Woodward-Clyde
Engineering & sciences applied to the earth & its environment

March 3, 1998

Mr. Robert Schick
Chief, Remedial Section A
Bureau of Western Remedial Action
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7010

Subject: Revised Remedial Investigation Report
Cole-Zaiser Inactive Hazardous Waste Site #738013

Dear Mr. Schick:

The enclosed remedial investigation (RI) report is being submitted for the subject facility by Woodward-Clyde International-Americas on behalf of Borg-Warner Automotive, Inc. This RI report has been revised to incorporate the results of the test pit investigation and groundwater sampling that were recently completed at the site. Revisions have also been made to address comments provided by the New York State Department of Environmental Conservation (NYSDEC) on the previous (June 1997) submittal. Responses to the NYSDEC's comments have also been enclosed. The enclosed responses have been revised from our previous (August 1997) responses to address concerns that were raised by the NYSDEC during a teleconference on August 13, 1997.

The enclosed RI report includes the use of ~~strikethrough~~ to identify text to be removed from the previous report. Text additions are underlined. A final version of the RI text will be submitted following the NYSDEC's review and approval of the enclosed document.

Should you have any questions, please do not hesitate to contact Mr. Michael McKim at (440)349-2708, Ms. Leslie Voss at (913)344-1000, or Ms. Jane Montgomery of Schiff, Hardin & Waite at (312)258-5508.

Sincerely,

Lisa M. Pfaff FOR

Michael J. McKim
Project Geologist

Leslie B. Voss, P. E.
Senior Project Engineer

Enclosures

cc: See enclosed distribution list

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COLE ZAISER INACTIVE HAZARDOUS WASTE SITE #738013
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REVISED RESPONSES TO COMMENTS ON THE JUNE 1997 DRAFT REMEDIAL INVETIGATION REPORT COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK (SITE NO. 7-38-013)

This document presents revised responses to general and specific comments prepared by the New York State Department of Environmental Conservation (NYSDEC) on the June 1997 Draft Remedial Investigation (RI) Report for the Cole-Zaiser site in Amboy Township, New York. Initial responses were submitted to NYSDEC with a letter on August 11, 1997. These responses were reviewed by NYSDEC, Woodward-Clyde International-Americas (Woodward-Clyde), and Borg-Warner Automotive, Inc. during a teleconference on August 13, 1997. The revised responses in this document address concerns raised during the conference call and include information related to supplemental RI activities performed in October 1997.

Please note that the NYSDEC comments have been reproduced in *italics*. The revised responses are provided immediately following each comment. In general, the responses reference the specific section where each item has been addressed in the February 1998 RI Report enclosed with this submittal.

GENERAL COMMENTS

Comment 1: *Additional work is needed to properly characterize the former lagoon area. This work could include Geoprobe sampling, soil borings, or other techniques. NYSDEC initially requested test pits in the former lagoon area. However, in scoping out the RI Work Plan NYSDEC agreed with Borg-Warner to avoid the former lagoon area, since it could damage an existing leach field. At this point, high concentrations of DCE suggest NAPL presence. This makes a more invasive investigation of the lagoon area necessary in order to adequately characterize the site.*

Addendum No. 2 to the RI Work Plan was prepared to include test pit excavation in the former bermed/lagoon area following receipt of this comment. Minor work scope clarifications and approval of Addendum No. 2 were provided by the NYSDEC in a letter dated October 27, 1997.

The field work described in Addendum No. 2 was performed on October 27, 28, and 29, 1997. Subsurface soil samples were collected from the test pits and submitted for laboratory analysis based on hydrophobic dye testing and headspace screening. Field procedures and analytical results are presented in the February 1998 RI Report.

Comment 2: *Two to three background samples to characterize site background metals concentrations.*

Background samples for metals in surface soil or subsurface soil are not necessary since the data do not indicate any "hot spot" area where site-specific data consistently exceed conservative

State of New York Screening Criteria. The reference to site-specific background levels has been removed from Section 6.6.1.3 (Infrequent Exceedances) as requested during the August 13, 1997 teleconference.

Comment 3: *Samples should be collected from the drainage ditch leaving the site.*

Surface soil sample S-7 was collected from the upslope portion of the southeast drain area and approximately 2 feet downstream of where the drainpipe emerges into this area. The sampling location was established in accordance with the RI Work Plan. The text in Section 4.4 (Surface Soil Sampling) has been revised to clarify the location of surface soil sample S-7.

SPECIFIC COMMENTS

Comment 1: *Section 2, Site Background and Physical Setting. This section does not discuss all of the historical information available regarding the site. The NYSDEC provided Woodward-Clyde with a letter received from a private citizen, dated June 13, 1980. This letter describes a "20'x15' pond like hole", filled with an oily like liquid (letter attached). Also attached is letter to Charles Cole date April 7, 1976 from the NYSDEC. In that letter the NYSDEC asked Cole-Zaiser to reinforce the on site lagoon to prevent spillage or leakage off site. This letter was written after a NYSDEC inspection of the facility. Another letter from the Oswego County Health Services (attached) details how the Lowes described where the former pond was located before it was backfilled. A Senior Sanitary Engineer for the NYSDEC's Division of Solid Waste is qualified to determine what is, and what is not, a lagoon. The Lowes are also qualified to determine the difference between a soil berm and pond. Both these letters, as well as the letter from the private citizen overwhelmingly indicate that a lagoon existed on site during Cole-Zaiser's operation. A discussion with Charles Cole is not enough evidence to discount the lagoon's existence. Therefore, please include the existence of the lagoon in the site's history.*

Section 2.1.2 (Surface Conditions) has been modified to present the information provided in the letters referenced above and to acknowledge the apparent presence of a former lagoon area.

Comment 2: *Section 2, Site Background and Physical Setting. Please provide the NYSDEC with a copy of the aerial photos referenced in Section 2.1.3.*

A copy of the June 1972 aerial photograph referenced in Section 2.1.3 (Aerial Photographs) is provided with this Comment-Response Report. Copies of additional photographs that were recently obtained for 1955, 1964, and 1995 are also provided.

