous waste transportation regulations and federal and state DOT regulations. When the shipper/generator sections of the manifests had been signed by an authorized and trained RMC employee, the trucks transported the soils to the Toxic Substances Control Act (TSCA) landfill at Model City, New York, operated by Chemical Waste Management, Inc. Completed and signed manifests indicating receipt and disposal at the offsite landfill were returned to RMC for its permanent records.

Soil with PCBs <50 ppm was disposed of in the onsite Landfill, which was managed in accordance with the *Operation, Maintenance, and Contingency Plan for the Onsite Disposal of Waste Soils*, included in the RD (Bechtel 1993b).

North Yard excavation and disposal volumes are summarized as follows:

PCB Level (ppm)	Volume (yd^3)	Disposal Location
≥1 and <50	15,332	Landfill/Former Potliner Storage Area
≥50	19,528	Chemical Waste Management, Inc., Model City, New York
Total	44,860	

Table 1 provides a breakdown by remediation phase.

3.5 PHASE III SAMPLING AND COMPLIANCE VERIFICATION

This section addresses verification of compliance with the remediation goals listed for the North Yard in the ROD (NYSDEC 1992) and ROD amendment (NYSDEC 1995). The goal for verification sampling was to demonstrate that the site was remediated as specified in the approved project documents and in accordance with *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media* (EPA 1989).

Compliance verification is the process by which sampling and analysis activities for a remediation area are planned, executed, documented, and reported. Compliance verification includes developing a defensible sampling strategy, sampling as specified in approved plans, analyzing samples using industry standard protocols, independently validating resulting data, comparing analytical results with cleanup standards, documenting results, and reporting.

3.5.1 Post-Excavation Sampling Plans

Verification Sampling Plan for Area 1. Requirements for verification sampling in Area 1 are defined in Section 6.0 of the RD (Bechtel 1993b). The RD indicated acceptable sampling locations (Figure 26 in the RD), though exact locations were to be determined in accordance with Section 6.0 of the RD.

For many onsite remediation areas, Phase III sampling used a statistical sampling model to verify that specified cleanup goals had been attained. For Area 1 in the North Yard, however, the purpose of Phase III sampling was to document residual PCB levels in the bottom of the completed excavations. Phase III samples were collected on the grid pattern at approximately 50-ft centers. The plan specified collection of 36 samples with PCB analyses on all samples, PAH analysis on 7 samples, and PCDF and PCDD analyses on 3 samples. When excavation was completed, Phase III samples were sent to the offsite laboratory for analysis. Sample results were reported using ASP Category B format and were reviewed and verified in accordance with Section 3.5.3.

Although Area 1 was not bound by cleanup goals, as defined for other remedial areas, post-excavation Phase III sampling demonstrated that except in a portion of grid block OM21, the target level of <10 ppm PCBs and ROD-derived cleanup goals for PAHs were attained. Phase III sample locations are shown in Drawing ATL-NYD-06, and laboratory results are shown in Tables 2 and 3. PCDDs and PCDFs were not detected in any of the Phase III samples collected (Table 3).

Verification Sampling Plan for Area 2. Requirements for verification sampling in Area 2 are defined in Section 6.0 of the RD. The number and locations of samples were defined in the Verification Sampling Plan for Area 2 (Bechtel 1995f).

Area 2 was not essential to plant operations and hence was not constrained by schedule, allowing verification sampling consistent with that used for other onsite remediation areas. Verification sampling was, therefore, conducted in accordance with a *Statistical Model for North Yard Area 2* (Appendix C in the RD, Bechtel 1995b), which was prepared to scientifically evaluate whether the soil concentrations of PCBs in the remediation area comply with the cleanup goal established in the ROD. The model was based on and consistent with *EPA guidance in Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media* (EPA 1989).

The model used a distribution-free, or nonparametric, method of statistical analysis. The sampling method selected was appropriate for analyzing the Phase III analytical data because the PCB results were expected to be below the quantification limit of the method (i.e., nondetectable) and were therefore not normally distributed. This method did not require any preliminary data such as mean or standard deviation. Instead, an exact test was performed using parameters selected for this site to determine the level of confidence that a proportion or percentile of the site was clean. Key parameters included (1) the level of significance (alpha), which established the probability for a false positive result (declaring a remediation to be successful when it has actually failed); and (2) the power of the test (beta), which established the probability for a false negative result (declaring a remediation to have failed when it has actually succeeded). The parameters selected for this site (α=0.10; β=0.20) required the collection and analysis of 29 random samples for a 90 percent level of confidence that the remediation effort was successful. The statistical bases for sampling (selection of the statistical parameters, number of sample units, number of allowable exceedances, and random number selection) are contained in the model and are not repeated in this document.

After the 29 sample units were randomly selected for the statistically based analysis, two excavation areas did not contain a sampling unit. Though not required by EPA guidelines, an additional verification sample unit, independent of the statistical model, was added to each of these areas for increased confidence that the cleanup was successful.

While the Sampling and Analysis Plan, which is part of the RD/RA Work Plan (Bechtel 1993b), defined the logistics for Phase III sampling and analysis, the Verification Sampling Plan defined the number and locations of Phase III samples and called for laboratory analyses of key contaminants. The plan required that samples be taken from the 0- to 2-in. interval at nine separate locations within each designated 25- by 25-ft sampling unit. The nine surface aliquots were then composited to provide the sample for that sampling unit.

Area 2 verification samples were collected in the grid blocks shown in Figures 2 and 3 of the Verification Sampling Plan and analyzed for total PCB concentrations; sampling locations are indicated on Drawing ATL-NYD-06, and results are shown in Table 4. Thirty-one samples were analyzed for PCBs, and 6 of these were analyzed for PAHs. Laboratory results for the verification samples were all below the specified cleanup levels for PCBs and PAHs, demonstrating that remediation was successful.

Data were reported in the ASP Category B format, reviewed, verified, and validated as described in Section 3.5.3.

Verification Sampling Plan for Containment Dike Area. Design changes in the pitch and fuel oil storage tank area (FCR 155, FCR 163) resulted in revision of the Area 1 and Area 2 boundaries in this area and the preparation of the Containment Dike Verification Sampling Plan (FCR 167).

The entire containment dike area was originally included in Area 1. The pitch tank area was retained in Area 1; however, based on the removal of the fuel oil tank and design changes in the remaining 67B fuel oil tank area, the central to eastern area (R28-37 through V28-37) was included in Area 2. Remediation goals were <25 ppm PCBs in Area 1 and <10 ppm PCBs in Area 2.

The Containment Dike Verification Plan was prepared to supplement the original approved Area 1 Verification Sampling Plan (Figure 26 in the RD). The Area 1 plan included eight sample locations for this area and was completed as planned; analyses included PCBs, and at selected locations, PAHs and PCDFs/PCDDs. The supplemental Verification Plan required sample collection and immunoassay and laboratory analysis for PCBs (reported at Level C) at all grids not included in the original plan. Table 5 lists PCB results for the supplemental verification samples collected in the containment dike area. As shown, remediation goals were met; all PCB concentrations were less than 10 ppm.

3.5.2 Laboratory Analyses

Atlantic Testing Laboratories (ATL) performed laboratory analyses using analytical methods and protocol for PCB and PAH compounds approved by EPA and NYSDEC and outlined in the RD/RA Work Plan (Bechtel 1993b). Phase III sample analyses for Areas 1 and 2 followed the protocol and documentation requirements specified in the NYSDEC ASP (NYSDEC 1989), which requires that all analyses be documented in a specific format to allow complete reconstruction of all reported results.

Because the ROD-required cleanup goal for most PAH compounds is well below the standard level of detection for the approved EPA method (SW-846 Method 8270), a method modification was necessary. This modification, requested by NYSDEC, consists of concentrating the sample extract to a smaller amount than normal and injecting a larger amount into a gas chromatograph/mass spectrometer instrument. While the method modification concentrates the PAH compounds for greater detection, it also concentrates the interferents that can adversely affect precision and accuracy; therefore, the data validators flag these results "J" (estimated) when the effect of the interferences is evident.

The PAH results shown in Tables 2 and 4 reflect the laboratory-estimated detection limit when samples were nondetects. For example, the value "0.18U" for pyrene in sample NYOF3302VP at grid OF33 means that pyrene was not detected, and if there is any pyrene in the sample, it is at a concentration below 0.18 ppm.

