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CHROMIC ACID LINE
RE-SLEEVING OPERATIONS
WATERVLIET ARSENAL
WATERVLIET, NEW YORK

Prepared for:
WATERVLIET ARSENAL
WATERVLIET, NEW YORK

Prepared by:
EMPIRE SOILS INVESTIGATIONS, INC.
BALLSTON SPA, NEW YORK
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1.0 INTRODUCTION

Empire Soils Investigations, Inc. (Empire Soils) was contracted by the Watervliet Arsenal (WVA) to provide on-site inspection, documentation and environmental sampling and analysis of excavations completed for the re-sleeving operations of the Chromic Acid Waste Line (Acid Line) within the Watervliet Arsenal, Watervliet, New York. The location of the project site is depicted on the "Site Location Map" (Drawing No. 1) presented in Appendix A.

Work performed by Empire Soils on this project was pursuant to the request by the Watervliet Arsenal on August 7, 1992 and completed under the terms and agreement of Watervliet Arsenal Purchase Order No. DAAA22-92-M-2355 dated September 30, 1992. The request for inspection and environmental services came as a result of the discovery of 23 defects within the Acid Line as documented on a video survey completed by Dowell Schlumberger, Inc., of Mt. Holly, New Jersey in February 1992, and the subsequent notification of the condition of the line to the New York State Department of Environmental Conservation (NYSDEC). The repair of the defects within the Acid Line were completed in February and March 1992. The re-sleeving operations of the Acid Line were completed in August and September 1992.

The work performed by Empire Soils as requested by the Watervliet Arsenal involved the following tasks:

- Part time on-site inspection and documentation of the conditions encountered at each of the excavation locations by a hydrogeologist. This included visual inspection of subsurface conditions, re-sleeving procedures and other pertinent data. A record of the inspection data was kept in a designated field book for this project.
- Offer professional opinion in regard to the conditions observed at each location during the re-sleeving operations for immediate implementation of appropriate sampling programs (i.e. monitoring wells, collection of additional samples soil and/or groundwater, etc.).
- The soils cited for possible disposal as "hazardous" material were placed within roll-off containers and/or dump trailers line to the bottom of the excavation at each resleeving location. A composite soil sample from each roll-off container or dump trailer was obtained for laboratory analysis to define the soils as either hazardous or non-hazardous material on the basis of Total and TCLP RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and PCB Concentrations, and thereby determine disposal requirements. In addition, two (2) groundwater samples were collected and analyzed for both total and dissolved concentrations of the eight (8) RCRA Metals from two of the re-sleeving locations where groundwater was encountered.
- Soils considered "non-hazardous" in character were excavated and temporarily stockpiled on plastic sheeting. A composite

soil sample was collected from the soils excavated from ground surface to a depth of approximately two (2) feet above the Acid Line at each resleeving location and analyzed for both leachable (TCLP) and total concentrations of the RCRA Metals. This was performed to allow for proper off-site disposal of the excavated soils or re-use as backfill material.

- Temporary well casings were installed at each resleeving location to allow for soil sampling and/or safe well installation, if necessary, at a later date.
- Empire Soils has prepared this report of our findings and conclusions, including general recommendations for any further investigations and/or remedial action based on data and information collected through this investigation.

2.0 PROJECT DESCRIPTION

The Chromic Acid Line is utilized for the collection and channeling of wastes containing chromic acid and heavy metals from the non-cyanide electroplating operations at the manufacturing and laboratory facilities within the WVA. All wastes within the Chromic Acid Line are channeled via gravity flow to the Watervliet Arsenal's Industrial Wastewater Treatment Plant.

The re-sleeving operation was initiated as a result of twenty-three (23) defects discovered within the Acid Line during a video survey of the line in February 1992. The re-sleeving operations commenced in August 1992 following repair of the Acid Line defects in February and March 1992.

The acid line re-sleeving operation began on August 10, 1992 and was completed by Anjo Construction, Ltd. of Latham, New York working as the project prime contractor, and Dowell Schlumberger, Inc., of Mt. Holly, New Jersey as subcontractors to Anjo Construction. Anjo Construction was contracted by Watervliet Arsenal to excavate and backfill access locations where the re-sleeving of the lines would be initiated. Dowell Schlumbergers' function was to re-sleeve the acid line by pulling 6-inch black polyethylene piping from one location to another and making all required connections at intersecting points.

During the re-sleeving operations, the soils located from approximately two (2) feet above the acid line to the bottom of the excavation were considered potential "hazardous" material. These potentially "hazardous" soils were placed within roll-off

containers and/or dump trailers lined with plastic sheeting, and stored on-site until analysis of the soils was completed. The analyses were performed to determine whether the soils would be defined as "hazardous" or "non-hazardous" material, and determine the proper off-site disposal requirements.

The pipe debris from each of the removed portions of the acid line during the re-sleeving operations were placed into a roll-off container (Roll-off "I") and stored on-site until the re-sleeving operations were completed. This material was considered "hazardous" and was disposed of at the Environmental Waste Resources Facility located in Waterbury, Connecticut, a U.S. EPA approved hazardous waste disposal facility (U.S. EPA I.D. Number CT0072138969). Copies of the Hazardous Waste Manifest are presented in Appendix C.

The excavated soils considered "non-hazardous" material were temporarily stockpiled on plastic sheeting within the construction staging area. The "non-hazardous" material was comprised of the soil or other material excavated from ground surface to two feet above the acid line. Composite soil samples were collected from this material at each of the resleeving locations to verify that the soils were "non-hazardous" material. Some of the soils considered "non-hazardous" material was re-used as backfill material at the re-sleeving locations with the remaining portions disposed of at the Albany County Landfill. Copies of the Weigh Tickets from the Albany County Landfill are presented in Appendix C.

All laboratory work was completed following USEPA Contract Laboratory Protocol (CLP) which was utilized to verify QA/QC procedures. Huntingdon Analytical Services (HAS), located in Middleport, New York completed the analyses. HAS is certified by the New York State Department of Health under their Environmental Laboratory Approval Program (ELAP No. 10833) and is also a NYSDEC Technically Acceptable Laboratory (ASP).

3.0 METHOD OF INVESTIGATION

3.1 Re-sleeving and Environmental Sampling Procedures

A total of 12 excavations were completed at the re-sleeving locations depicted on the "Site Plan" (Drawing No. 2, Appendix A). The excavation locations were based on areas which would minimize the number of intercepts required to re-sleeve the acid line. The following procedures were followed during the re-sleeving operations of the chromic acid waste line.

a) Anjo Construction equipment and personnel excavated the soils considered to be "non-hazardous" material. This material consisted primarily of any excavated material (i.e. soil, concrete, and asphalt) from ground surface to a depth of approximately two (2) feet above the top surface of the acid line.

b) The excavated "non-hazardous" material from each excavation was transported to Anjo's construction staging area located west of Building 136 of the WVA, and placed on a single layer of plastic sheeting. The soils were temporarily stockpiled and a portion of this material was later utilized for backfill material at the re-sleeving locations.

c) To characterize the "non-hazardous" material, a total of thirteen (13) composite soil samples (S-101N through S-112N & S-110) were collected between August 10 and September 8, 1992.

Samples S-109N, S-110 and S-112N were collected directly from the excavations. The remaining "non-hazardous" samples were collected from the soil stockpiles within the construction staging area. The composite samples were analyzed for leachable concentrations of the eight (8) RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) by Toxicity Characteristic Leaching Procedure (TCLP), and total concentrations of the same metals.Copies of the analytical results are presented in Appendix B.

d) Anjo Construction personnel excavated the soils treated as "hazardous" material, approximately two (2) feet above the top of the acid line to the termination depth of each excavation, and loaded it into either a roll-off container or a dump trailer lined with two layers of plastic sheeting. These containers were temporarily stored on-site until the toxicity characterization was completed. The excavation work was completed utilizing a dedicated rubber tire backhoe and hand tools.

e) A composite soil sample from each roll-off container or dump trailer was collected for laboratory analyses to determine the toxicity characteristics of the material that was considered "hazardous". A total of three (3) composite soil samples were submitted for laboratory analysis of the leachable concentrations of the RCRA metals by the Toxicity

Characteristic Leaching Procedure (TCLP) and total concentrations of the same metals. Additionally, each of the composite soil samples were analzed for total concentrations of PCB's.

f) The re-sleeving operations were completed by Dowell Schlumberger, Inc. personnel in Level C or B Personal Protective Equipment (PPE). During the excavation of the soils, the area immediately surrounding the excavation was sealed off with banners and barricades. Only designated personnel with the appropriate PPE and training were allowed to enter the exclusion zone.