Comment 3: *Section 3.4, NYSDOH Sampling. The NYSDOH sampled the Trumble well in August 1992, not 1990. A typo in the November 1992 Phase II Report on page 4-32 may be the* *source of your error. Also, the NYSDEC (not NYSDOH) supplied bottled water, and installed and monitors the filter on the Trumble well.*

The text in Section 3.4 (New York State Department of Health Sampling) has been revised to reflect the correct date and to clarify that the NYSDEC supplied bottled water, installed the carbon filter, and monitors the Trumbles' drinking water well.

<u>Comment 4</u>: Section 4, Summary of Field Activities and Observations. Any differences between the actual procedures used in the field and the standard procedures should be documented in this section, since they may affect data in ways not apparent at this time. For instance, a NYSDEC inspector observed the homogenization of a sample from boring B-4 prior to the collection of the VOC sample. As stated in the RI report, mixing can cause volatilization, making the sample not representative. This variation from standard procedures for this samples, as well as any others, should be presented in the report.

The sample from boring B-4 was inadvertently homogenized prior to collecting the sample to be analyzed for VOCs. This variation from standard procedures was noted in Section 4.5 (Soil Borings). No other variations from standard procedures were made.

<u>Comment 5</u>: Section 5, Analytical Results. An unsupported assumption that the elevated levels of metals in site surface soils represents site background was made by the RI. Without collection of adequate background samples, this assumption cannot be justified. Soil boring samples did not contain many of the metals found in surface soils (arsenic, copper, nickel, lead, etc.), suggesting that these metals were deposited on site soils as a result of past operations. Furthermore, these metals are similar to those found at the Cole-Zaiser site in Brutus, Cayuga County (data attached). The Brutus site was used by Cole-Zaiser, Inc. to store waste materials prior to shipment to the Amboy site. Background samples collected at the Brutus site demonstrate that many of the metals are site related. While it is possible that the elevated metals represent background levels, no conclusion can be made without collecting background samples. Collection and analysis of two or three background samples would remove much of the speculation regarding background metals levels at the site.

Statements that referenced naturally occurring metals concentrations in the site soils have been revised at the end of Section 5.5 (Surface Soil Analytical Results) and Section 5.6.1 (Soil Borings). However, the existing data do not warrant an additional sampling event to collect background soil samples. A site-specific risk evaluation, if performed for the site, is not likely to result in a significantly elevated hazard from exposure to surface soils contaminate with metals. In the absence of a risk or hazard, no remediation would take placed and, thus, the data would add anything to the characterization of the site for purposes of establishing the appropriate remedial action, if any.

The comparison of surface soil metals concentrations to subsurface soil concentrations is without merit. Surface soils have different characteristics and properties from subsurface soils. Deviations in metals concentrations would be expected as changes occur from one soil horizon to the next.

As for the reference to the Cole-Zaiser site in Brutus, Cayuga County, Woodward-Clyde cannot comment on the comparability of the data without further information and disagrees that the data can be used to draw conclusions at the Cole-Zaiser site in Amboy Township, Oswego County.

Comment 6: Section 5, Analytical Results. No discussions of the possibility of a NAPL near MW-7 is presented. Past site history suggests that a waste oil lagoon was located in this area. The concentration of 1,2-DCE in groundwater has been as high as 20 ppm, which is approximately 3% of the theoretical solubility of 1,2-DCE in water. According to the USEPA publication entitled, "Dense Nonaqueous Phase Liquids - Workshop Summary, USEPA, 1991", groundwater concentrations of 1% or less of the effective solubility can be found even in the immediate proximity of DNAPL. Therefore, detection of such concentrations should be viewed as indirect evidence of DNAPL presence.

Since apparently no work has been done to identify or rule out the presence of NAPL additional work is warranted. Past site history and groundwater data both suggest the presence of NAPL near the bermed/lagoon area. Knowledge of the presence/absence and extent of NAPL is important when evaluating and costing out remedial alternatives.

The scope of work for the test pit portion of the October 1997 RI field activities was completed to address this comment. The activities included excavation of three test pits in the former bermed/lagoon area. Subsurface soil samples were submitted for laboratory analysis based on hydrophobic dye testing and headspace screening. Analytical results are presented in the February 1998 RI Report.

Comment 7: Section 5, Analytical Results. The report notes that one of the deep monitoring wells contained 23 µg/l of benzene, while the shallower well of the pair contained no benzene. No conclusions are drawn from this observation in this section or in the Conclusion and Recommendations Section. It isn't clear in the report what Woodward-Clyde makes of this finding or what they plan to do to confirm it.

Analytical results for a confirmatory sample collected from MW-4A in October 1997 did not indicate the presence of benzene. As such, the 23 µg/l of benzene that was identified in the January 1997 sample is thought to be the result of laboratory error. These results are presented and discussed in Section 5.7.2 (January-February 1997 Sampling Event) and Section 5.7.3 (October 1997 Sampling Event).

<u>Comment 8</u>: Section 6, Human Health Pathway Evaluation. The RI States that no subsurface landfilling of waste oil residues or chlorinated solvents occurred, according to available data. This is not true. The letters attached refer to a possible waste oil lagoon, which was later filled in.

The waste oil lagoon is not considered subsurface landfilling of wastes. The Resource Conservation and Recovery Act of 1976 (RCRA), the law defining means of disposal, would define the lagoon as an impoundment. Once backfilled, it could be called a closed lagoon or impoundment. As agreed during a conference call with NYSDEC on August 13, 1997, the text in Section 6.2 (Potential Contaminant Source Areas) was revised to indicated that waste may have been placed in a lagoon and later backfilled.