Data review, contract compliance screening, and verification were performed on all laboratory sample results as required by project procedures and in accordance with the Project Data Management Plan (Bechtel 1993b, Section 3). Verification ensures that results contained in the laboratory electronic deliverable and project database match those reported on the hard copy. Contract compliance screening evaluates the data for contractual, procedural, and technical requirements.

Samples collected from Area 1 and the Containment Dike were reviewed and verified. Samples from Area 1 were reported using ASP Category B format so that independent validation could be performed later if necessary. Although validation was not required for Area 1 samples, some of the sample data were validated. Containment Dike sample data were reported as Level C, as specified in FCR 167, and were reviewed and verified. Sample data from Area 2 were reported in ASP Category B format, reviewed, verified, and validated.

Environmental Standards, Inc. (ESI) independently reviewed the verification sample results for Area 2 (and a portion of Area 1) and validated the data using guidance from the *National Functional Guidelines for Evaluating Organic Analyses* (EPA 1988). Data were examined to determine the usability of the analytical results and the contractual compliance relative to the analytical requirements and/or deliverables specified in the NYSDEC protocol. Appendix G presents the ESI validation summaries.

3.5.4 Results and Conclusions

Tables 2 and 3 present the results of Area 1 sampling. Table 2 lists the PCB and PAH results; Table 3 contains the PCDD/PCDF results. Figure 4 shows the post-excavation residual PCB levels in each grid block based on both immunoassay and laboratory testing. As shown, the target level of <10 ppm PCBs was attained in all but 8 grids or partial grids, and the ROD-specified remediation goal of <25 ppm PCBs was attained in all but two partial grid blocks. The immunoassay result for PCBs in grid block OL34 was 25–50 ppm, and the analytical results for OM21 indicated 270 ppm PCBs and elevated concentrations of PAHs. The northern and eastern portions of grid OM21 were excavated 1 and 5 ft deeper, respectively, than the southwestern quadrant of OM21. A sample collected from the center of the northern section of OM21 and analyzed for PCBs and PAHs (Level C reporting) yielded results of 2.2 ppm PCBs and 0.18 ppm PAHs. The southeastern section was excavated in conjunction with OM22 to a depth of 15 ft with results of <10 ppm PCBs and 0.18 ppm PAHs. The goal of the remediation in these areas was to excavate to the depths indicated on the excavation plan and to pursue greater depths only where suspect material was encountered. As indicated by the data, greater depths were pursued at most locations as guided by immunassay field testing and allowed by the work schedule. However, due to scheduling constraints, greater depths were not pursued at the partial grids listed above.

Table 4 summarizes verification data for Area 2 in the North Yard. As shown, remediation in this area successfully removed PCBs to <10 ppm PCBs. Results from the six samples analyzed for PAHs were also below the cleanup goals.

Table 5 summarizes the supplemental containment dike verification results for PCBs. The data were Level C because independent data validation was not required for these samples. All results were below the remediation goals for Area 1 (<25 ppm) and Area 2 (<10 ppm).

3.6 RESTORATION

3.6.1 Backfill

General Backfill. Soil for backfilling and general construction and restoration came from the onsite borrow area approximately a quarter-mile west of the plant. The Borrow Area Use Plan (Bechtel 1994) shows the layout of the area and describes its operation.

Controlled Low-Strength Material. To expedite restoration in Area 1, CLSM was used in lieu of conventional backfill and compaction methods. CLSM is sand, cement, flyash, and water mixed in the proper proportions to yield an excellent structural backfill that readily flows to fill voids and hard-to-reach places, solidifies without compaction, has a compressive strength in the range of 100 to 200 psi, exhibits almost no long-term settlement, and can be easily excavated if needed using conventional equipment. CLSM will support heavy equipment traffic after only 4–48 hours, allowing grading and follow-up work to be done quickly. CLSM speeds up the backfill process because it eliminates the need for placing, compacting, and testing in lifts (especially in deep excavations, which often require shoring) and because it is an efficient and effective material for backfilling around buildings, structures, and foundations. CLSM was regularly tested to ensure proper slump, mixture proportions, and strength. Before the liner system was installed, the underlying CLSM was graded to provide positive slope to catchbasins. CLSM was used for backfilling the deep excavations east and west of the pitch tank vault, throughout the rail yard area, beneath the pipe bridge tower on the eastern side of the Pitch Pumphouse, and in selected grid blocks within the Pitch Storage and Fuel Oil Tank area.

3.6.2 Area 1 Cap

The cap in Area 1 was largely dictated by the following factors:

- The cap must minimize surface water infiltration into the underlying soils to control the migration of residual contamination.
- Remaining soils with PCB levels ≥10 ppm must be capped.
- Area 1 is the center of considerable activity, so the cap must be durable even during the bitter Massena winters.

Two different cap designs were selected: one consisting of multiple layers of geosynthetic materials and the other consisting of concrete. Concrete was placed in areas used for heavy loadings from plant operations where dusty process materials might be spilled and to rebuild the tank containments.

Geotextile Fabric, Geomembrane Liner, and Geonet Composite. The geosynthetic cap consisted of individual layers, each with a distinct function: geotextile fabric as a cushion layer, geomembrane liner as a water barrier, and geonet composite to protect the top of the geomembrane and also drain water off the cap and into the storm drainage system. This cap system was used primarily over the CLSM backfill in the rail yard area. First, the geotextile fabric was placed over the CLSM to help protect the geomembrane from being damaged by movement against the CLSM. Next, the impermeable geomembrane liner was installed over the geotextile and was secured to structures (e.g., pavement edges, building foundations, etc.); liner seams were joined using thermal fusion welding and were checked for leak-tightness. Finally, the geonet composite was laid over the geomembrane. The geosynthetic cap system was protected by a layer of crushed stone. A geotextile fabric bonded on top of the geonet composite prevented the crushed stone from clogging the drainage matrix.

This unique cap placed below the North Yard rail system allowed for isolation of any residual contamination, while normal track maintenance could be performed without disturbing the integrity of the cap.

Concrete Paving. The remaining portions of Area 1 were capped with minimum 6-in. thick concrete pavement after backfilling and subgrade preparation were completed.

3.6.3 Rail Yard

The primary channel for raw materials essential for plant production is the rail service through the North Yard. Detailed up-front planning and stockpiling of materials afforded the project a limited window to complete the work in the rail yard, making time of the essence.

Following excavation and post-excavation sampling, the area was quickly returned to service. Key to this success was the use of CLSM backfill, which greatly speeded up the backfilling operations (Section 3.6.1) and also provided a sturdy structural subbase.

Following installation of the Area 1 cap (Section 3.6.2), crushed stone was placed throughout the rail yard to provide a sub-ballast under the tracks. In the cap areas, the sub-ballast provided an underdrain to the catchbasins.

The railroad tracks were preassembled in 20-ft lengths by attaching the rails to new ties; existing ties were assumed to have been in contact with soil containing PCBs and were disposed of offsite. Assembled units were dropped in position by sliding them on the existing rails with a backhoe. This method of replacing rails removed during remediation proved to be another innovative way to meet tight schedule requirements.

3.6.4 Pitch and Fuel Oil Piping

The areas surrounding the pitch tanks and between the pitch tanks and the Pitch Pumphouse were cluttered with large pipes, service platforms, and walkways. There was also a 6 ft wide pipe-run between the Pitch Pumphouse and the fuel oil tanks. The pipes were close to the ground, with buried supports and footings, and would have prevented excavation in these areas if not removed. RMC issued a contract separate from the remediation effort for the removal of the asbestos insulation from these pipes. After asbestos was removed, the remediation crews installed temporary pitch piping and removed the interfering pipes. Fuel oil tank 67A was dismantled, and tank 67B was taken out of service so temporary fuel oil piping was not necessary. Remedial excavation was then successfully completed in the areas of the pipe-runs. Spill containment was restored and then the piping, access platforms, and walkways were replaced, and tank 67B restored to service.

3.6.5 Tank Containment Structures

The remediated Fuel Oil Tank and Pitch Storage Tanks areas were backfilled with CLSM. Concrete slabs and containment walls were placed after each area was properly graded for drainage. Water stops and expansion joints were installed at all construction joints. Improvements were made to the seal at the tank wall/concrete slab interface to ensure the containment of any liquids. The concrete slab and walls provide oil containment and serve as a cap to reduce surface water infiltration and transport of any residues.

The temporary pumps and piping from the tank containment areas have been replaced with permanent gravity-flow piping. A new western sump was also built adjacent to the surge tank to pump the incoming flow into the surge tank.