g) Soil and/or groundwater samples were collected from each re-sleeving location to document whether metals contamination existed at each location. If groundwater was present, both soil and groundwater samples were collected. The soil sampling consisted of obtaining a composite soil sample from the excavation in the area of the re-sleeving. The composite soil samples were prepared by obtaining several grab samples from the excavated soil with a stainless steel spoon. The soil was then composited within a stainless steel bowl prior to placing the sample in an I-Chem 200 series 500 ml glass sample container. The groundwater samples were collected by slipping a latex glove over an I-Chem 200 series 500 ml glass container, and then passing the container to a laborer in the

excavation. The container was immersed within the groundwater collected in the excavation. The groundwater samples were raw water samples with no nitric acid added.

h) Laboratory analysis of the collected soil samples from each re-sleeving location involved the preparation of an extract from each of the samples by Toxicity Characteristic Leaching Procedure (TCLP). The extract was then analyzed for concentrations of arsenic barium, cadmium, chromium, lead, mercury, selenium, and silver. The analysis of the raw water samples collected from the excavations where groundwater was present, was for total and dissolved concentrations of arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Analysis for total metals concentration was performed on the unfiltered raw water, and dissolved metals on the laboratory filtered portion of each of the collected water samples.

i) All of the collected soil/groundwater samples from each of the re-sleeving locations were placed within a cooler packed with ice and delivered to Huntingdon Analytical Services (HAS) of Middleport, N.Y. The results of the soil/groundwater analyses are presented in the analytical report in Appendix B of this report and discussed further in Section 5.0 "Analytical Results for Soil and Groundwater".

j) A chain of custody (COC) record was filled out for all samples obtained and transported to the laboratory for analysis. When the samples were released from the custody of sampling personnel, the form was signed by both relinquishing and receiving parties with the date and time indicated. This process is completed each time possession is relinquished until the time they are delivered to the laboratory. At this time, samples are considered dispatched and the person delivering the samples must sign in the appropriate area. Once delivered to the laboratory the information on the COC form is checked to verify the condition of the samples and that the appropriate number, size and type of sample containers were received . Once completed, the form is signed by receiving laboratory personnel in both the appropriate areas. The sample containers are next given unique HAS I.D. numbers which are written on the chain of custody record opposite the sample ID and location information. Once received, samples are stored in a locked vault within the secured laboratory walk-in refrigerator. Keys to the walk-in and vault are possessed by the laboratory director and laboratory receptionist. Use of these keys by other laboratory personnel is documented in a log book. Samples are kept in the locked vault until removed for analysis. At the time samples are placed in the vault a record is made in a chain of custody log book (found in the vault). The log book duplicates the sample description found on the chain of

custody record. Each time a sample is removed for analysis, the sample I.D., analyst name, date, time, and condition of sample (sealed, clear, cloudy, etc.) is recorded. The same procedure is repeated when the sample is returned. Careful note is made of the volume of sample before and after analysis. Documentation of final sample disposal is also made in this book. Each sample is logged in the analyst's log book using the HAS I.D. number when the analysis is performed.

k) The laboratory analyses of the soil and groundwater samples performed by HAS were completed utilizing Contract Laboratory Protocol (CLP) to verify QA/QC procedures. The CLP Data Package for all of the laboratory analyses is presented in Appendix B.

l) Upon completion of the re-sleeving operation and environmental sampling at each of the locations, a temporary well casing was installed adjacent to the acid line (on the downgradient side if possible) to allow for soil sampling and/or safe well installation, if necessary, at a later date. The temporary wells were constructed of machine slotted (0.010" slot) two (2) inch diameter PVC well screen with flush threaded connections. The two (2) inch PVC wells were installed through a four (4) inch diameter stainless steel casing. The stainless steel casing was placed at the bottom of each of the excavations prior to backfilling operations. The backfill

material utilized at each re-sleeving location consisted of imported fine to medium sand ("bedding" sand) placed around the acid line and approximately the lower two feet of each of the excavations. The remaining portion of the excavations was backfilled with either the excavated "non-hazardous" material and/or imported sand and gravel. Once the excavations were backfilled, the two (2) inch PVC (open end with no cap on the bottom) was installed within the four (4) inch stainless steel casing and then the stainless steel casing was removed. Upon completion of the backfill operations and pilot well installations, the pavement scars were either repaired with "cold patch" asphaltic concrete or concrete with a flush-mounted curb box installed over each of the pilot wells.

4.0 RE-SLEEVING OBSERVATIONS AND DOCUMENTATION

4.1 Introduction

The following twelve (12) sub-sections outline the field observations and the data collected for each of the re-sleeving locations. No camera permit was issued for this investigation, therefore, no photographs were taken during the entire resleeving project. Empire Soils personnel were on-site part-time during the excavation/re-sleeving operations. The following information is included within each sub-section:

- A description of the subsurface conditions encountered during the excavation of the re-sleeving location.
- The presence of other underground utility lines observed during the excavation of the re-sleeving location.
- The type and location of the environmental sampling in the excavation/re-sleeving location.
- The location of the two (2) inch PVC temporary well within the excavation/re-sleeving location.

Presented on the following page is a tabulation of the excavation/re-sleeving location identification numbers, their respective environmental sampling identification number with the nearest manhole location, and the location where the soil and/or groundwater sample was actually collected. Refer to the "Site Plan" (Drawing No. 2) presented in Appendix A for the location of each of the excavation/re-sleeving locations.

The analytical results of the soil and water samples are presented in Appendix B and are discussed further in Section 5.0.

Summary of Sampling Information
Acid Line Resleeving
Watervliet Arsenal

Sample Date	Sample Location	Sample I.D.	Nearest Manhole	Collection Location
8/10/92	Exc. 101	S-101N S-101H GW-101	Manhole #4 " "	Stockpile Roll-off "U" Excavation
8/11/92	Exc. 102	S-102N	Manhole #11	Stockpile
8/12/92	Exc. 102 Exc. 103	S-102H S-103H S-103N	Manhole #11 Manhole #13 "	Dump Trailer "040" Dump Trailer "040" Stockpile
8/14/92	Exc. 104 Exc. 105	S-104N GW-104 S-105N S-105H	Manhole #6 " Manhole #28 "	Stockpile Excavation Stockpile Excavation
8/17/92	Exc. 106	S-106N	Manhole #32	Stockpile
8/19/92	Exc. 107	S-107N	Manhole #16	Stockpile
8/20/92	Exc. 108	S-108N	Manhole #20	Stockpile
8/25/92	Exc. 109	S-109N S-109H	Manhole #24 "	Excavation Roll-off "U"
8/26/92	Exc. 110	S-110N S-110H S-110	Manhole #23 " "	Stockpile Roll-off "U" Excavation
8/31/92	Exc. 111	S-111N S-111H	Manhole #16 "	Excavation Excavation
9/8/92	Exc. 112	S-112N S-112H	Manhole #22 "	Excavation Roll-off "U"

Note: Exc = Excavation
S = Soil
GW = Groundwater
N = Non-hazardous
H = Hazardous

4.2 Re-sleeving Location No. 101

Re-sleeving Location No. 101 is located west of Building 135, and adjacent to the north side of Manhole #4. The excavation/re-sleeving operations began on August 10, 1992.

The subsurface soils encountered at this location consisted primarily of dark gray weathered shale. There were no visibly stained or discolored soils observed within the excavation. The depth of the acid waste line (invert elevation) at this location was approximately eight (8) feet below ground surface, this being the termination depth of the excavation. Groundwater was encountered between seven (7) and eight (8) feet below ground surface at this location. The pavement debris and the soil/fill materials excavated to the six (6) foot depth were treated as "non-hazardous" material, and stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from the six (6) to eight (8) foot depth were treated as "hazardous" material and placed within Roll-off Container "U".

During the excavation of the soils at this location one groundwater sample (GW-101) and two soil samples (S-101H & S-101N) were collected. Sample GW-101 was collected from within the excavation, while sample S-101H was collected from Roll-off Container "U" and sample S-101N was collected from the stockpile.

A temporary well was not installed at the completion of the re-sleeving operations at this location, as the excavation was backfilled before Empire Soils could instruct Anjo Construction personnel differently.

4.3 Re-sleeving Location No. 102

Re-sleeving Location No. 102 is located south of Building 110, adjacent to the east side of Manhole #11. The excavation/re-sleeving operations began on August 10, 1992.

The subsurface soils encountered at this location consisted primarily of brown granular fill material. There were no visibly stained or discolored soils observed within the excavation. The depth of the acid waste line (invert elevation) at this location was approximately eight (8) feet below ground surface, the termination depth of the excavation. Two other drain pipes were uncovered in this excavation, a six inch drain pipe which Anjo cut off, and another clay pipe. The clay pipe is located approximately two feet above the top of the acid line and runs at approximately a 45 degree angle to the acid line. Approximately fifty (50) feet of the acid line was removed due to the presence of concrete within the pipe and replaced with 6-inch polyethylene pipe. Groundwater was not encountered at this location. The pavement debris and the soil/fill materials excavated to the six (6) foot depth were treated as "non-hazardous" material, and stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from the six (6) to eight (8) foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

During excavation of the soils at this location, two soil samples were collected (S-102H and S-102N). Sample S-102H was collected from Dump Trailer #40, while sample S-102N was collected from the soil stockpile within the construction staging area.