<u>Comment 9</u>: Section 6, Human Health Pathway Evaluation. The Lowe well, which is reported to be in bedrock, was measured by Woodward-Clyde to be 76.5 feet deep. A report prepared for the NYSDEC reports the depth of the Lowe well to be approximately 100 feet. Also, the boring program conducted by Woodward-Clyde placed the bedrock at a depth of great than 85 feet. Is the 76.5 foot measured depth accurate? If so, is the Lowe well in bedrock?

The depth of 76.5 feet is an accurate measurement of the existing bottom of the Lowe Well. Drilling observations made at boring B-7D indicate that the Lowe Well was likely installed in the unconsolidated materials located above bedrock. Woodward-Clyde is not aware of any drilling record or well log to confirm the depth of the Lowe Well. Additional information related to these observations has been incorporated into Section 6.3 (Groundwater Occurrence and Use).

<u>Comment 10</u>: Section 6, Human Health Pathway Evaluation, The RI states that if solvent contamination was coming from a single source, then concentrations in the Trumble well should have declined due to natural attenuation. Also, the RI states that the degradation products found in on-site wells do not match those found in the Trumble well. Woodward-Clyde suggests that the Cole-Zaiser site may not be the source of the Trumbles' contaminated well. The NYSDEC does not agree with these statements for the following reasons:

- *If NAPL exists at the Cole-Zaiser site, it would act as a continuing source of contamination for a long period of time. You would then not expect groundwater concentrations to decrease over the relatively short period of time we have been monitoring the Trumble well.*
- *1,2-DCE, which was found in the greatest concentrations on site, may not be degradation product. DCE was manufactured for use as a solvent (The Merck Index, 11th Edition). Cole-Zaiser accepted waste oils from many different industries, including, but not limited to Morse Chain. The different waste streams likely contained different solvents. This is evidenced by the fact that PCE was found in groundwater, which is more highly chlorinated than TCE (Which is most likely the CAH contained in Trichlor).*

- *Even if 1,2-DCE is a degradation product of what was originally disposed of by Cole-Zaiser, finding different degradation products in the Trumble well does not necessarily mean that the Trumbles' contamination didn't come from the Cole-Zaiser site. Although we know the general paths of degradation undertaken by chlorinated solvents in the laboratory, what happens in the field is still not fully understood. Different solvents and their degradation products have vastly different chemical properties. These properties include(but are no limited to) solubility, viscosity, vapor pressure, density, and volatility. Other factors may include how chemicals adsorb to soil.*
- *There are no other industries or apparent sources of contamination in the area. Therefore, while it is possible that there is a source of contamination other than the Cole-Zaiser site, it is unlikely. If it is Woodward-Clyde's position that the contamination is coming from another source, then they should locate that source. Unless another source is identified, and can be directly attributed to the Trumble well contamination, the NYSDEC will consider the source of the Trumbles' well contamination to be the Cole-Zaiser site.*

A sentence has been added to the end of Section 6.3 (Groundwater Contaminant Transport) to indicate that no other potential sources have been identified to date. The October 1997 test pit investigation was also completed to address this comment. It is also important to point out that although 1,2-dichloroethene (1,2-DCE) may have been used as a solvent, the four most common chlorinated solvents listed by Pankow and Cherry (1996) are tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and methylene chloride. Based on the historical site records that they accepted waste oil containing "trichlor", the presence of 1,2-DCE would most likely be a degradation product of TCE.

Comment 11: Woodward-Clyde refers to the groundwater flow direction as "apparent". The RI Data seemed to present a consistent groundwater flow direction, therefore the term "apparent" should not be used.

The term "apparent" has been replaced with "observed" in Section 6.5.1.2 (Groundwater Pathways) of the 1998 RI Report.

Comment 12: Section 6.5.1.1, Soil Pathways. Woodward-Clyde states that there is no evidence of off site contamination. Were any off site samples taken? The basis for this conclusion should be stated in the report.

No off-site samples were collected. The conclusion draw in the report is based on observation of topography, surface water runon/runoff patterns, and site-specific geologic conditions. The text in Section 6.5.1.1 (Soil Pathways) has been revised to reflect the basis of Woodward-Clyde's conclusion.

Comment 13: Section 6.5.2.1, Soil Pathways. It is true that massive soil relocation or disturbance is unlikely in a residential setting, however, people have home gardens and do *landscaping. In the second paragraph the consultant assumes that anyone who lived on the site in the future would live in the current old office building, which is constructed on a slab. It is unrealistic to assume that a future site owner wouldn't dig a basement or build a new structure (but would drill a new well). Section 6.5.2.2 makes the same assumption.*

The site conceptual model developed for the Cole-Zaiser site did not include construction of a new basement or new structure. It is acknowledged that migration of VOCs from subsurface soil or groundwater into the indoor atmosphere may be considered a significant exposure pathway if a basement were to be constructed at the site in the future. It is also acknowledged that home gardens and landscaping could involve excavation and potential exposure to contamination, if present. The text in Sections 6.5.2.1 (Soil Pathways) and 6.5.2.2 (Groundwater Pathways) was revised to address this comment.

Comment 14: Section 6.6.1.1. Essential Human Nutrients are not a part of a Human Health Evaluation. Persons do not assume to get their Recommended Dietary Allowances from incidental ingestion of soil at a hazardous waste site. If these values are used, it must be clear that they are being used to show magnitude of concentrations, rather than "it's OK because they need it anyway".

The text in Section 6.6.1.2 (Essential Human Nutrients) was revised to clarify the Recommended Dietary Allowances are being used to show the magnitude of concentrations identified at the Cole-Zaiser site.

Comment 15: Section 6.6.1.3. Please change the title to Comparison to Eastern U.S. Background Concentrations.

The title of Section 6.6.1.4 has been changed to Comparison of Eastern US Background Concentrations.

Comment 16: Last paragraph, page 6-8. While it may be valid for surface soil concentrations, it is not appropriate to discuss average groundwater plume concentrations in a Human Health Pathway Evaluation since a receptor drinks from one well.

The discussion of average concentrations in groundwater has been removed from the last paragraph in Section 6.6.2.1 (VOC Exceedances).