3.6.6 East and West Sumps

Between the south road and the Carbon Plant, the storm drain and sewage drain lines run parallel to the road sloping downward toward the east, and the drain line for the fume scrubber liquor slopes downward toward the west end of the North Yard area. The lines are 20 ft below the surface at each end of the remediation area but closer to the surface near the Carbon Plant. There is also a telephone duct bank at shallow depth directly under the center of the south road. The ROD called for collection and treatment of groundwater flowing along these drain and duct runs, the bedding and backfill of which provided preferential pathways to groundwater through the surrounding glacial till. Locations of the collection points are shown on drawing Y-NYY-009.

The collection point for the western groundwater flow was installed in the fume control liquor thickener tank area, just west of the surge tank for the GAC filter system. The liquor drain slopes steadily downward to the selected intercept point. A narrow excavation was made on both sides and below the liquor drain, and the downstream half of the excavation was backfilled with clay to create a groundwater flow plug. The upstream half of the cross-trench was backfilled with underdrain stone with a heavy-wall perforated plastic pipe installed across and underneath the liquor drain. The perforated pipe was continued with solid pipe to a new sump and pump station installed adjacent to the surge tank—the West Sump. The end of the solid pipe is visible in the sump and discharges a steady flow, demonstrating its effectiveness. This installation is illustrated in detail 2 on drawing Y-NYY-019. All water collected in the West Sump is treated through the GAC filter plant.

Two groundwater intercept systems were installed at the eastern end of the North Yard area—with similar french drains and clay plugs across the sanitary sewer line and the duct bank—and then connected to a new sump. The sump was connected via a new line to sanitary manhole 217. The sanitary manhole was deeper than the line from the new french drains so that no pumps were needed; flow from the french drains to the sump and then to the manhole is by gravity. All effluent from the sanitary sewage treatment plant is filtered through GAC filters for PCB removal.

3.6.7 Storm Drain Modifications

As part of the ROD remediation work in 1995, a new storm drain system was installed, replacing the 1990 system that routed stormwater from the rail yard to the GAC filter plant system. The 1995 improvements routed stormwater to Catch Basin (CB) 76 of the new 001 Sediment Basin System. The discharge into CB-76 was configured so that it could be sampled and, if necessary, kept separate from the main flow. Initially, runoff was kept separate (i.e., not actually discharged into the CB-76 flow) and routed to the GAC filter plant system for treatment. After the storm drains were cleaned in 1996 and sample results were satisfactory, the temporary plug was removed, and runoff was routed directly to the 001 Sediment Basin System.

3.6.8 Modifications Along Haverstock Road

A french drain was installed to remove shallow groundwater and discharge it to the 001 Sediment Basin System. A new surface water drainage swale was built between the southern side of Haverstock Road and the french drain. The drainage swale is parallel to the french drain, and crushed stone from the swale extends to the southern side of the french drain. The design eliminated CB-123, allowing upstream flow to be routed to the 001 Sediment Basin System.

3.6.9 Baghouse Modifications

During fall 1997, as part of the Environmental Compliance Project, an existing baghouse was moved to the western side of the Bucket Elevator Structure, and a new baghouse was built on the eastern side of the structure. Before the necessary concrete footings were installed, 293 yd^3 of soil was excavated from the area on the southeastern side of the Unloading Shed—197 yd^3 from grids H34 and H35, and an additional 96 yd^3 from the surrounding area. Pre-remediation PCB concentrations in the area were <50 ppm and typically <10 ppm. Grid H34 was excavated to elevation 216.8 ft MSL and Grid H35 was excavated to 214.9 ft MSL. Additional excavation at Grid H34 was limited by water lines at 216 ft MSL. Analytical results for the post-excavation samples from Grids H34 and H35 were 12 ppm and 0.25 ppm PCBs, respectively.

The excavation spoils were disposed of in the onsite Landfill. Because the work was done in late 1997, a good grass cover could not be established over the spoils; consequently, special precautions were taken to prevent erosion. All excavation, transport, and decontamination was in accordance with the Work Plan and the RD for the North Yard.

4.0 POST-REMEDIAL ACTIVITIES

Post-remedial activities will be performed in accordance with Section 2.0, "Post-Remedial Operation, Maintenance, and Contingency Plan," of the RD (Bechtel 1995b) and any subsequent changes as agreed to by NYSDEC and RMC.

Results will be periodically reported to NYSDEC in the post-remedial monitoring reports. Reporting will initially be quarterly; depending on the results, the reporting frequency may be adjusted later.

4.1 FACILITY-WIDE ACTIVITIES

Some post-remedial activities in the North Yard will be conducted under a facility-wide effort along with the other onsite remediation areas. The two key elements of the facility-wide effort pertain to surface water and groundwater monitoring. Surface water chemistry will be monitored within the scope of established sampling and reporting procedures at the plant's designated outfalls. Monitoring wells/piezometers and surface water monitoring stations will also be inspected under the facility-wide effort.

Monitoring wells MW-36, MW-37, and MW-38 were installed downgradient (north) of the North Yard to complement existing wells that monitor shallow groundwater; these three new wells are screened approximately 22 to 32 ft below grade. Groundwater elevations and analytical data are being collected to determine the vicinity groundwater elevation contours and chemistry. Figure 5 shows the location of each well, and Appendix H provides borehole and well installation logs for MW-36, MW-37, and MW-38.

4.2 AREA 1

Area 1 will be inspected to verify the integrity of the infiltration caps (concrete and geomembrane) and to verify that institutional controls are in effect to protect workers and the environment.

4.3 AREA 2

Area 2 inspections will address soil/grass surfaces, groundwater and surface water drainage systems, roads, fencing, gates, and bollards.

4.4 SECONDARY CONTAINMENT FOR TANKS

The secondary containment for the tanks will be examined for overall integrity, concrete surface, construction joints, seal between slab and tank, and high water marker.

5.0 SAFETY AND HEALTH

A comprehensive, integrated safety and health program was developed and implemented for North Yard remediation activities in accordance with the Bechtel Safety and Health Manual, Occupational Safety and Health Administration requirements, and RMC safety policies and procedures. General safety and health requirements are defined in the *Program Safety and Health Plan* in the RD/RA Work Plan (Bechtel 1993b); task-specific requirements are given in the *Area-Specific Safety and Health Plan* (Bechtel 1995a).

Starting in May 1994, air was monitored daily at the RMC boundary for respirable particulate matter (aerodynamically less than 10 microns) during remediation activities. All results were below the action level for particulate matter and below the detection limit for PCBs. After NYSDEC review of the data from two construction seasons, air monitoring at the plant boundary was discontinued in October 1995.

Personnel breathing zones were sampled in accordance with Bechtel Safety and Health Services procedures for air surveillance, particulate (dust) levels were monitored at the exclusion zone perimeter using a miniram aerosol monitor, and PCBs in air were monitored using National Institute for Occupational Safety and Health Method 5503. Results verified that personnel were never exposed to contaminants.

6.0 QUALITY ASSURANCE

In accordance with the *Construction Quality Assurance Plan for Remedial Action Activities* (Bechtel 1995e), the Construction Quality Assurance (CQA) program for work at the North Yard area mandated that the CQA manager and the CQA program be independent of all other project management functions; the CQA manager reported directly to the RMC remediation project director. Appendix I is the CQA manager's report.