A temporary well was installed at this location on September 10, 1992. A 7.5 foot length of well screen was installed to a depth of eight (8) feet below grade, approximately 1.5 feet north of the acid line and approximately 51 feet NE of Manhole #11.

4.4 Re-sleeving Location No. 103

Re-sleeving Location No. 103 is located south of Building 35, adjacent to the west side of Manhole #13. The excavation/re-sleeving operations began on August 12, 1992.

The subsurface soils encountered at this location consisted primarily of brown granular fill comprised of graded sands and gravels. There were no visibly stained or discolored soils observed within the excavation. The depth of the acid waste line (invert elevation) at this location was approximately eight (8) feet below ground surface, the termination depth of the excavation. An oil waste line, constructed of 8-inch clay pipe, was encountered approximately three (3) feet north of the acid line. Groundwater was not encountered at this location. The pavement debris and the soil/fill materials excavated to the six (6) foot depth were treated as "non-hazardous" material, and temporarily stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from the six (6) to eight (8) foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

During the excavation of the soils at this location, two soil samples were collected (S-103H and S-103N). Sample S-103H was

collected from within Dump Trailer #40, while sample S-103N was collected from the soil stockpile within the construction staging area.

A temporary well was installed at this location on September 14, 1992. A six (6) foot length of PVC well screen was installed at a depth of 6.4 feet below grade. The well is located approximately six (6) feet west of Manhole #13 and approximately 1.5 feet north of the acid line.

4.5 Re-sleeving Location No. 104

Re-sleeving Location No. 104 is located at the northwest corner of building 135, adjacent to the east side of Manhole #6. The excavation/re-sleeving operations began on August 14, 1992.

The subsurface soils encountered at this location consisted primarily of dark gray shale and fill material ranging from sand to boulder size. The depth of the acid waste line (invert elevation) is approximately eleven (11) feet below ground surface. An oil waste line constructed of 8-inch clay pipe and a six (6) inch waterline were encountered during excavation of the soils. The oil waste line was located approximately three (3) feet north of the acid line, and at approximately the same elevation. The waterline was observed at the northeast corner of the excavation and located approximately four (4) feet north of the acid line and five (5) feet below grade. Groundwater was encountered at this location at approximately eleven (11) feet below ground surface. The pavement debris and the soil/fill materials excavated to the eight (8) foot

depth were treated as "non-hazardous" material, and temporarily stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from the eight (8) to eleven (11) foot depths were treated as "hazardous" material and placed within Dump Trailer #40.

During the excavation of the soils at this location, a groundwater sample (GW-104) and a soil sample (S-104N) were collected. Sample GW-104 was collected from the excavation, while sample S-104N was collected from the soil stockpile.

A temporary well was installed at this location on August 24, 1992. A twelve (12) foot length of PVC well screen was installed to a depth of approximately 12.5 feet below grade. The well is located approximately one (1) foot south of the acid waste line at the east end of the excavation.

4.6 Re-sleeving Location No. 105

Re-sleeving Location No. 105 is located between the southwest corner of Building 22 and the north end of Building 35, adjacent to the north side of Manhole #28. The excavation/re-sleeving operations began on August 14, 1992.

The subsurface soils encountered at this location consisted primarily of light to dark brown granular fill material. The depth of the acid waste line (invert elevation) at this location was approximately eight (8) feet below ground surface, the termination depth of the excavation. There were no visibly stained or discolored soils observed within the excavation. Groundwater was

not encountered at this location. The pavement debris and the soil/fill materials excavated to approximately the six (6) foot depth were treated as "non-hazardous" material, and temporarily stockpiled on plastic sheeting in the construction staging area. The soil/fill material excavated from approximately the six (6) to eight (8) foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

During the excavation of the soils at this location, two soil samples (S-105H and S-105N) were collected. Sample S-105H was collected from within the excavation, while sample S-105N was collected from the soil stockpile within the construction staging area. Soil samples S-102H, S-103H, and S-105H were composited at the laboratory for toxicity characterization of the material within Dump Trailer #40.

A temporary well was installed at this location on August 19, 1992. A 7.5 foot length of PVC well screen was installed at a depth of approximately 8.0 feet below ground surface. The well is located approximately four (4) feet east of the center of Manhole #28 and approximately six (6) inches north of the acid line.

4.7 Re-sleeving Location No. 106

Re-sleeving Location No. 106 is located between the southeast corner of Building 22 and the northwest corner of Building 20, adjacent to the west side of Manhole #32. The excavation/re-sleeving operations began on August 17, 1992.

The soils encountered at this location consisted primarily of

brown granular fill material comprised of graded sands and gravels. The depth of the acid line (invert elevation) at this location was approximately five (5) feet below ground surface, the termination depth of the excavation. There were no visibly stained or discolored soils observed within the excavation. Groundwater was not encountered at this location. The pavement debris and the soil/fill materials excavated to approximately the three (3) foot depth were treated as "non-hazardous" material, and temporarily stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from approximately the three (3) to five (5) foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

One soil sample (S-106N) was collected from the soil stockpile within the construction staging area.

A temporary well was installed at this location on August 28, 1992. A 4.2 foot length of PVC well screen was installed at a depth of approximately 4.7 feet below ground surface.

4.8 Re-sleeving Location No. 107

Re-sleeving Location No. 107 is located between the southeast corner of Building 120 and the southwest corner of Building 115, adjacent to the south side of Manhole #16. This is the same location as "Repair/Excavation Location No. 10" that was explored in March 1992. The excavation/re-sleeving operations began on August 19, 1992.

The subsurface soils encountered at this location consisted

primarily of sand and gravel with numerous shale fragments. Severely weathered and fractured shale bedrock was encountered beneath the acid line and along the west wall of the excavation. The depth of the acid waste line (invert elevation) at this location is approximately 5.5 feet below ground surface. There were no visibly stained or discolored soils observed within the excavation. Groundwater was not encountered at this location. The pavement debris and the soil/fill materials excavated to approximately the 3.0 foot depth were treated as "non-hazardous" materials, and temporarily stockpiled on plastic sheeting within the construction staging area. The soil/fill material excavated from the 3.0 to 5.5 foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

An oil waste line constructed of 8-inch clay pipe was encountered at this excavation, located approximately one-foot east of the acid line and running parallel to the acid line. Additionally, a one-inch water line was encountered and broken during excavating operations. Anjo personnel repaired the broken water line. The water line was a service lateral for Building 120 from the main located beneath the roadway, immediately east of the excavation, and was located at a depth of approximately four (4) feet below ground surface.

One soil sample (S-107N) was collected from the soil that was removed from this excavation and stockpiled within the construction staging area.

The original PVC pilot wells at Repair/Excavation Location No. 10 and the north end of Repair/Excavation Location No. 13 that were installed in March, 1992, were re-installed in their original locations on August 25, 1992. One well is located between the oil and acid waste lines, with approximately a six (6) inch spacing from each line, and approximately four (4) feet south of Manhole #16. The second pilot well was re-installed at the south end of Re-sleeving Location No. 107 between the oil and acid lines, and approximately 18 feet south of Manhole #16.

4.9 Re-sleeving Location No. 108

Re-sleeving Location No. 108 is located at the north end of Building 112, south of Building 115, adjacent to the west side of Manhole #20. This is the same location as "Repair/Excavation No. 11" that was explored in March 1992. The excavation/re-sleeving operations began on August 20, 1992.

The subsurface soils encountered at this location consist primarily of dark brown graded sands and gravels. The depth of the acid line (invert elevation) at this location is approximately eight (8) feet below ground surface, the termination depth of the excavation. There were no visibly stained or discolored soils observed within the excavation. Groundwater was not encountered at this location. The pavement debris and the soil/fill materials excavated to approximately the six (6) foot depth were treated as "non-hazardous" material, and temporarily stockpiled within the construction staging area. The soil/fill material excavated from

approximately the six (6) to eight (8) foot depth were treated as "hazardous" material and placed within Dump Trailer #40.

One soil sample (S-108N) was collected from the "non-hazardous" soil removed from this excavation, that was stockpiled within the construction staging area.

A temporary well was installed at this location (utilizing the PVC well screen that was originally installed in March 1992 at Repair/Excavation Location No. 11) on August 25, 1992. A 7.5 length of PVC well screen was installed at a depth of approximately 8.0 feet. The well was installed approximately 4.5 feet southwest of Manhole #20 at the east end of the excavation, one (1) foot south of the acid line and 2.5 feet west of a six (6) inch water line. The water line is located at a depth of approximately five (5) feet below ground surface.

4.10 Re-sleeving Location No. 109

Re-sleeving Location No. 109 is located in the alley between Buildings 110 and 35, adjacent to the east side of Manhole #24. The excavation/re-sleeving operations began on August 25, 1992.