Comment 17: Last paragraph, page 6-9. Woodward-Clyde notes consistently high levels of aluminum, iron, magnesium, and manganese throughout the site. Why don't the Trumbles' wells have these high levels of metals?.

The consistently high levels of metals that were identified in the on-site monitoring wells are likely to be at least in part due to the turbidity of these samples when compared to the samples collected from the residential wells located on the Trumble property. Readings taken at the time of sample collected indicated that the groundwater exceeded the instrument measuring limit of 999 NTUs in all seven of the shallow on-site monitoring wells. Turbidity measurements in the Trumble wells ranged from 0 to 13 NTUs. The text in Section 6.6.2.3 (Metal Exceedances) was revised to state that the absence of high concentration of these metals in the Trumbles' wells may be attributed to lower turbidity of the groundwater samples collected from these wells.

Comment 18: Last sentence, page 6-10. It is not valid to discuss average plume concentrations of lead. Same comment for second paragraph, page 8-2.

The discussion of average plume concentrations of lead was removed from Section 6.6.2.3 (Metal Exceedances) and Section 8.1 (Conclusions of the Human Health Pathway Evaluation).

Comment 19: Page 8-4. Though migration of VOCs in the groundwater may be small in absolute distance, VOCs have migrated off site onto someone else's property and impacted a drinking water supply. Any discussion of "limited" migration should make the preceding facts clear.

The word "limited" has been removed from the last paragraph of Section 8.3 (Recommended Remedial Action Objectives). However, it is important to point out that the contamination detected in the Trumbles' wells has been the basis for the design and implementation of the RI. The RI has identified a limited source area and a limited plume has been identified with confidence. A focused remedial effort could minimize the potential for further off-site migration.

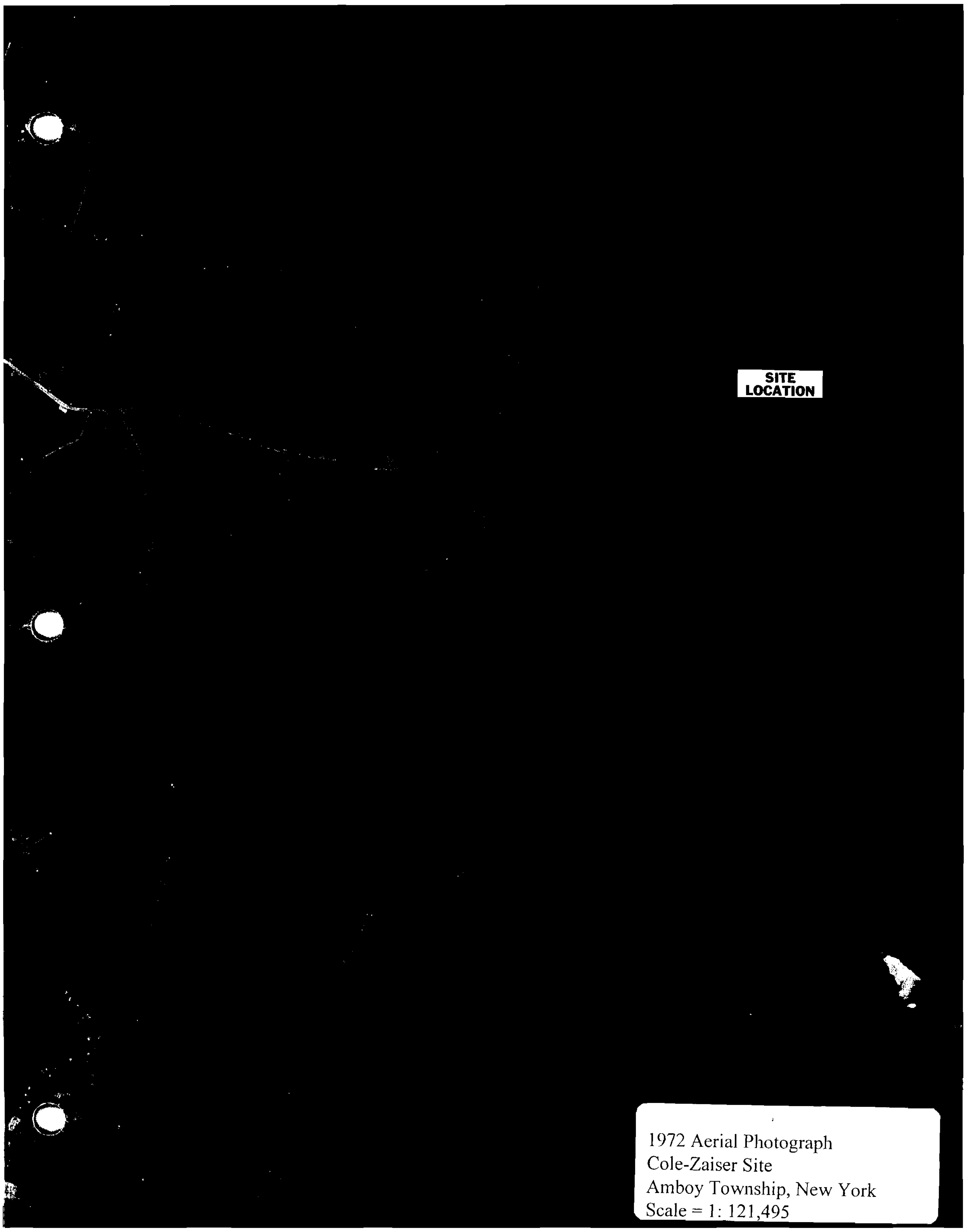
Comment 20: Potential Off site impacts have not been adequately characterized. Based on data from groundwater, surface soils, and soil borings in the southeast area of the site, sampling of the southeast drainage area is warranted. Soil sampling shows metals, including mercury, and consistent detection of low levels of PCBs near the drainage ditch S-6, S-7, S-8, B-4, B-6, and B-8). Soil boring B-6 contained numerous pesticides. Also, MW-7 contained 20 ppm of 1,2-DCE. A sample in the drainage ditch was called for in the August 1995 RI Work Plan on page 6-3, but was not collected. The only sample collected in this area was up slope of the drainage ditch. The purpose of the sample called for in the work plan was to determine whether or not contamination was leaving the ditch. The following actions or questions should be addressed.