FIGURES AND TABLES

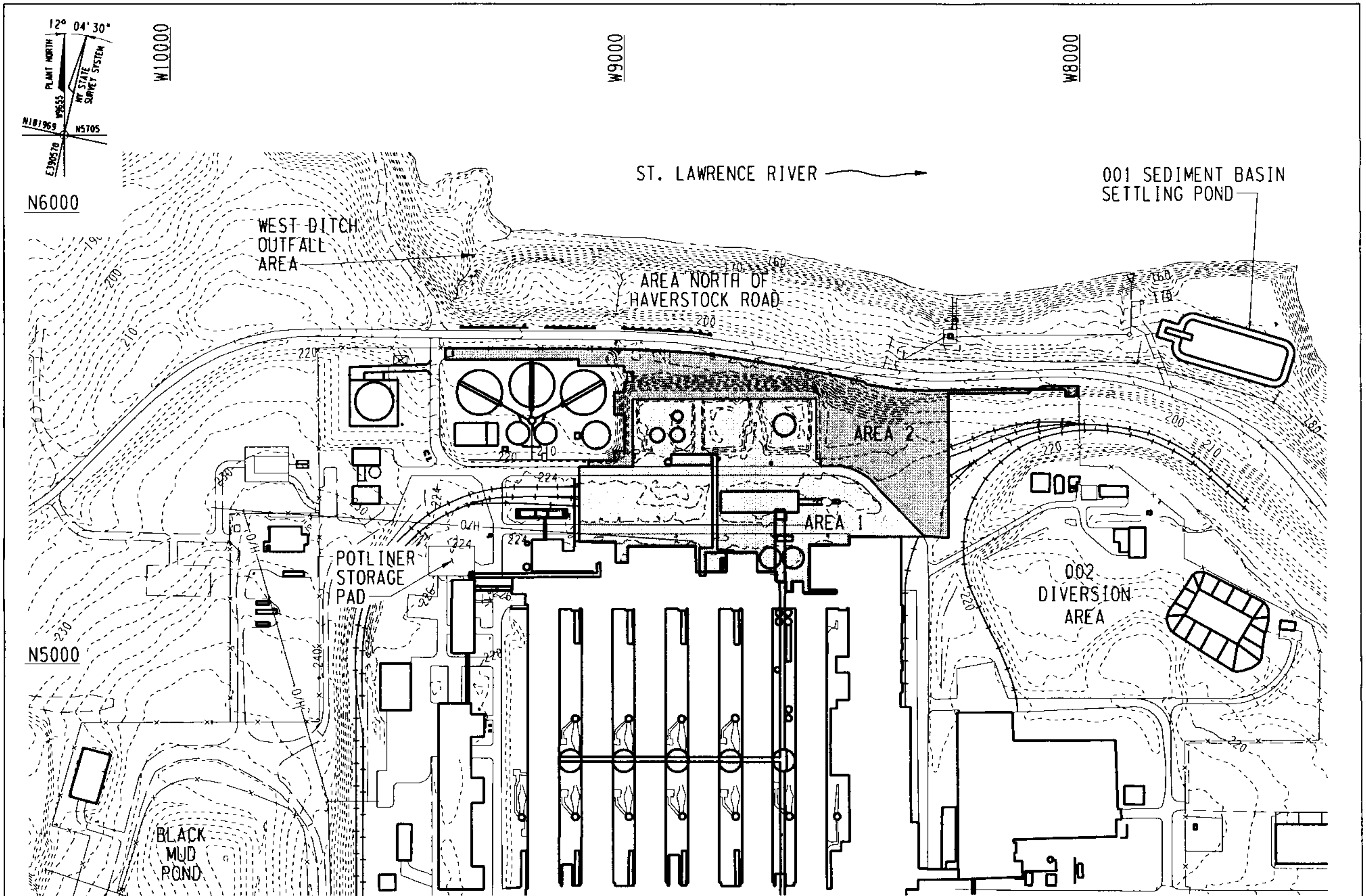
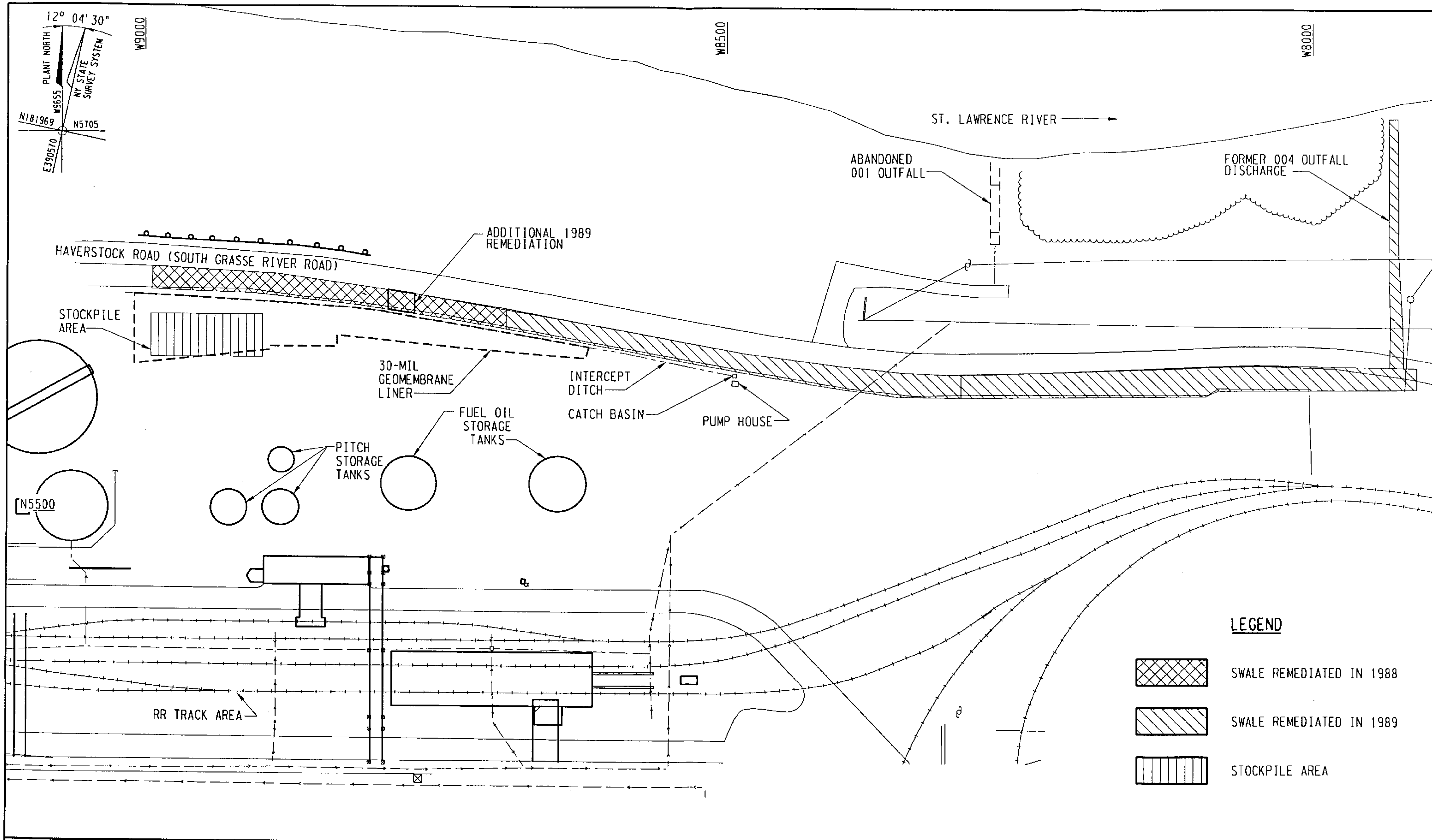