The subsurface soils encountered at this location consisted primarily of graded sands and gravels. There were no visibly stained or discolored soils observed within the excavation. No groundwater was encountered at this location. The depth of the acid waste line (invert elevation) is approximately 5.5 feet below ground surface at this location. The pavement debris and the soil/fill materials excavated to approximately the 3.5 foot depth

were treated as "non-hazardous" material, and temporarily stockpiled within the construction staging area. The soil/fill material excavated from approximately the 3.5 to 5.5 foot depth were treated as "hazardous" material and placed within Roll-off Container "U".

During the excavation of the soils at this location, the acid line was noted to be constructed of an 8-inch metal alloy pipe that exited Manhole #24 and entered a concrete tunnel (or pipe chase), approximately ten (10) feet east of Manhole #24, where the acid line passes beneath Building 35. In addition, a six (6) inch natural gas line was uncovered during the excavating operations at this location. The gas line runs parallel with the acid line at approximately the same elevation with approximately six (6) inches of spacing between each of the lines.

On August 28, 1992, Empire Soils personnel were present on-site for the documentation of the conditions at this re-sleeving location along with Mr. James Sherman of the WVA Environmental Quality Department. A hair-line fracture was observed on the exterior wall of Manhole #24 in the area around the acid line where the pipe exits the manhole. According to Mr. Sherman, Anjo personnel had removed a temporary expandable plug from the cut off portion of the pipe that exited the manhole, and some chromium contaminated water was released from the manhole. The water accumulated within the western portion of the excavation, approximately two (2) to three (3) inches deep. Subsequently, Anjo personnel pumped the water from the excavation into a tanker truck

for disposal at the WVA Wastewater Treatment Plant. In addition, approximately three (3) to four (4) inches of the soils were immediately removed from the portion of the excavation where the water had accumulated. This material was considered "hazardous" material, and was disposed of within Roll-Off Container "I" along with the pipe debris.

A total of two soil samples (S-109H and S-109N) were collected from the soils from this excavation. Soil sample S-109N was collected from within the excavation, and sample S-109H was collected from Roll-Off Container "U".

A temporary well was installed at this location on September 8, 1992. A 4.0 foot length of PVC well screen was installed at a depth of approximately 4.4 feet within the northeast portion of the excavation, and approximately 1.5 feet north of the gas line.

4.11 Re-sleeving Location No. 110

Re-sleeving location No. 110 is located off the southeast corner of Building 112, west of Building 110, and adjacent to the east side of Manhole #23. The excavation/re-sleeving operations began on August 26, 1992.

The subsurface soils encountered at this location consisted primarily of graded sand and gravel with some shale fragments. There were no visibly stained or discolored soils observed within the excavation. Groundwater was not encountered at this location. The depth of the acid line (invert elevation) at this location was approximately four (4) feet below ground surface. The pavement

debris and the soil/fill materials excavated to the 2.5 foot depth were treated as "non-hazardous" material, and temporarily stockpiled within the construction staging area. The soil/fill material excavated the 2.5 to 4.0 foot depth were treated as "hazardous" material and placed within Roll-off container "U".

The re-sleeving operations completed at this location involved the removal of Manhole #23, constructed of laid up brick, and approximately fifteen (15) feet of the acid line. The portion of the acid line that was removed extended from Manhole #23 east to the point where the acid line enters a 15-inch culvert pipe sleeve. The acid line is sleeved with the 15-inch culvert pipe as it passes beneath Building 110. The portion of the removed acid line and Manhole #23 were replaced with the installation of 6-inch polyethylene piping. A clean out was installed at the former location of Manhole #23. During the removal of this portion of the acid line, visibly chromium contaminated water was observed at the east end of the excavation. Approximately five (5) gallons of the chromium contaminated water was removed from the excavation by Anjo Construction personnel, and disposed of within Manhole #24 under the direction of Mr. James Sherman of the WVA Environmental Quality Department. In addition, the soils immediately surrounding the area of the ponded water was removed and placed within Roll-off Container "I" along with the pipe debris.

During the excavation of the soils at this location three soil samples (S-110, S-110N and S-110H) were collected. Sample S-110 was collected from the area where the chromium contaminated water

had accumulated at the bottom of the excavation. Sample S-110N was collected from the stockpiled soil within the construction staging area and sample S-110H was collected from Roll-off Container "U".

A temporary well was installed at this location on August 31, 1992. A 3.5 foot PVC well screen was installed approximately 4.1 feet below grade at the northeast corner of the excavation, and approximately 0.75 feet north of the acid line.

4.12 Re-sleeving Location No. 111

Re-sleeving Location No. 111 is located at the southeast corner of Building 120, adjacent to the west side of Manhole #16. The excavation/re-sleeving operations began on August 31, 1992.

The subsurface soils encountered at this location consisted primarily of graded sand and gravel with numerous shale fragments. Visibly stained or discolored soils were not observed within the excavation and groundwater was not encountered at this location. The depth of the acid line (invert elevation) at this location was approximately 5.5 feet below ground surface, the termination depth of the excavation. A three (3) inch diameter natural gas line was encountered during the excavation of the soils, that was observed to run parallel to and approximately the same depth as the acid line. The distance between the gas line and acid line was approximately 3.0 feet. The soil/fill materials excavated to the 3.5 foot depth were treated as "non-hazardous" material and temporarily stockpiled within the construction staging area. The soil/fill materials excavated from the 3.5 to 5.5 foot depth were

treated as "hazardous" material and placed within Roll-off container "U".

During the excavation of the soils at this location, two soil samples (S-111N and S-111H) were collected. Both samples were collected from the excavation.

At this re-sleeving location, the acid line was constructed of a fourteen (14) foot length of 8-inch clay pipe from Manhole #16 west and connected to a 4-inch cast iron pipe that enters Building 120. Dowell Schlumberger removed this portion of the acid line and replaced it with 6-inch polyethylene piping.

A temporary well was installed at this location on September 8, 1992. A 4.5 foot length of PVC well screen was installed to a depth of approximately 5.0 feet between the acid line at the north (0.75 feet) and the gas line to the south (0.75 feet).

4.13 Re-sleeving Location No. 112

Re-sleeving Location No. 112 is located east of Building 112 and west of Building 110, adjacent to the west side of Manhole #22. The excavation/re-sleeving operations began on September 8, 1992.

The subsurface soils encountered at this location consisted primarily of sand and gravel with shale and brick fragments. Groundwater was not encountered at this location. The depth of the acid line (invert elevation) was approximately 2.5 feet below ground surface. The pavement debris and the soil/fill materials excavated to the one (1) foot depth were treated as "non-hazardous" material and temporarily stockpiled within the construction staging

area. The soil/fill material excavated from the 1.0 to 2.5 foot depth were treated as "hazardous" material and placed within Roll-off container "U".

During the excavation of the soils at this location two soil samples (S-112N and S-112H) were collected. Sample S-112N was collected from the excavation. Sample S-112H was collected from Roll-off container "U". Samples S-109H, S-110H, S-111H, and S-112H were composited at the laboratory for toxicity characterization of the material within Roll-off Container "U" for proper off-site disposal of the material.

Re-sleeving operations were not performed on the portion of the acid line between Manholes #22 and #20. Instead, the contractor removed this portion of the acid line and replaced it with the installation of 6-inch polyethylene piping. In addition, Manhole #22 was removed and replaced with a clean-out. The debris from manhole #22 was considered "hazardous" and was disposed of within Roll-off Container "I" along with the pipe debris.

A temporary well was installed at this location on September 9, 1992. A 1.6 foot length of PVC well screen was installed to a depth of 2.0 feet along the north side of the excavation approximately one (1) foot north of the acid line cleanout.

5.0 ANALYTICAL RESULTS OF SOIL AND GROUNDWATER

5.1 Analytical Results for "Non-Hazardous" Soil

Soil samples considered "non-hazardous" material were collected from excavated soils at each of the re-sleeving locations. The samples were delivered to Huntingdon Analytical Services, Inc. to determine leachable concentrations of the eight (8) RCRA Metals by the Toxicity Characteristic Leaching Procedure (TCLP), and total concentrations for the same metal analytes. Table I on the ensuing page presents a summary tabulation of the analytical results for the soils considered "non-hazardous" material. For comparison purposes the tabulation includes the NYSDEC Groundwater Quality Standard, and the USEPA Hazardous Waste Regulatory Level for each detected analyte. A copy of the analytical report and the QA/QC documentation is presented in Appendix B.

In summary, the total concentrations of the eight (8) metal analytes are relatively similar within the soil samples collected from each of the re-sleeving locations. The number of analytes detected for total concentrations above the limit of laboratory detection ranged from four (4) to six (6) at each location. Total concentrations of arsenic, barium, chromium and selenium were present above the limit of laboratory detection within each of the soil samples. Lead was detected within each sample with the exception of sample S-111N. In addition, concentrations of cadmium (S-101N), mercury (S-106N), and silver (S-110N) were detected above the limit of laboratory detection.