- *Sediment and (if applicable) surface water samples should be collected at several locations in the drainage ditch both on-site and downstream where the drainage enter WM-13.*
- *The source of the drainpipe should be determined.*
- *Does groundwater enter the drainage ditch or other ditches in the "hummocky" area?*

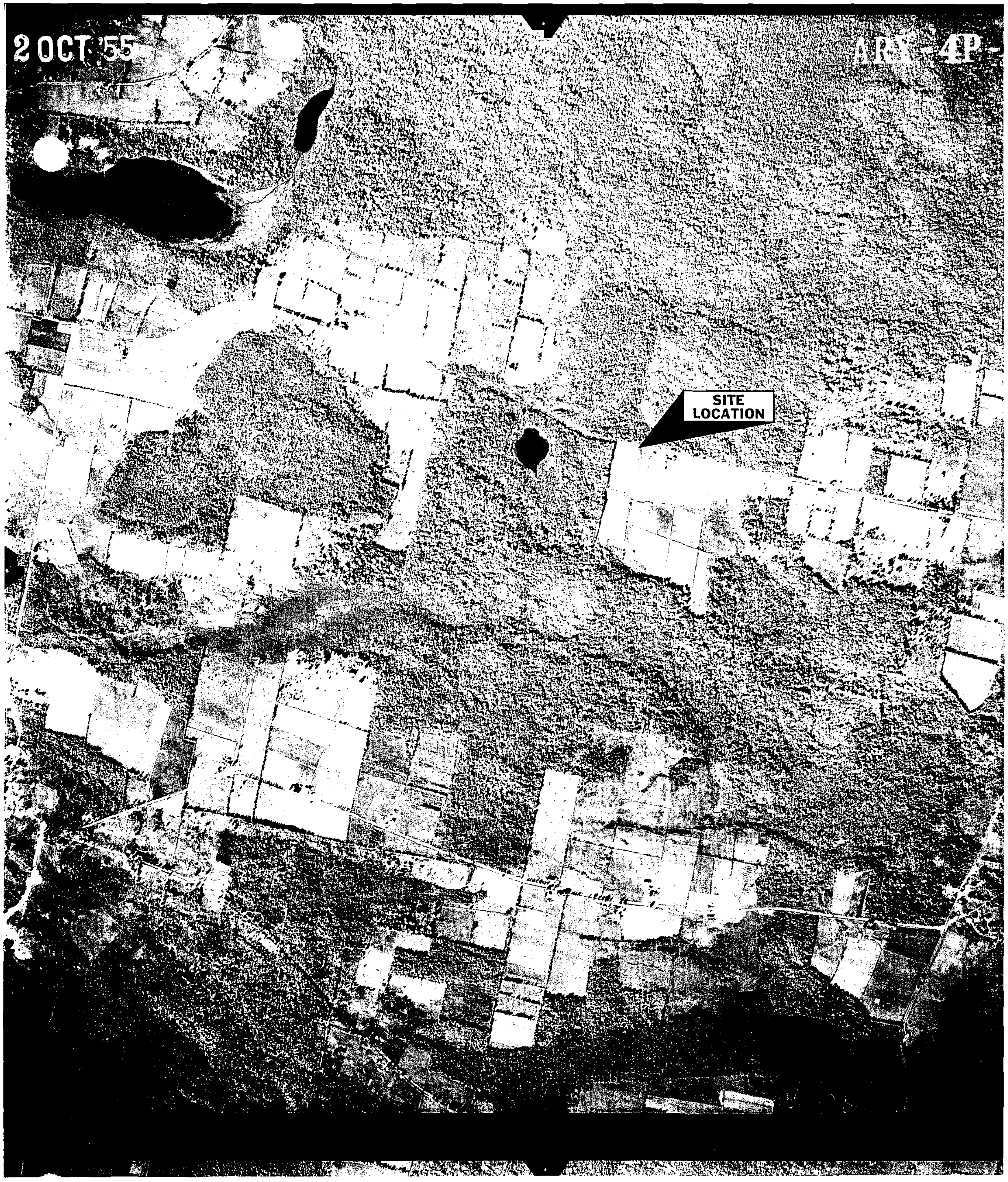
The surface soil sample that was called for on Page 6-3 of the August 1995 RI Work Plan was collected from the location designated as S-7. This sample was collected from the upslope portion of the drainage ditch and approximately 2 feet downstream of where the drainpipe emerges. Analytical results for this sample are similar to those for the surficial soil samples collected in other areas of the site and do not appear to warrant additional sampling in the drainage area.

The recognizable portion of the ditch that leads from the drainage area is about 40 feet long and terminates along the slope in the southeast portion of the site. Historical site records do not identify the source of the drainpipe. Observation of piping encountered during the October 1997 test pit excavation indicates that the drainpipe may be part of a septic system leach field.

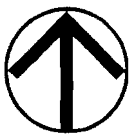
No water was present in the drainage ditch during the RI sampling. The measured depth to groundwater in the drainage area is approximately 5 to 10 feet below ground surface. The groundwater in the southeast portion of the site is not expected to discharge into the drainage ditch or other ditches in the "hummocky" area, which are limited to a depth of about 2 feet.