Figure 1
North Yard Site Plan

7/26/98 20384 FIG-347.DGN

REV 2/96



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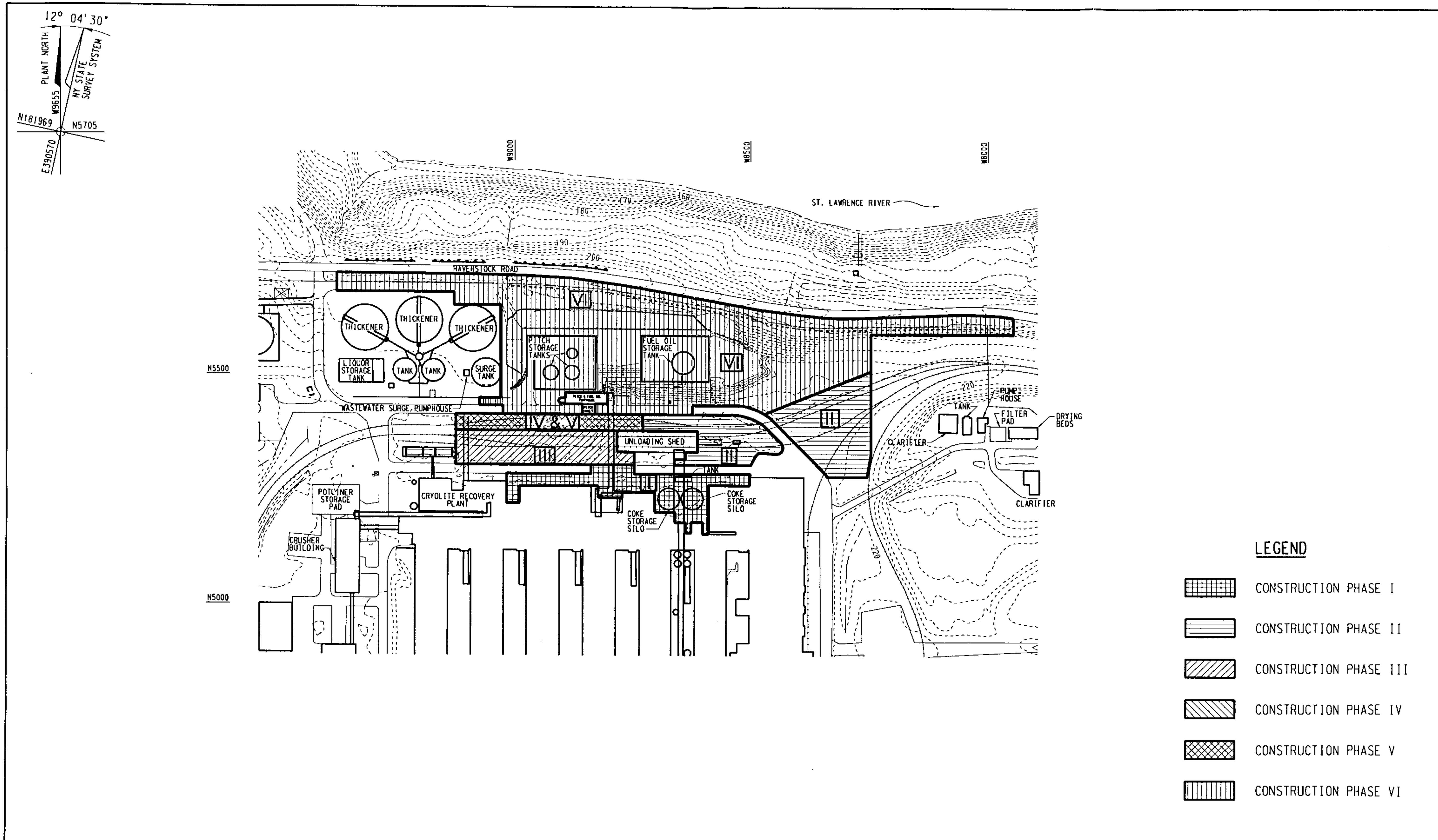
OAK RIDGE, TENNESSEE

FIGURE 2
NORTH YARD REMEDIATION OF
DITCH ALONG HAVERSTOCK ROAD
THROUGH 1989

7/26/98 20384/FIG 352.DGN

REV 8/93

11 X 17



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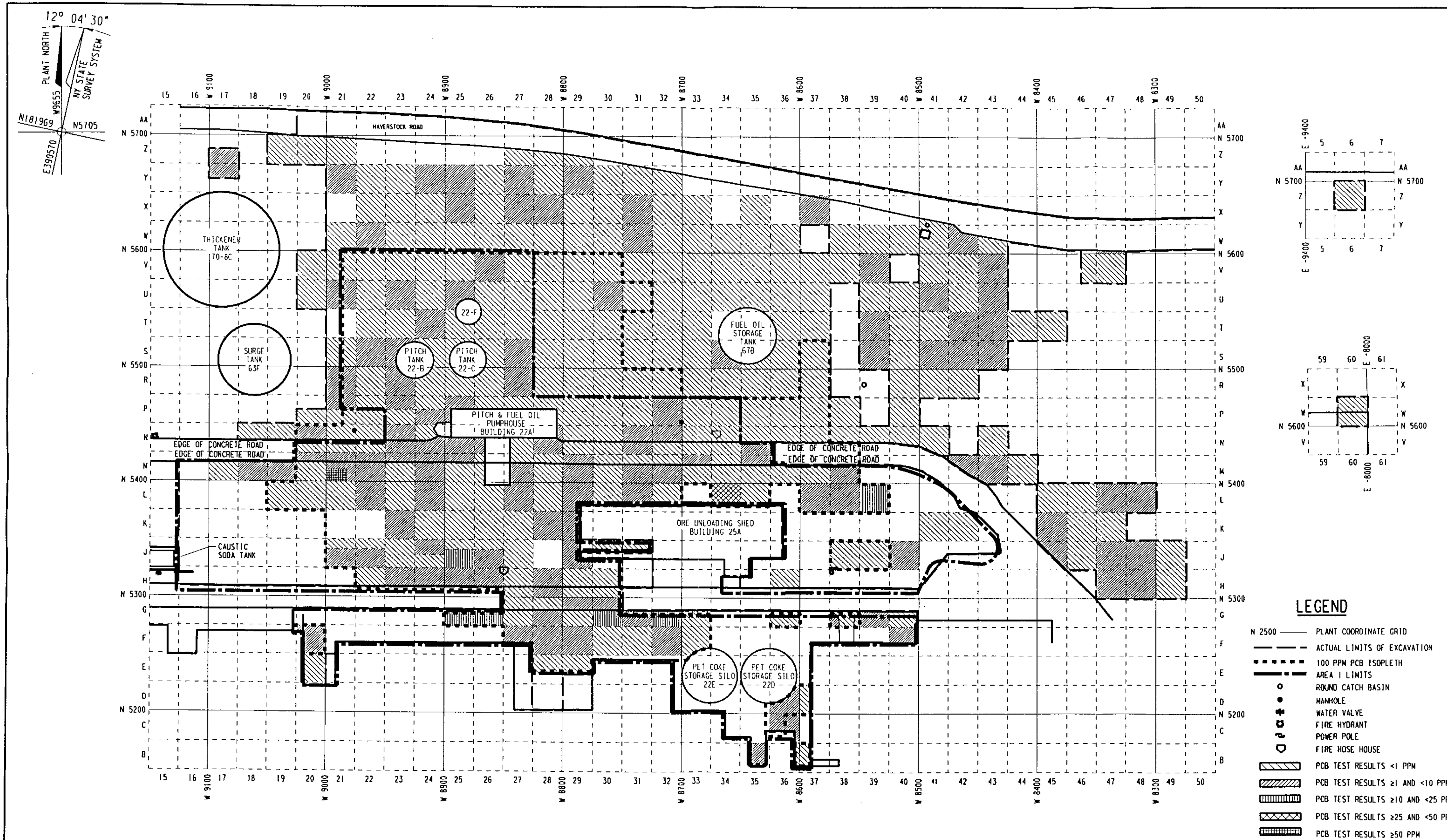
OAK RIDGE, TENNESSEE