Table I
Summary of "Non-Hazardous" Soil Analytical Results
Acid Line Resleeving
Watervliet Arsenal

Sample I.D.	Analytes Detected	Totals Concentration (mg/kg)	TCLP Concentration (mg/l)	NYSDEC Groundwater Standard (mg/l)	USEPA H.W. Regulatory Level (mg/l)
S-101N	Arsenic	124.4	0.04	0.05	5.0
	Barium	145.0	0.06	1.0	100.0
	Cadmium	6.0	ND	---	---
	Chromium	25.8	ND	---	---
	Lead	37.0	ND	---	---
	Selenium	36.6	ND	---	---
S-102N	Arsenic	119.1	ND	---	---
	Barium	203.5	0.1	1.0	100.0
	Chromium	20.2	ND	---	---
	Lead	54.8	ND	---	---
	Selenium	30.9	ND	---	---
S-103N	Arsenic	101.7	ND	---	---
	Barium	108.9	0.11	1.0	100.0
	Chromium	15.4	ND	---	---
	Lead	36.9	ND	---	---
	Selenium	27.0	ND	---	---
S-104N	Arsenic	129.3	ND	---	---
	Barium	198.2	0.06	1.0	100.0
	Chromium	26.3	ND	---	---
	Lead	44.8	ND	---	---
	Selenium	29.2	0.06	0.01	1.0
S-105N	Arsenic	88.1	ND	---	---
	Barium	120.2	0.15	1.0	100.0
	Cadmium	ND	0.01	0.01	1.0
	Chromium	15.9	ND	---	---
	Lead	25.2	ND	---	---
	Selenium	21.1	ND	---	---
S-106N	Arsenic	105.8	ND	---	---
	Barium	113.2	1.22	1.0	100.0
	Chromium	16.0	ND	---	---
	Lead	21.0	ND	---	---
	Mercury	106.2	ND	---	---
	Selenium	28.0	0.63	0.01	1.0
S-107N	Arsenic	116.5	ND	---	---
	Barium	153.0	1.16	1.0	100.0
	Chromium	21.1	0.99	0.05	5.0
	Lead	53.7	ND	---	---
	Selenium	34.4	ND	---	---
S-108N	Arsenic	95.6	ND	---	---
	Barium	89.8	0.93	1.0	100.0
	Chromium	19.1	0.22	0.05	5.0
	Lead	38.6	ND	---	---
	Selenium	28.5	ND	---	---

Table I (continued)
Summary of "Non-Hazardous Soil Analytical Results
Acid Line Resleeving
Watervliet Arsenal

S-109N	Arsenic	90.6	ND	---	---
	Barium	127.0	1.17	1.0	100.0
	Chromium	19.7	0.15	0.05	5.0
	Lead	35.0	ND	---	---
	Selenium	32.4	0.65	0.01	1.0
S-110N	Arsenic	73.8	ND	---	---
	Barium	134.5	0.67	1.0	100.0
	Chromium	16.3	ND	---	---
	Lead	35.1	ND	---	---
	Selenium	25.6	ND	---	---
	Silver	4.9	ND	---	---
S-111N	Arsenic	61.5	ND	---	---
	Barium	80.7	0.75	1.0	100.0
	Chromium	11.7	0.18	0.05	5.0
	Selenium	20.9	ND	---	---
S-112N	Arsenic	68.2	ND	---	---
	Barium	91.0	0.73	1.0	100.0
	Chromium	30.7	ND	---	---
	Lead	44.0	ND	---	---
	Selenium	36.9	ND	---	---

Table II presents the results of the eight (8) analytes detected along with their naturally occuring "total" concentrations observed within the Eastern United States. For the comparison, the sources noted on Table II were referenced. The analytical results for the soil samples considered "non-hazardous" material were compared to the arithmetic mean concentrations and observed ranges for each of the eight (8) metal analytes as they naturally occur within the soils of the Eastern United States.

The concentrations of four of the eight metal analytes are within the observed ranges, and two of the eight metal analytes are within the arithmetic mean concentrations for these analytes. NYSDEC guidance values or standards have not been established for total concentrations of these analytes within soils.

The leachable (TCLP) concentrations of the detected analytes are significantly lower than the total concentrations. As shown on Table I, the leachable concentrations of each of the metal analytes detected are below the USEPA Regulatory Levels. However, the leachable concentrations of barium (within soil samples S-106N, S-107N, and S-109N), and selenium (within samples S-104N and S-109N), and chromium (within samples S-107N, S-108N, S-109N and S-111N) exceed their respective NYSDEC Groundwater Quality Standard.

5.2 Analytical Results for "Hazardous" Soil

The soils that were considered for possible disposal off-site as "hazardous" material within Roll-off Container "U" and Dump Trailer "040" consisted of the material excavated and removed from

Table II
Naturally Occuring Concentrations
for the
Eight RCRA Metals
Acid Line Resleeving
Watervliet Arsenal, Watervliet, New York

Metal Analyte	Observed Range Within the Excavation Locations	Observed Range for Eastern U.S.	Average Concentration, U.S. (a)	Estimated Arithmetic Mean, Eastern U.S. (b)
Arsenic	61.5 - 129.3	<0.1 - 73	5	7.4
Barium	72.2 - 203.5	10 - 1500	430	420
Cadmium	6.0	<0.5 - 2	0.06	1.0 (d)
Chromium	11.7 - 40.5	1 - 1000	100	52
Lead	21.0 - 81.3	<10 - 300	10	17
Mercury	106.2	0.01 - 3.4	0.03	0.12
Selenium	20.9 - 36.9	0.1 - 3.88	0.3	0.52 (c)
Silver	4.9	0.01 - 5 (a)	0.05	ND

Notes:

(a) Source: Hazardous Waste Land Treatment, USEPA, SW-874 (April, 1983).
(b) Source: Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, USGS, Professional Paper 1270 (1984).
(c) Source: Selenium, Fluorine, and Arsenic in Surficial Materials of the Conterminous United States, USGS, Circular 692 (1974).
(d) Source: Lithium in Surficial Materials of the Conterminous United States and Partial Data on Cadmium, USGS, Circular 673 (1973).
(e) All concentrations are presented in parts per million.
(f) "ND" indicates no data available from USGS publications.
(g) The observed range within the excavation locations represents the concentrations observed within the "Non-Hazardous" soils (S-101N through S-112N).

approximately two (2) feet above the acid line to the bottom of the excavation at each re-sleeving location. A total of three (3) composite soil samples were collected from the material placed within each of the roll-off containers and dump trailers. The samples were delivered to Huntingdon Analytical Services, Inc. for analysis of leachable concentrations of the eight (8) RCRA Metals by the Toxicity Characteristic Leaching Procedure (TCLP), and total concentrations for the same metal analytes and for total PCB's. The first composite soil sample that was submitted for toxicity characterization was collected from the material placed within Roll-Off "U" and consisted of soils removed from Re-sleeving Location No. 101. The second soil sample was a composite prepared by the laboratory from soil samples S-102H, S-103H and S105H, and represents the material placed within Dump Trailer "040". The soils that were considered potentially "hazardous" material and placed within Dump Trailer "040" consisted of soils removed from Re-Sleeving locations No. 102 through 108. The remaining soil sample was a composite prepared by the laboratory from soil samples S-109H, S-110H, S-111H and S-112H and represents the material placed within Roll-Off "U" from Re-Sleeving Locations No. 109 through 112. Table III on the ensuing page presents a summary tabulation of the analytical results for the soils considered "hazardous" material. For comparison purposes the tabulation includes the NYSDEC Groundwater Quality Standard, and the USEPA Hazardous Waste Regulatory Level for each detected analyte. A copy of the analytical report and the QA/QC documentation is presented

Table III
Summary of "Hazardous" Soil Analytical Results
Acid Line Resleeving
Watervliet Arsenal

Sample I.D.	Analytes Detected	Totals Concentration (mg/l)	TCLP Concentration (mg/l)	NYSDEC Groundwater Standard (mg/l)	USEPA H.W. Regulatory Level (mg/l)
S-101H	PCB's	ND	ND	---	---
	Arsenic	91.8	ND	0.05	---
	Barium	72.2	0.53	1.0	100.0
	Chromium	17.4	ND	0.05	---
	Lead	24.0	ND	0.025	---
	Selenium	34.4	ND	0.01	---
Composite S-102H S-103H S-105H	PCB's	ND	ND	---	---
	Arsenic	70.2	ND	0.05	---
	Barium	91.8	0.85	1.0	100.0
	Chromium	15.0	ND	0.05	---
	Lead	36.6	ND	0.025	---
	Selenium	27.6	ND	0.01	---
Composite S-109H S-110H S-111H S-112H	PCB's	ND	ND	---	---
	Arsenic	88.6	ND	0.05	---
	Barium	131.6	0.86	1.0	100.0
	Chromium	40.5	0.14	0.05	5.0
	Lead	81.3	ND	0.025	---
	Selenium	33.7	ND	0.01	---

in Appendix B.