1972 Aerial Photograph
Cole-Zaiser Site
Amboy Township, New York
Scale = 1: 121,495



1955 Aerial Photograph
Cole-Zaiser Site
Amboy Township, New York
Scale = 1: 20,000



1964 Aerial Photograph
Cole-Zaiser Site
Amboy Township, New York
Scale = 1: 20,000

1995 Aerial Photograph
Cole-Zaiser Site
Amboy Township, New York
Scale = 1: 40,000

VOLUME I

REMEDIAL INVESTIGATION
COLE-ZAISER SITE
AMBOY, NEW YORK
SITE NO. 738013

Prepared for
Borg-Warner Automotive, Inc.
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March 3, 1998

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Borg-Warner Automotive, Inc. (Borg-Warner) executed the Order on Consent prepared by the New York State Department of Environmental Conservation (NYSDEC) for the Cole-Zaiser Inactive Hazardous Waste Site #738013 on May 8, 1995. The order obligates Borg-Warner to perform a Remedial Investigation and Feasibility Study (RI/FS) for the Cole-Zaiser site, located in Amboy Township, Oswego County, New York. The site was operated as a waste oil. reclamation facility from 1973 to 1977. A general location map is provided in **Figure 1-1**.

1.1 RI WORK PLAN

Woodward-Clyde International-Americas, formerly known as Woodward-Clyde Consultants, (Woodward-Clyde), was retained by Borg-Warner to complete the RI for the Cole-Zaiser site. In February 1996, Woodward-Clyde submitted the final RI Work Plan for the site. The February 1996 Work Plan was revised and finalized based on a NYSDEC comment letter dated November 8, 1995. Additionally, the February 1996 submittal included replacement pages of minor revisions made to the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP). The replacement pages represent addenda to the previous (October 1995) versions of the FSP and QAPjP. No revisions were required for the October 1995 Health and Safety Plan (HASP). The Citizen Participation Plan, which is also required by the Order on Consent, was finalized and submitted in July 1996.

The majority of the field work described in the February 1996 Work Plan was performed in June and July 1996. Based on the findings of this portion of the RI, a Work Plan Addendum (Addendum No. 1) was prepared by Woodward-Clyde for Borg-Warner to address the potential for vertical migration of chemicals in the site groundwater. The scope of the addendum was discussed with Mr. Jeff Edwards of NYSDEC and submitted with a letter dated January 7, 1997. Verbal approval of the addendum was provided by Mr. Edwards. The additional field work was completed in February 1997.

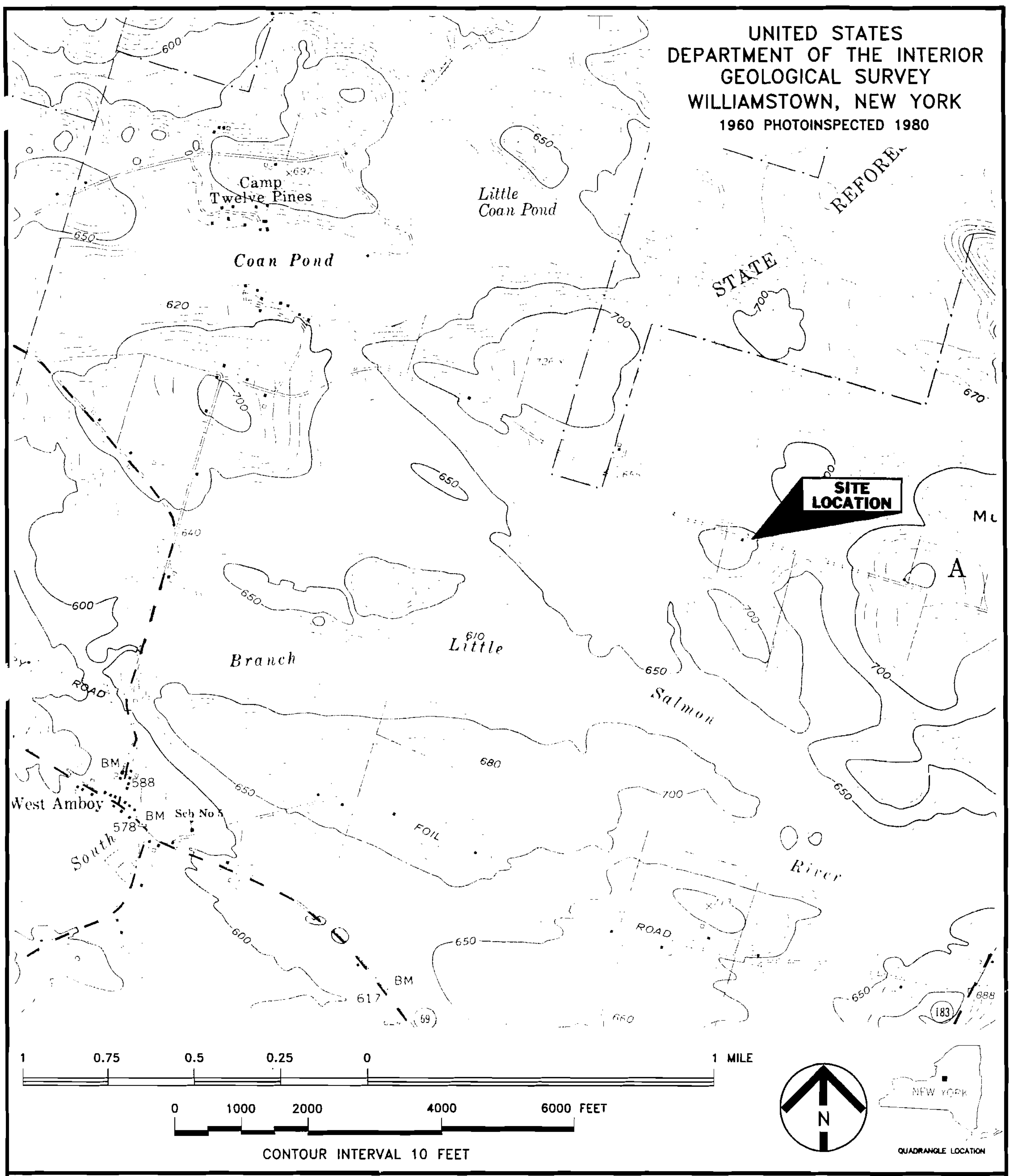
Based on comments provided by the NYSDEC in a letter dated July 15, 1997 and discussed during a teleconference on August 13, 1997, a second Work Plan Addendum (Addendum No. 2) was prepared to include additional groundwater sampling and test pit exploration near a potential on-site source area. Addendum No. 2 was submitted to the NYSDEC with a letter dated September 30, 1997. Minor work scope clarifications and approval of Addendum No. 2 were provided by the NYSDEC in a letter dated October 27, 1997. The additional field work was completed on October 27, 28, and 29, 1997.