FIGURE 3
NORTH YARD CONSTRUCTION PHASES

7/27/98 20384 FIG-370A.DGN

REV 8/93

11 X 17



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OAK RIDGE, TENNESSEE

FIGURE 4
NORTH YARD
POST-EXCAVATION SAMPLE RESULTS

7/31/98 20384 FIG-371.DGN

REV 6/93

11 X 17

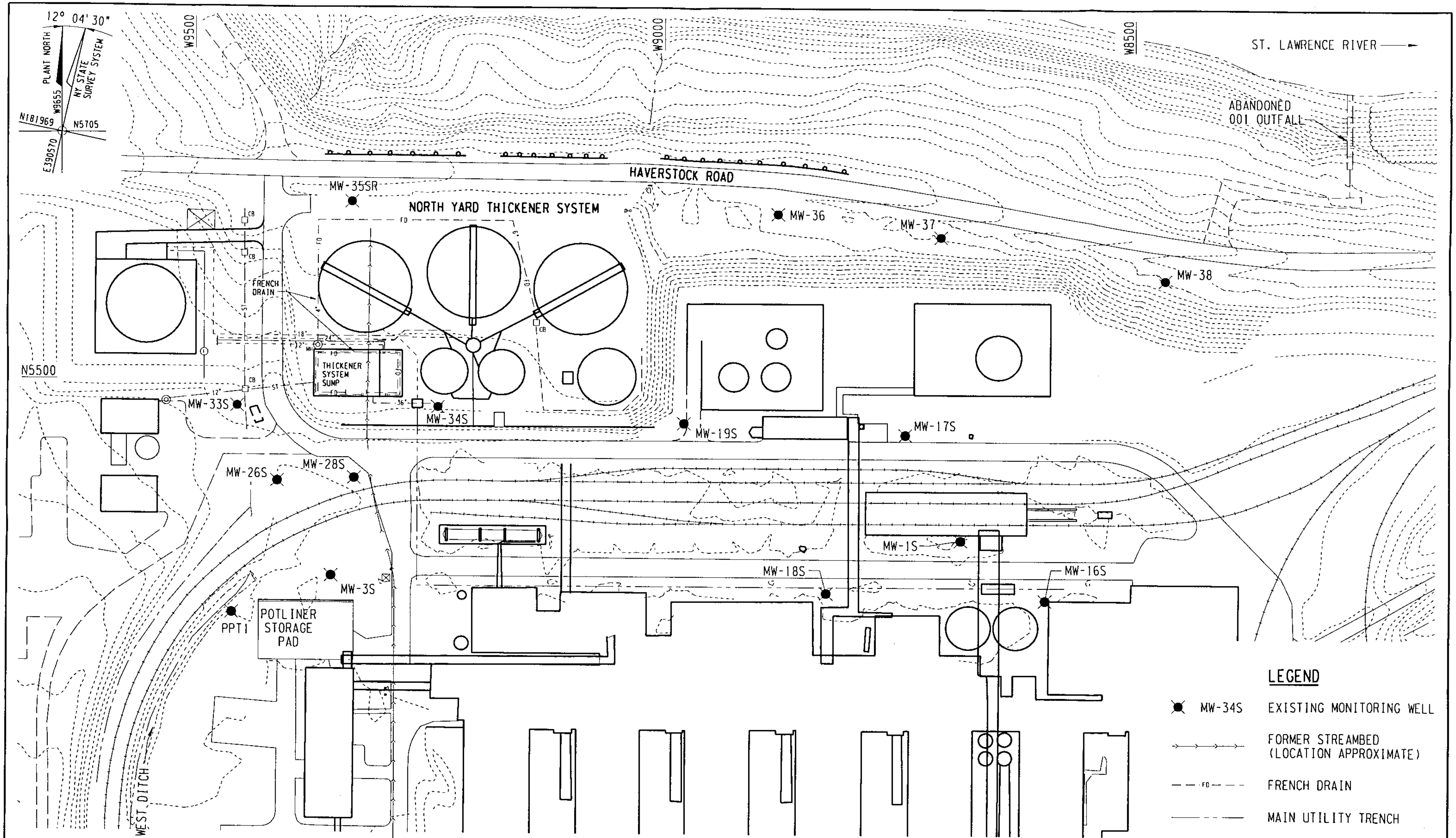

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FIGURE 5
NORTH YARD MONITORING WELLS

7/27/98 20384 FIG-346.DGN

REV 8/93

11 X 17

Table 1
Excavation Quantities

Description of Remediation Area	Excavation and Disposal Volumes (yd^3)		
	< 50 ppm PCBs (Onsite disposal)	**≥ 50 ppm PCBs (Offsite disposal)**	**Total**
Interim Remedial Measures *	152	60	212
Record of Decision			
♦ Phase I	998	1,794	2,792
♦ Phase II	1,980	1,182	3,162
♦ Phase III	2,189	1,861	4,050
♦ Phase IV/V	1,695	3,138	4,833
♦ Phase VI	18,470	11,553	30,023
Total ROD	25,332	19,528	44,860
TOTAL FOR NORTH YARD	**25,484**	**19,588**	**45,072**

*Volumes for IRM remediation work are estimates in some cases and do not include incidental quantities (e.g., residue from cleaning storm drains). Details are given in the text.

Table 2

PCB and PAH Verification Sampling Results for Area 1 of the North Yard[a]

(ASP Level Data)

Sample Date	Grid ID	Sample ID	Total PCBs[b] (ppm)	PAHs (ppm)[b] Benzo (b)-fluoranthene	Benzo (k)-fluoranthene	Chrysene	Fluoranthene	Pyrene
09-AUG-95	OC36	NYOC3602VF	5					
24-AUG-95	OF20	NYOF2003VL	5.2					
21-AUG-95	OF29	NYOF2902VF	2.6					
16-AUG-95	OF31	NYOF3102VI	.02J					
10-AUG-95	OF33	NYOF3302VP	0.26	0.180U	0.180U	0.180U	0.180U	0.180U
17-AUG-95	OF40	NYOF4001VE	4.3					
22-AUG-95	OH23	NYOH2302VE	3					
21-AUG-95	OH25	NYOH2502VK	1.8J					
17-AUG-95	OH27	NYOH2702VJ	0.9					
15-AUG-95	OH29	NYOH2902VE	0.42					
27-JUL-95	OH36	NYOH3603VE	0.78J	0.21	0.170J	0.18	0.3	0.26
24-JUL-95	OJ39	NYOJ3902VG	0.093J					
30-AUG-95	OK25	NYOK2502VAA	0.025J					
31-AUG-95	OK27	NYOK2702VAA	0.4					
29-AUG-95	OK29	NYOK2902VU	1.3J					
29-SEP-95	OM21	NYOM2102VX	270	13	12	14	20	21
16-OCT-95	OM21	NYOM2104PV	2.2	0.180U	0.180U	0.180U	0.180U	0.180U
30-SEP-95	OM23	NYOM2302VAA	0.065					
01-OCT-95	OM25	NYOM2502VAN	0.12					
01-OCT-95	OM27	NYOM2702VAK	4J					
01-OCT-95	OM29	NYOM2902VAI	3.3					
01-OCT-95	OM31	NYOM3102VS	10	0.180U	0.180U	0.180U	0.180U	0.180U
27-JUL-95	OM33	NYOM3302VI	0.087U					
28-JUL-95	OM35	NYOM3502VG	0.046J					
27-JUL-95	OM37	NYOM3702VI	0.18J					
23-OCT-95	OP23	NYOP2302VL	0.38J					
26-OCT-95	OP29	NYOP2902VW	0.8J	0.180U	0.180U	0.180U	0.180U	0.180U
29-APR-96	OP31	NYOP3102VN	0.034J					
28-MAY-96	OP33	NYOP3302VV	0.037J					
15-JUL-96	OS23	NYOS2302VS	2.2					
26-JUN-96	OS27	NYOS2702VAC	3.1					
20-MAY-96	OS37	NYOS3704VW	0.07U	0.200U	0.200U	0.200U	0.200U	0.200U
01-JUL-96	OU23	NYOU2302VP	1					
24-JUN-96	OU25	NYOU2502VT	2.4					
06-MAY-96	OU29	NYOU2902VG	.07U					
13-MAY-96	OU31	NYOU3102VM	.08U					
14-MAY-96	OU33	NYOU3302VK	0.28	0.180U	0.180U	0.180U	0.094J	0.094J

[a] Area 1 sampling was to document residual chemical levels.
Cleanup standards (ppm) for Area 1 are:
Total PCBs = 25,
Pyrene = 6.5, Fluoranthene = 19, Chrysene = 0.33, Benzo(b) and (k) fluoranthene = 0.33.

[b] U = not detected at the value listed; J = quantification is approximate.

Table 3

Dioxin and Furan Verification Sampling Results for the North Yard

	Results (ppt or ng/g) [d,e,f]		
	Grid 0H29 [a]	*Grid 0M25* [b]	*Grid 0U29* [c]
Analyte	***15-Aug-95***	***1-Oct-95***	***6-May-96***
1,2,3,4,6,7,8-HPCDD	0.095U[e]	0.04U	0.12U
1,2,3,4,6,7,8-HPCDF	0.08U	0.034U	0.2U
1,2,3,4,7,8,9-HPCDF	0.08U	0.034U	0.2U
1,2,3,4,7,8-HXCDD	0.081U	0.043U	0.071U
1,2,3,4,7,8-HXCDF	0.047U	0.039U	0.056U
1,2,3,6,7,8-HXCDD	0.081U	0.043U	0.071U
1,2,3,6,7,8-HXCDF	0.047U	0.039U	0.056U
1,2,3,7,8,9-HXCDD	0.081U	0.043U	0.071U
1,2,3,7,8,9-HXCDF	0.047U	0.039U	0.056U
1,2,3,7,8-PECDD	0.058U	0.062U	0.29U
1,2,3,7,8-PECDF	0.037U	0.059U	0.037U
2,3,4,6,7,8-HXCDF	0.047U	0.039U	0.056U
2,3,4,7,8-PECDF	0.037U	0.059U	0.037U
2,3,7,8-TCDD	0.029U	0.03U	0.024U
2,3,7,8-TCDF	0.044U	0.059U	0.043U
OCDD	0.17U	0.15U	0.23U
OCDF	0.16U	0.11U	0.27U
TOTAL HPCDD	0.095U	0.04U	0.12U
TOTAL HPCDF	0.08U	0.034U	0.2U
TOTAL HXCDD	0.081U	0.043U	0.071U
TOTAL HXCDF	0.047U	0.039U	0.056U
TOTAL PECDD	0.41UJ	0.062U	0.29U
TOTAL PECDF	0.037U	0.059U	0.037U
TOTAL TCDD	0.44UJ[f]	0.03U	0.024U
TOTAL TCDF	0.044U	0.059U	0.043U