Results for total PCB's indicate that they are not present above the laboratory detection limit within the composite soil samples. The totals concentrations for the eight (8) metal analytes are relatively similar within each of the composite soil samples. Five (5) analytes (arsenic, barium, chromium, lead, and selenium) were present above the limit of laboratory detection within each composite sample analyzed for total concentrations.

A comparison of these results with the naturally occuring concentrations (Table II) indicates barium, chromium, and lead to be within the observed range for the Eastern United States. Arsenic was within its naturally occuring range for the second composite sample. Arsenic was found above the naturally occurring range in two of the samples, and selenium exceeds the naturally occurring range of 0.1 - 3.88 mg/l in each sample. The NYSDEC does not currently have guidance values or standards established for total concentrations of these analytes within the soils.

Although arsenic and selenium occur above the naturally occuring range for the Eastern United States, the leachability (TCLP) results indicate that they were not detected above the laboratory detection limit. The leachable concentration of barium within the third composite sample is 0.86 mg/l, which is below the NYSDEC Groundwater Standard of 1.0 mg/l. The leachable concentration of chromium (0.14 mg/l) detected within the third composite sample is slightly above its groundwater standard of 0.05 mg/l, however, it is below the USEPA Hazardous Waste Regulatory

Level of 5.0 mg/l, thus defining the material as "non-hazardous".

5.3 Analytical Results for Groundwater

Two groundwater samples (GW-101 and GW-104) were collected during the re-sleeving operations at Excavations 101 and 104. The groundwater samples were delivered to Huntingdon Analytical Services, Inc. for analysis of total and dissolved concentrations of the eight (8) RCRA metals. Table IV on the following page, presents a summary tabulation of the analytical results for the groundwater. For comparison purposes, the NYSDEC Groundwater Quality Standard for the respective analytes detected are also presented. A copy of the analytical report and the QA/QC documentation is presented in Appendix B.

A review of the results indicate that the total concentrations of the eight (8) metal analytes are somewhat higher in GW-104. Arsenic, barium, chromium, lead and selenium were detected in each sample above the limit of laboratory detection. In addition, mercury was also detected in GW-104.

When comparing the total and dissolved analytical results, a significant decrease in concentration is noted. The elevated total concentrations of each of the metal analytes detected within the groundwater at each of the locations are inferred to be related to the turbidity (ie. suspended sediment) of the groundwater within the excavations at the time the samples were collected. The portion of the groundwater samples analyzed for total concentrations was neither filtered in the field or the laboratory.

Table IV
Summary of Groundwater Analytical Results
Acid Line Resleeving
Watervliet Arsenal

Sample I.D.	Analytes Detected	Totals Concentration (mg/l)	Dissolved Concentration (mg/l)	NYSDEC Groundwater Standard (mg/l)
GW-101	Arsenic	0.22	ND	0.05
	Barium	0.67	0.04	1.0
	Chromium	0.03	ND	0.05
	Lead	0.09	ND	0.025
	Selenium	0.19	0.12	0.01
GW-104	Arsenic	18.6	ND	0.05
	Barium	7.0	0.08	1.0
	Chromium	3.2	ND	0.05
	Lead	6.8	ND	0.025
	Mercury	0.0173	0.0003	0.002
	Selenium	8.5	0.22	0.01

As such, the total concentrations of the metal analytes likely represents the sediment suspended in the groundwater. Dissolved arsenic, chromium, and lead were not present above the limit of laboratory detection. Dissolved concentrations of barium and selenium were detected in GW-101 at 0.04 and 0.12 mg/l, respectively. The concentration of barium is below the NYSDEC Groundwater Standard, while the concentration of selenium slightly exceeds its NYSDEC Standard of 0.01 mg/l.

Barium, mercury, and selenium were detected in GW-104 at concentrations of 0.08, 0.0003, and 0.22 mg/l, respectively. The concentrations of barium and mercury do not exceed their respective NYSDEC Groundwater Standard, while the concentrations of selenium slightly exceeds its NYSDEC Standard of 0.01 mg/l.

6.0 CONCLUSIONS

The following conclusions provide a discussion of the analytical results for the soil and/or groundwater samples collected from the excavation/re-sleeving locations. Based upon the observations of the re-sleeving operations by Empire Soils personnel, it is our opinion that the re-sleeving of the acid waste line was completed satisfactorily.

Excavated soils were classified as "non-hazardous" or "hazardous" based on the depth from which they were excavated. Ground surface to two (2) feet above the acid waste line was considered "non-hazardous", while two (2) feet above the acid waste line to the termination depth of the excavation was considered

"hazardous". The soils were analyzed for both leachable (TCLP) and total concentrations of the RCRA metals. In addition, the "hazardous" soil samples were also analyzed for Total PCB concentrations.

Based upon the results of the laboratory data for the excavated soils, the analytes detected by the TCLP method were below the USEPA Hazardous Waste Regulatory Level. Therefore, all of the excavated soils are considered "non-hazardous" on the basis of this criteria. However, at Re-sleeving Locations No. 104, 106 through 109, and 111 leachable concentrations of one or more of the following metal analytes: barium, chromium and selenium were detected above their respective NYSDEC Groundwater Quality Standard. The results of the Total PCB analysis indicated that PCB's were not present within the soils at any of the excavations.

Groundwater results indicated the presence of barium, mercury, and selenium at excavation locations 101 and 104. The dissolved concentrations of barium and mercury are below the NYSDEC Groundwater Standards. However, the dissolved concentrations of selenium exceeded the NYSDEC Groundwater Standard at both locations.

7.0 RECOMMENDATIONS

Based upon the laboratory analyses of the soil and/or groundwater smaples, it is recommended that a groundwater monitoring well be installed within the pilot hole at each of the following re-sleeving locations: Re-sleeving Locations No. 101,

104, 106 through 109, and 111. Once installation is complete, the wells should be sampled for the eight (8) RCRA Metals in acccordance with Watervliet Arsenal groundwater sampling specifications. If metals contamination is confirmed to be present within the groundwater at any of the proposed well locations, then additional monitoring wells would be required to determine if a contaminant plume exists in these areas.