1.2 RI OBJECTIVES

The objectives of this investigation we~~a~~re to obtain and provide data relative to: (1) the presence of hazardous constituents, if any, at the site; ~~and~~ (2) the nature and extent of such constituents in groundwater; and (3) the source of such constituents. In general, the RI involved a focused investigation of the occurrence of chemicals in the soil and groundwater underlying the site in order to support the development of appropriate remedial alternatives, if necessary. The scope of the RI was developed to ensure that sufficient data could be obtained to support a qualitative assessment of human health risks, which consider potential receptors and contaminant transport pathways, and to assess the potential for the site to impact fish and wildlife.

1.3 ORGANIZATION OF THE REPORT

This report summarizes the RI activities that were performed in accordance with the approved RI Work Plan and the January and September 1997 Addenda~~um~~. It is intended to provide a description of site history and chemical usage and to present the results and conclusions of the RI. The text portion of this RI report is divided into nine sections. Section 1.0 is the introduction. Information regarding the site background and physical setting is presented in Section 2.0. Section 3.0 presents the results of the data collection activities completed prior to the RI. A discussion of the RI field activities and observations is presented in Section 4.0. Section 5.0 provides a summary of the laboratory analytical results obtained during the RI. Section 6.0 discusses contaminant sources and migration, potential human receptors, and exposure pathways. A summary of the potential site impacts to fish and wildlife is provided in Section 7.0. Conclusions and recommendations for future activities are presented in Section 8.0. Lastly, Section 9.0 provides a complete listing of the references cited in this report.



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GENERAL LOCATION MAP
COLE-ZAISER SITE - AMBOY, NEW YORK

DRAWN BY: LMP	CHECKED BY: MJM	PROJECT NUMBER: 5E15509	DATE: 4-24-97	FIGURE NO: 1-1

Woodward-Clyde Consultants

The Cole-Zaiser site consists of approximately 2½ acres of developed land on Little Pond Road, Amboy Township, Oswego County, New York. A 1974 Oswego County Tax Map indicates that the site is situated on a parcel of rural land with a total area of 16.62 acres. The site was purchased from Barbara Comstock in 1971 by Charles Cole and Gene Zaiser. They operated a waste oil reclamation facility on the site from 1973 to 1976. Mr. Cole then sold the facility to Bill Uhl, who operated it until early 1977. After a period of overdue payments, ownership reverted to Mrs. Comstock, who sold the property to Charles and Dorothy Lowe.
Mr. and Mrs. Lowe used the former facility office as their summer residence, but have not occupied the property in the past few years ~~for a time and then moved~~. They still retain ownership of the property.

Woodward-Clyde personnel visited the site on June 15 and August 2, 1995. Charles Cole, former owner, summarized the previous operations and potential contaminant source areas during the second visit. He described changes in topography and site conditions since his ownership of the site. Descriptions of the site conditions and historical operations that were provided by Mr. Cole are provided in this section. Information gathered from historical aerial photos, available site records, ~~and~~ published references, and historical letters provided by the NYSDEC is also presented.

2.1 CURRENT AND FORMER SITE FEATURES

Current and former site features are shown in **Figure 2-1**. The northern site boundary is marked by Little Pond Road. Residential property (the Trumble residence) and woods are located north of this road. An unplanted field to the south is separated from the site by a line of small trees. An overgrown field with hummocky ground lies to the southeast. Grass fields are located to the west and east.

2.1.1 Site Buildings - Cole-Zaiser Operations

A large concrete block building (main building), which is located near the western site boundary, originally housed the offices and some facility processes for Cole-Zaiser. According to Mr. Cole, a pole building on a concrete slab was attached to the east side of the main building. The pole building reportedly contained three 10,000-gallon tanks and a boiler. Two small concrete buildings, which are joined on one side, are located approximately 100 feet east of the main building. Mr. Cole stated that the two ~~smaller attached~~ concrete buildings ~~located east of the main building~~ were used as a garage and storage shed. ~~In addition, a pole building on a concrete slab was formerly attached to the east side of the main building. The pole building~~

~~reportedly contained three 10,000-gallon tanks and a boiler.~~ Historical site operations involving the tanks and boiler are discussed in **Section 2.2**.

2.1.2 Site Buildings - Post-Operations Modifications

The main building and two joined concrete buildings are still present at the Cole-Zaiser site. The pole ~~pole~~ building, tanks, and boiler have been removed.

2.1.3 Surface Conditions - Cole-Zaiser Operations

~~Observations made during the Woodward-Clyde site visits indicate that earthen fill has been banked on the north, east, and west side of the main building, obscuring the concrete pad on which the pole building was located. Earthen fill has also been banked on the west side of the garage. A bank of soil, approximately 6 to 7 feet high, was constructed east of the garage area, possibly to screen a number of junked cars from the road.~~

A circular, grass-covered ~~gravel~~ driveway is currently located between the main building and the garage/shed buildings. According to Mr. Cole, an arc-shaped, earthen berm approximately two feet high was constructed southeast and downgradient of the driveway. The berm was reportedly constructed to contain potential spills from the oil reclamation operations. ~~This bermed area is referred to as a lagoon in previous reports.~~

While Mr. Cole did not identify a lagoon in the former bermed area, various historical records indicated part or all of the former bermed area may have been considered a lagoon. Specifically, Mr. Larry Gross, Senior Sanitary Engineer for the NYSDEC's Division of Solid Waste, referred to the former bermed area as a lagoon in a letter dated April 7, 1976 and stated that it should be reinforced and extended to prevent spillage or leakage. Mr. Daniel Halton, a private citizen, indicated, in a letter dated June 13, 1980, the presence of a 20-foot by 15-foot pond filled with oily liquid. On April 8, 1986, Mr. Evan Walsh of Oswego County Health Services visited the site and spoke to Charles and Dorothy Lowe. The Lowes' showed Mr. Walsh the approximate location of a former pond. This visit was documented in a memorandum dated April 15, 1986.