[a] Grid Block OH29, Sample ID NYOH2902VE
[b] Grid Block OM25, Sample ID NYOM2502VAN
[c] Grid Block OU29, Sample ID NYOU2902VG
[d] Cleanup standards are: PCDD = 0.5 ppt and 2,3,7,8-TCDD = 0.5 ppt
[e] U = not detected at the value listed
[f] J = quantification is approximate

Table 4
PCB and PAH Verification Sampling Results for Area 2 of the North Yard
(ASP Level Data)

No.	Sample Date	Grid ID	Sample ID	Total PCBs (ppm)	PAHs (ppm) Benzo (b)-fluoranthene	Benzo (k)-fluoranthene	Chrysene	Fluoranthene	Pyrene
1	26-JUL-95	OJ47	NYOJ4702VI	1.6					
2	25-JUL-95	OK45	NYOK4502VI	2.7					
3	20-JUL-95	OK47	NYOK4702VC	0.77					
4	24-JUL-95	OM43	NYOM4302VE	1J					
5	14-NOV-95	ON21	NYON2103VR	0.4J	0.16JN	0.20U	0.13J	0.20J	0.22J
6	05-OCT-95	OP40	NYOP4002VG	0.2					
7	04-OCT-95	OR42	NYOR4202VC	0.38					
8	04-OCT-95	OS40	NYOS4002VH	0.55					
9	04-OCT-95	OS43	NYOS4302VE	2.2					
10	23-OCT-95	OT39	NYOT3902VR	3.3J	0.18U	0.18U	0.18U	0.11J	0.13J
11	16-OCT-95	OT43	NYOT4302VM	1.7J					
12	12-OCT-95	OT45	NYOT4502VF	0.07U					
13	18-JUL-96	OU20	NYOU2002VE	1.2					
14	18-OCT-95	OU43	NYOU4302VG	4.5J					
15	23-OCT-95	OV38	NYOV3802VP	0.33	0.25	0.28	0.23	0.31	0.35
16	28-AUG-96	OV47	NYOV4702VE	0.11U					
17	11-JUL-96	OW21	NYOW2102VM	0.41					
18	01-JUL-96	OW28	NYOW2802VM	0.62					
19	28-MAY-96	OW34	NYOW3402VH	0.18J					
20	28-AUG-96	OW38	NYOW3802VM	0.73J	0.18U	0.18U	0.18U	0.093J	0.18U
21	04-SEP-96	OW60	NYOW6002VK	0.033J					
22	13-JUN-96	OX27	NYOX2701VK	3.1J					
23	04-JUN-96	OX28	NYOX2802VC	1.4J					
24	31-MAY-96	OX31	NYOX3102VH	2.5					
25	30-MAY-96	OX32	NYOX3201VH	0.41					
26	30-MAY-96	OX33	NYOX3301VI	0.029U	0.19U	0.19U	0.19U	0.19U	0.19U
27	29-MAY-96	OX35	NYOX3502VE	0.038U					
28	22-JUL-96	OY17	NYOY1702VF	2.2J					
29	31-MAY-96	OY31	NYOY3102VK	0.032J					
30	22-JUL-96	OZ06	NYOZ0602VG	0.23					
31	11-JUN-96	OZ19	NYOZ1902VL	0.84J	0.20U	0.20U	0.20U	0.20U	0.20U

[a] Cleanup standards (PPM) are:
Total PCBs = 10,
Pyrene = 6.5, Fluoranthene = 19, Chrysene = 0.33, Benzo(b) and (k) fluoranthene = 0.33

[b] J = quantification is approximate

[c] N = presumptive evidence of material (i.e., analysis indicated but did not confirm that the material was present)

[d] U = not detected at the value listed

[e] Area 2 data was independently validated.

Table 5
ASP Level C[a] PCB Verification Sampling Results for the North Yard

No.	Sample Date	Grid ID	Sample ID	Total PCBs (ppm)	Area [d]
1	09-MAR-95	OK41 [e]	NYOK4101VM	0.07U[c]	1
2	09-MAR-95	OK42 [e]	NYOK4201VM	0.31	1
3	18-JUL-96	OR22	NYOR2202VS	0.30	1
4	15-JUL-96	OR23	NYOR2302VS	3.4	1
5	10-JUL-96	OR24	NYOR2402VR	0.37	1
6	10-JUL-96	OR25	NYOR2502VW	0.06	1
7	26-JUN-96	OR26	NYOR2602VZ	0.22J[d]	1
8	10-JUL-96	OR26	NYOR2603VU	0.22J	1
9	24-JUN-96	OR27	NYOR2702VAC	1J	1
10	02-MAY-96	OR28	NYOR2802VI	0.3J	2
11	02-MAY-96	OR29	NYOR2902VM	0.82	2
12	07-MAY-96	OR30	NYOR3002VK	0.024J	2
13	21-MAY-96	OR31	NYOR3101VP	0.026J	2
14	22-MAY-96	OR32	NYOR3203VAB	0.27	2
15	23-MAY-96	OR33	NYOR3302VV	0.06	2
16	21-MAY-96	OR34	NYOR3402VJ	0.08	2
17	20-MAY-96	OR35	NYOR3502VI	0.19J	2
18	20-MAY-96	OR36	NYOR3602VH	0.08U	2
19	21-MAY-96	OR37	NYOR3703VZ	0.08U	2
20	17-JUL-96	OS22	NYOS2203VS	2	1
21	26-JUN-96	OS24	NYOS2401VS	0.08	1
22	25-JUN-96	OS26	NYOS2602VP	0.029J	1
23	02-MAY-96	OS28	NYOS2802VC	0.07	2
24	02-MAY-96	OS29	NYOS2902VC	0.41J	2 [f]
25	09-MAY-96	OS29	NYOS2903VJ	0.06	2 [g]
26	16-MAY-96	OS30	NYOS3003VJ	0.07U	2
27	20-MAY-96	OS31	NYOS3102VP	0.07U	2
28	21-MAY-96	OS32	NYOS3203VAB	0.07U	2
29	21-MAY-96	OS33	NYOS3302VS	0.14J	2
30	21-MAY-96	OS34	NYOS3401VC	3.1	2
31	21-MAY-96	OS35	NYOS3501VD	0.031J	2
32	20-MAY-96	OS36	NYOS3602VD	0.21	2
33	17-JUL-96	OT22	NYOT2202VS	0.14J	1
34	02-JUL-96	OT23	NYOT2302VT	0.029J	1
35	26-JUN-96	OT24	NYOT2402VN	1.1J	1
36	26-JUN-96	OT25	NYOT2502VK	1.5J	1
37	26-JUN-96	OT26	NYOT2602VJ	0.11	1
38	27-JUN-96	OT27	NYOT2702VAC	0.07U	1
39	06-MAY-96	OT28	NYOT2802VM	0.032J	2
40	02-MAY-96	OT29	NYOT2902VC	0.17	2 [f]
41	13-MAY-96	OT29	NYOT2903VI	0.07U	2 [g]
42	13-MAY-96	OT30	NYOT3001VH	0.07U	2
43	21-MAY-96	OT31	NYOT3102VP	0.055	2
44	15-MAY-96	OT32	NYOT3203VAA	0.08U	2
45	15-MAY-96	OT33	NYOT3302VR	0.07U	2
46	20-MAY-96	OT36	NYOT3602VF	0.056J	2
47	16-MAY-96	OT37	NYOT3704VR	0.07U	2