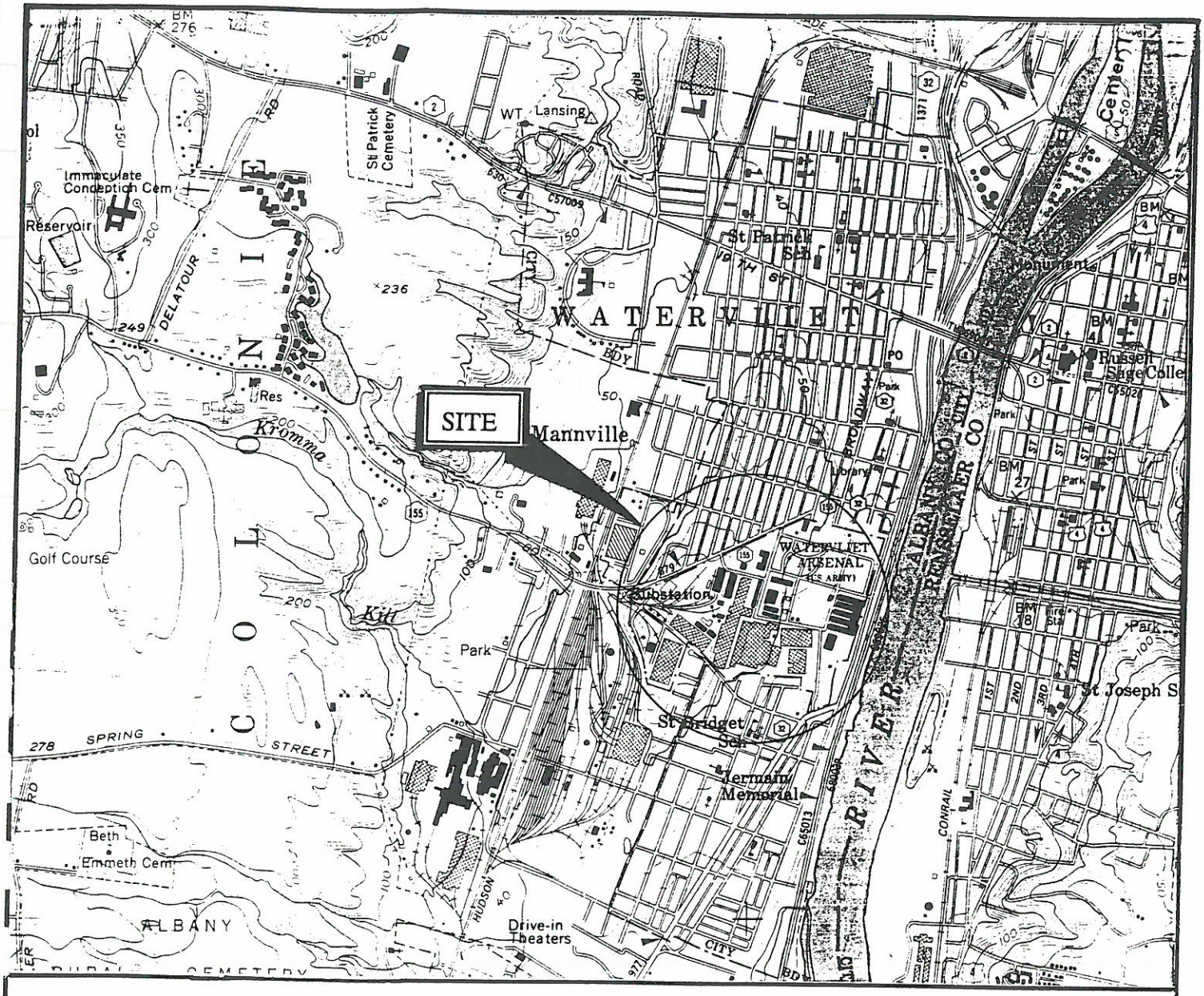
8.0 CLOSURE

This report presents the findings and conclusions of the re-sleeving operations performed on the Chromic Acid Waste Line at the Watervliet Arsenal, Watervliet, New York. The services provided by Empire Soils Investigations, Inc. to the Watervliet Arsenal were completed in accordance with Watervliet Arsenal's Purchase Order No. DAAA22-92-M-2355 dated September 30, 1992.

The information presented herein is based upon the investigations completed to date by Empire Soils. The opinion of the environmental conditions existing within the project site represents the condition believed to exist at the time of our investigation. No other warranties, expressed or implied, are made.

DRAWINGS

APPENDIX A



N

SCALE 1:24 000

1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

.5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

EMPIRE SOILS INVESTIGATIONS INC

SITE LOCATION MAP

CHROMIC ACID LINE RE-SLEEVING
WATERVLIET ARSENAL
WATERVLIET , NEW YORK

DR. BY: –	SCALE: AS SHOWN	PROJ. NO.: ATA-92-158
REV'D. BY:	DATE: 1/93	DRWG. NO.: 1

Summary Tabulation of "Non-Hazardous" Soil Analytical Results
Acid Line Resleeving
Watervliet Arsenal

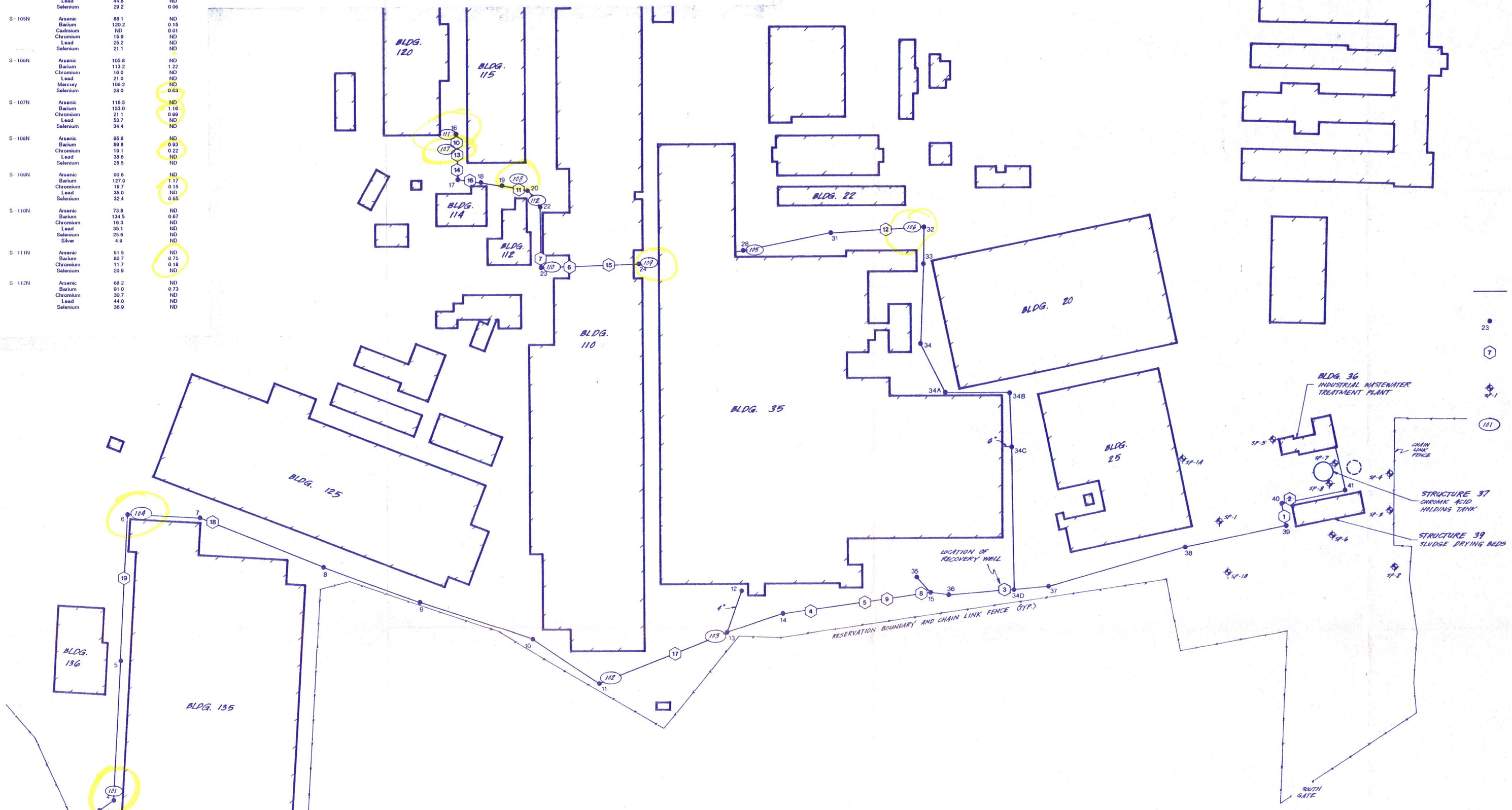
Re-Sleeving Location	Sample ID	Analytes Detected	Total Concentration (mg/kg)	TCLP Concentration (mg/l)
101	S-101N	Arsenic	124.4	0.04
		Barium	145.0	0.06
		Cadmium	6.0	ND
		Chromium	25.8	ND
		Lead	37.0	ND
		Selenium	36.6	ND
102	S-102N	Arsenic	119.1	ND
		Barium	203.5	0.1
		Chromium	20.2	ND
		Lead	54.8	ND
		Selenium	30.9	ND
103	S-103N	Arsenic	101.7	ND
		Barium	108.9	0.11
		Chromium	13.4	ND
		Lead	38.9	ND
		Selenium	27.0	ND
104	S-104N	Arsenic	129.3	ND
		Barium	198.2	0.06
		Chromium	29.3	ND
		Lead	44.8	ND
		Selenium	29.2	0.06
105	S-105N	Arsenic	88.1	ND
		Barium	120.2	0.15
		Cadmium	ND	0.01
		Chromium	15.9	ND
		Lead	25.2	ND
		Selenium	21.1	ND
106	S-106N	Arsenic	105.8	ND
		Barium	113.2	1.22
		Chromium	16.0	ND
		Lead	21.0	ND
		Mercury	106.2	ND
		Selenium	28.0	0.63
107	S-107N	Arsenic	116.5	ND
		Barium	153.0	1.16
		Chromium	21.1	0.99
		Lead	53.7	ND
		Selenium	34.4	ND
108	S-108N	Arsenic	95.6	ND
		Barium	89.8	0.93
		Chromium	19.1	0.22
		Lead	38.6	ND
		Selenium	29.5	ND
109	S-109N	Arsenic	90.6	ND
		Barium	127.0	1.17
		Chromium	19.7	0.13
		Lead	35.0	ND
		Selenium	32.4	0.65
110	S-110N	Arsenic	73.8	ND
		Barium	134.5	0.67
		Chromium	16.3	ND
		Lead	35.1	ND
		Selenium	25.6	ND
		Silver	4.9	ND
111	S-111N	Arsenic	61.5	ND
		Barium	80.7	0.75
		Chromium	11.7	0.18
		Selenium	20.9	ND
112	S-112N	Arsenic	68.2	ND
		Barium	91.0	0.73
		Chromium	30.7	ND
		Lead	44.0	ND
		Selenium	36.9	ND