Sheet 1 of 2

Table 5

ASP Level C[a] PCB Verification Sampling Results for the North Yard

No.	Sample Date	Grid ID	Sample ID	Total PCBs (ppm)	Area [d]
48	17-JUL-96	OU22	NYOU2202VV	0.1	1
49	25-JUN-96	OU24	NYOU2402VR	0.1	1
50	24-JUN-96	OU26	NYOU2602VU	0.019J	1
51	01-JUL-96	OU27	NYOU2702VAD	0.59	1
52	06-MAY-96	OU28	NYOU2802VI	0.13	2
53	07-MAY-96	OU30	NYOU3002VI	1.5	2
54	13-MAY-96	OU32	NYOU3203VAC	0.07U	2
55	14-MAY-96	OU34	NYOU3402VI	0.07U	2
56	14-MAY-96	OU35	NYOU3502VE	0.16	2
57	14-MAY-96	OU36	NYOU3602VH	0.07U	2
58	16-MAY-96	OU37	NYOU3704VT	0.15J	2
59	11-JUL-96	OV22	NYOV2202VV	0.32	1
60	10-JUL-96	OV23	NYOV2302VW	0.07U	1
61	09-JUL-96	OV24	NYOV2402VY	0.052	1
62	08-JUL-96	OV25	NYOV2502VY	0.19J	1
63	03-JUL-96	OV26	NYOV2602VV	2	1
64	02-JUL-96	OV27	NYOV2702VAD	0.023J	1
65	01-JUL-96	OV28	NYOV2802VT	0.62	2
66	09-MAY-96	OV29	NYOV2902VN	0.28	2
67	02-MAY-96	OV30	NYOV3002VP	0.07U	2
68	13-MAY-96	OV31	NYOV3102VV	0.07U	2
69	07-MAY-96	OV32	NYOV3202VAD	0.078	2
70	13-MAY-96	OV33	NYOV3302VW	0.07U	2
71	13-MAY-96	OV34	NYOV3402VX	0.07U	2
72	14-MAY-96	OV35	NYOV3502VW	0.07U	2
73	15-MAY-96	OV36	NYOV3602VV	0.024	2
74	15-MAY-96	OV37	NYOV3702VY	0.08U	2

[a] Level C Data includes summary sample results.

[b] PCB cleanup standards are: Area 1 = 25 ppm, Area 2 = 10 ppm.

[c] U = not detected at the value listed. J = quantification is approximate.

[d] Area = samples collected in Area 1 or Area 2 (reference FCN 167)

[e] NYOK4101VM and 4201VM were collected during excavation for railcar puller foundation (not part of the containment dike area) but are presented because they were reported as Level C.

[f] NYOS2902VC and NYOT2902VC taken off tank pad.

[g] NYOS2903VJ and NYOT2903VI taken under tank pad

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APPENDIX A

AS-BUILT DRAWINGS, FIELD CHANGE REQUESTS, AND FIELD CHANGE NOTICES

AS-BUILT DRAWINGS

Drawing Number	Revision	Drawing Title
Y-NYY-001	2	North Yard Remediation Project, Site Plan
Y-NYY-002	2	North Yard Remediation Project, Area 1 and Area 2
Y-NYY-003	2	North Yard Remediation Project, Construction Phasing Schedule
Y-NYY-005	3	North Yard Remediation Project, Pavement, Railroad Track, and Storm Structure Demolition Plan
Y-NYY-006	3	North Yard Remediation Project, Grid Excavation Summary
Y-NYY-007	4	North Yard Remediation Project, Grading and Restoration Plan
Y-NYY-008	3	North Yard Remediation Project, Pavement Restoration Plan
Y-NYY-009	4	North Yard Remediation Project, Utility Restoration Plan
Y-NYY-011	2	North Yard Remediation Project, Railroad Track Profiles and Section
Y-NYY-012	3	North Yard Remediation Project, Finish Grade Sections
Y-NYY-013	3	North Yard Remediation Project, Sections and Details
Y-NYY-014	3	North Yard Remediation Project, Sections and Details
Y-NYY-019	2	North Yard Remediation Project, North Yard West Sump
Y-NYY-020	3	North Yard Remediation Project, Containment Dike Layout
Y-NYY-021	3	North Yard Remediation Project, Sections and Details
Y-NYC-001	2	North Yard Remediation Project, Containment Dikes Plans, Sections, and Details
Y-NYC-002	1	North Yard Remediation Project, Pitch Storage Tanks Pipe Support System, Sections and Details
ATL-NYD-01	0	North Yard Area Original Ground Surface
ATL-NYD-02	0	North Yard Area Plan View Final Excavated Surface
ATL-NYD-03	0	North Yard Area Western Portion of Restored Ground Surface
ATL-NYD-04	0	North Yard Area Eastern Portion of Restored Ground Surface

ATL-NYD-05	0	North Yard Area French Drain Plan & Profile South of Haverstock Road
ATL-NYD-06	0	North Yard Area Verification Sample Locations
ATL-NYD-07	0	North Yard Area As-Built Surface of Geomembrane Liner
ATL-NYD-X1	0	North Yard Area Cross-Sections Location Map Sheet 1 of 7
ATL-NYD-X2	0	North Yard Area Cross-Sections Location Map Sheet 2 of 7
ATL-NYD-X3	0	North Yard Area Cross-Sections Location Map Sheet 3 of 7
ATL-NYD-X4	0	North Yard Area Cross-Sections Location Map Sheet 4 of 7
ATL-NYD-X5	0	North Yard Area Cross-Sections Location Map Sheet 5 of 7
ATL-NYD-X6	0	North Yard Area Cross-Sections Location Map Sheet 6 of 7
ATL-NYD-X7	0	North Yard Area Cross-Sections Location Map Sheet 7 of 7

FIELD CHANGE REQUESTS

FCR 104	Superseded by FCN 107
FCR 111	Provided for the removal of catch basins (CBs) and drain pipes from diked areas
FCR 116	Revised rail yard storm drainage to flow directly to 001 Sediment Basin system
FCR 117	Allowed excavated asphalt pavement that could be separated from subbase to be placed in onsite Landfill; if not, it was to be shipped offsite
FCR 119	Modified design of valve vaults (Note: Valve vaults were eliminated by FCR 134)
FCR 127	Voided
FCR 129	Revised typical railroad roadbed section to clarify minimum ballast thickness and minimum slopes in swales toward CBs
FCR 134	Eliminated new valve vaults
FCR 137	Revised location of west sump next to surge tank, added french drain along toe of slope to sump, and eliminated gravity-flow inlet to tank
FCR 155	Replaced earthen dikes with concrete slabs and walls for secondary containment of pitch and fuel oil storage tanks
FCR 163	Modified excavation plan for area around the fuel oil dikes
FCR 167	Revised limits of Area 1 and Area 2; added supplemental verification sampling plan
FCR 169	Eliminated Outfall 007 and CB 123 (runoff routed via new swale to 001 Sediment Basin system)

FIELD CHANGE NOTICES

FCN 100	Superseded by FCR 116
FCN 105	Allowed NYSDOT Table 703-4, Size No. 2 stone as substitute for Type I underdrain stone when Type I was not available due to local shortage
FCN 106	Revised geonet composite type and geotextile overlap
FCN 107	Revised anchor bolt spacing for anchoring liner
FCN 108	Added new concrete slabs east of unloading shed
FCN 110	Revised design to allow railroad tracks to be installed over the top of CB 89
FCN 112	Revised Figure 26 in Remedial Design
FCN 114	Replaced CB 71 to improve surface drainage
FCN 115	Allowed placement of geotextile fabric and crusher run stone over subballast stone
FCN 118	Clarified that area beneath an existing slab for a diesel fuel tank did not need to be remediated
FCN 121	Clarified that area beneath existing hose houses did not need to be remediated
FCN 122	Improved surface drainage around CB 54
FCN 123	Superseded by FCN 133
FCN 124	Voided
FCN 125	Allowed concrete and asphalt to be used interchangeably for restoration
FCN 130	Clarified that area beneath existing concrete ramp into Facility 35A did not require excavation
FCN 132	Provided drainage improvement south of unloading shed
FCN 133	Clarified that existing concrete ramp into Facility 24E was to be removed to allow excavation; clarified that area beneath asphalt paving near coke storage silos did not need to be excavated (Note: Asphalt was removed and replaced with concrete paving)
FCN 138	Revised the requirement for a tack coat between binder and top courses in asphalt pavement.
FCN 139	Installed CB to improve surface drainage in area east of coke storage silos
FCN 146	Modified boundaries of construction phases

FCN 172	Revised design so groundwater collected in east sump drains by gravity into sanitary sewer
FCN 173	Clarified use of releasing agent on concrete construction formwork
FCN 174	Clarified placement of horizontal reinforcing bars in containment dike walls
FCN 175	Modified wall joint detail resulting from use of a Westec® waterstop
FCN 186	Modified floor slab elevations at pitch tank containment dikes
FCN 188	Modified design, allowing french drain to be excavated in general fill material rather than in sand backfill
FCN 191	Revised size of concrete slab under fuel oil piping by Pitch Pumphouse
FCN 192	Modified coating system to be used to cover joint between base of tank and slab

NONCONFORMACE REPORTS

NCR 004	Reinforcement dowels were displaced during concrete pour; additional dowels installed (drilled holes and epoxied in place) at proper locations.