Summary Tabulation of "Hazardous"
Soil Analytical Results

Re-Sleeving Location	Sample ID	Analytes Detected	Total Concentration (mg/kg)	TCLP Concentration (mg/l)
101	S-101H	Arsenic	91.8	ND
		Barium	72.2	0.53
		Chromium	17.4	ND
		Lead	24.0	ND
		Selenium	34.4	ND
102, 103, 105	Composite S-102H S-103H S-105H	Arsenic	70.2	ND
		Barium	91.8	0.85
		Chromium	15.0	ND
		Lead	36.6	ND
		Selenium	27.8	ND
109, 110, 111 & 112	Composite S-109H S-110H S-111H S-112H	Arsenic	88.6	ND
		Barium	131.6	0.86
		Chromium	40.5	0.14
		Lead	81.3	ND
		Selenium	33.7	ND

Summary Tabulation of
Groundwater Analytical Results

Re-Sleeving Location	Sample ID	Analytes Detected	Total Concentration (mg/kg)	Dissolved Concentration (mg/l)
101	GW-101	Arsenic	0.22	ND
		Barium	0.87	0.04
		Chromium	0.03	ND
		Lead	0.09	ND
		Selenium	0.19	0.12
104	GW-104	Arsenic	18.6	ND
		Barium	7.0	0.08
		Chromium	3.2	ND
		Lead	6.8	ND
		Mercury	0.0173	0.0003
		Selenium	8.5	0.22



LEGEND

- 8" CLAY PIPE CHROMIC ACID WASTE LINE
- 23 — CHROMIC ACID SEWER MANHOLE WITH THE WATERVLIET ARSENAL IDENTIFICATION NUMBER
- (7) — EXCAVATION/LINE REPAIR LOCATION WITH THE EMPIRE SOILS IDENTIFICATION NUMBER
- MW-1 — MONITORING WELL NUMBER AND APPROXIMATE LOCATION
- (101) — EXCAVATION/RE-SLEEVING LOCATION WITH EMPIRE SOILS IDENTIFICATION NUMBER.

BASE MAP FURNISHED BY WATERVLIET ARSENAL.

EMPIRE SOILS INVESTIGATIONS INC

SITE PLAN

CHROMIC ACID LINE RE-SLEEVING	SCALE 1" = 100'	DRAWN BY JH
		REVISED
WATERVLIET ARSENAL WATERVLIET, NEW YORK		
DATE 1/93	ATA-92-158	DRAWING NUMBER 2

MADE IN U.S.A.

K+E ALBANENE © 10 3455 ARCHITECTS' STANDARD FORM

ANALYTICAL RESULTS AND CLP DATA PACKAGE

APPENDIX B

HAZARDOUS WASTE MANIFEST AND ALBANY COUNTY LANDFILL WEIGH TICKETS

APPENDIX C

68484

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Hazardous Waste MANIFEST PROGRAM, State Office Building
Hartford, CT 06106

13285

Please type (or print) *(Form designed for use on elite (12-pitch) typewriter.)*

FOR STATE USE ONLY

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. N.Y.7.2.1.3.8.2.0.9.4.0 Manifest Document No. 92094
2. Page 1 of 1

Information in the shaded areas is not required by Federal law, but may be required by State law.

3. Generator's Name and Mailing Address
WATERVLIET ARSENAL ATTN: SMCWV-EHU
WATERVLIET, N.Y. 12189
4. Generator's Phone (518) 266-5111

A. State Manifest Document Number CT F 0132468
B. G.S.I. (Gen. Site Address) SAME

5. Transporter 1 Company Name: WEST CENTRAL ENVIRONMENTAL CORP.
6. US EPA ID Number: N.Y.D.0.0.0.0.7.0.3.2.7.1
7. Transporter 2 Company Name:
8. US EPA ID Number:
C. S.T.I. (Trans. Lic. Plate #) 85350W
D. Tran. Phone (518) 272-6891
E. S.T.I. (Trans. Lic. Plate #)
F. Tran. Phone ( )

9. Designated Facility Name and Site Address
ENVIRONMENTAL WASTE RESOURCES
130 FREIGHT STREET
WATERBURY, CT 06702
10. US EPA ID Number: C.T.D.0.7.2.1.3.8.9.6.9
G. State Facility's ID (Not Required)
H. Facility's Phone (203) 755-2283

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ HAZARDOUS WASTE SOLID NOS (D007) (CHROMIUM, SOIL) ORM-E NA9189	001	DT	28620	P	EPA D007 / STATE
b.					EPA / STATE
c.					EPA / STATE
d.					EPA / STATE

J. Additional Descriptions for Materials Listed Above
a. c.
b. d.

K. Handling Codes for Wastes Listed Above
Interim / Final / Interim / Final
a. S01 b. c. d.

15. Special Handling Instructions and Additional Information
EWR STREAM #A21274
EMERGENCY PHONE #518-266-5111

20 yds

Point of Departure: NOT: 28520

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, and all applicable State laws and regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: [illegible] Signature: [signature] Month Day Year: 1 1 92

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: John M Pirozzi Signature: [signature] Month Day Year: 1 1 25 92

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: Signature: Month Day Year:

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Antoinette Buching Signature: Antoinette Buching Month Day Year: 1 1 25 92

COPY 5: TRANSPORTER 1 RETAINS

CT F 0132468

FOR SPILLS WITHIN CONNECTICUT, CONTACT CT DEP - OIL AND CHEMICAL SPILL RESPONSE AT (203) 566-3338

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/7/92 WCE TIME: _____

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
_____	74000 40600	140	Y

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
_____	33K00	_____	_____

16.7 @ 1069.30

REAR AXLE _____ DRIVER'S SIGNATURE X _____

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/5/92 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
________	56640	HAD	Y
ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
________	25980 30660	________	________

15,33 981,57
REAR AXLE ___,___ DRIVER'S SIGNATURE x [signature]

153,10 TONS

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/5/92 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
____________	4311 54200 35980 18220	LAL	Y

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
____________	____________	____________	____________

14.11 TONS

REAR AXLE ____.____ DRIVER'S SIGNATURE x [signature] J Le Moine

$903.06

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/5/92 TIME: _____

TRUCK NUMBER	GROSS WEIGH	CLASS CODE	CHARGEABLE
_____	~~56380~~ ~~35760~~ 30400	Lan	Y
ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
_____	_____	_____	_____

15.2
1.52 TONS

REAR AXLE _____ DRIVER'S SIGNATURE X Terry J LeMire

$973.05

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/6/98 TIME: _____

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
_____	55500	LAD	X
	35480		

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
_____	26220	_____	_____

REAR AXLE 13.11 DRIVER'S SIGNATURE X Kenneth J LeMire

[redacted] [redacted]

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/6/92 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
____________	53160 25980 27180	LAA	Y

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
____________	____________	____________	____________

13.59 Tons

REAR AXLE ____ DRIVER'S SIGNATURE x [signature]

$870.16

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/6/92 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
________	461 55520 25980 27540	LAIL	Y

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
________	________	________	________

REAR AXLE ___,___ DRIVER'S SIGNATURE X [signature]

13.62 Tons

$872.08

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/7/92 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
____________	52620	LAP	____________

ROLL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
____________	~~25980~~ 26640	____________	____________

REAR AXLE ______ 1332 DRIVER'S SIGNATURE x [signature]

85287

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/7/92

TIME: __________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
__________	52880 / 25980	LAD	Y

ROLL OFF TARE	~~PERMIT NUMBER~~	TRAILER NUMBER	CUBIC YARDS
__________	26900	__________	__________

REAR AXLE 13.45 861.20 DRIVER'S SIGNATURE x [signature]

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/7/98 TIME: ____________

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
____________	54960	CAD	X
	25980		

ROLL OFF TARE	~~PERMIT NUMBER~~	TRAILER NUMBER	CUBIC YARDS
____________	28980	____________	________

14.49 @ 937.79

REAR AXLE ___,___ DRIVER'S SIGNATURE x [signature]

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/9/92 TIME: _____

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
_____	53480	4 AM	X
	25980		

HULL OFF TARE	~~PERMIT NUMBER~~	TRAILER NUMBER	CUBIC YARDS
_____	27500	_____	_____
13.75	880.41		

REAR AXLE _____ DRIVER'S SIGNATURE X Timothy J LeMoine

[redacted] [redacted]

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/1/92 TIME: _____

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
_____	52060	LAW	X
	25280		

HULL OFF TARE	PERMIT NUMBER	TRAILER NUMBER	CUBIC YARDS
_____	26080	_____	_____
13.04	& 834.95		

REAR AXLE _____ DRIVER'S SIGNATURE X Thomas J. LeMoine

CITY OF ALBANY
DEPARTMENT OF PUBLIC WORKS
ANSWERS PROJECT SCALE TICKET

DATE: 10/7/92 WCE TIME: _____

TRUCK NUMBER	GROSS WEIGHT	CLASS CODE	CHARGEABLE
_____	74000 / 40600	LAD	Y
ROLL OFF TARE	**PERMIT NUMBER**	**TRAILER NUMBER**	**CUBIC YARDS**
_____	33K00	_____	_____
REAR AXLE 16.7	# 1069.30	DRIVER'S SIGNATURE X	