2.1.4 Surface Features - Post-Operations Modifications

The existing surface conditions at the site reflect changes that have occurred since Cole-Zaiser ceased operations. Observations made during the Woodward-Clyde site visits indicate that earthen fill has been banked on the north, east, and west side of the main building, obscuring the concrete pad on which the pole building was located. Earthen fill has also been banked on the west side of the garage. A bank of soil, approximately 6 to 7 feet high, was constructed east of the garage area, possibly to screen a number of junked cars from the road. Mr. Cole stated that earthen fill banked around the main building and east of the garage was not present during facility operations. -

The small arc-shaped containment berm present during Cole-Zaiser operations has been removed. The area now contains the leach field for the on-site septic system. A ditch, which may be connected to the leach field by underground piping, runs downhill for approximately 30 to 40 feet near the southern boundary of the site. According to Mr. Cole, this ditch was not present during his site operations. The area south of the former containment berm is hummocky and crossed by a number of short ditches with depths up to 2 feet. The site is generally overgrown with high grass, weeds, and wildflowers. Small trees have grown up along the southern property line and within the area defined by the circular driveway as well as in other isolated patches.

2.1.5 Aerial Photos

Woodward-Clyde conducted a historical aerial photograph search during the preparation of the RI Work Plan. An aerial photo taken in June 1972 shows that the main building and the garage/shed buildings existed at that time. A dark spot on the aerial photo to the southeast of the future bermed area may indicate the existence of a small shallow pond or depression at the time of the photo. This location, which does not correspond to the bermed area reported by Mr. Cole, is characterized by uneven terrain with a number of ditches crisscrossing it. An aerial photo from April 1981 has poor resolution and does not show any large scale features not already identified.

2.2 HISTORICAL OPERATIONS

Cole-Zaiser possessed a NYSDEC Septic Cleaner and Industrial Waste Collector Certificate of Registration from August 1973 to March 1977. Industrial waste oil was collected from a number of industrial clients including Morse Chain Company (owned by Borg-Warner Corporation), Xerox Corporation, Morton Salt Company, American Brass, Ithaca Gun Company, Rollway Bearing, and Crucible Steel. In addition to industrial waste oil, the site reportedly received transmission oil, hydraulic oil, quench oil, soluble oil, and oil containing "trichlor".

The reclamation of waste oil entailed a filtration and dehydration process. Solids were allowed to settle out, and the waste oil was then processed by thermal dehydration. The waste oil was processed in three 10,000-gallon tanks and heated by circulating hot oil through coils inside the tanks. The heat transfer oil was heated by the boiler located in the former pole building along with the three tanks. As a result of the heating process, water, water-soluble oil, and chlorinated solvents ("trichlor") would settle at the bottom of the tanks. These waste materials were temporarily stored in tanks prior to handling off-site by another company. The hydrocarbon oil that was recovered from the process was filtered in the main building. The filters consisted of metal strainers, Teflon® bag filters, and magnets to remove ferrous metals. The hydrocarbon oil was then sold as a heating fuel supplement.

2.3 HISTORICAL SPILLS

Several spills have been documented at the site. NYSDEC cited Cole-Zaiser for violating Section 270301 of the Environmental Conservation Law in April 1976 after noting that liquid wastes had been released to the soil. Cole-Zaiser pled guilty in 1977 and was fined.

According to Mr. Cole, one of the historical spills was associated with a 5,000-gallon tank truck that was used to store waste liquids generated from the reclamation process. This tank truck was located at or near the flat area formerly identified as a lagoon. It reportedly developed a leak that resulted in an oil slick running downgradient to the south and southeast. The slick extended approximately 300 feet toward the eastern property line. Mr. Cole attempted to clean up the residue manually and in the process started a started a fire downgradient of the site. The fire was extinguished by the local fire department and did not reach the operating area. An earthen berm was then constructed to contain potential future releases. The leaking tank truck was replaced with a 3,000-gallon skid mounted tank located north of the earthen berm. Mr. Cole reported one small release from this tank when a valve was left slightly open. This material was captured by the earthen berm and cleaned up.

In addition to the above-referenced spill, a small release reportedly occurred when a Canadian firm was demonstrating a new vacuum truck parked in the unloading area next to the former pole building. The waste liquids were released toward the southern property line behind the tank area and may have contained oil, grease, paint wastes, and solvents. Available information also indicates that surficial soil in the vicinity of the former unloading area became stained as a result of miscellaneous oil releases during Cole-Zaiser operations. Mr. Cole stated that some tank cleanout wastes (e.g., sludges) were disposed on the ground in this area.

Finally, Mr. Cole has stated that the new operator, Mr. Uhl, experienced a fire or explosion in early 1977 that involved the heat transfer boiler located in the former pole building. Records do not indicate whether heat transfer oil was released during the incident. Following this event, waste oil reclamation activities at the site ceased, and the site was added to the New York State Registry of Inactive Hazardous Waste Disposal sites in 1983 with the classification of 2a.

2.4 PHYSICAL SETTING

The following subsections discuss the physical characteristics of the Cole-Zaiser site. The information was obtained from pre-RI reports and published references. It includes data on climate, local topography and drainage, geology, and hydrogeology.

2.4.1 Regional Climate

The climate in eastern Oswego County consists of extremely cold winters and warm, humid summers (Pack, 1981). The area near the site receives approximately 18 inches of precipitation during May through September. Annual precipitation averages about 50 inches. The mean annual air temperature is 43 degrees Fahrenheit (° F). Temperatures of 90° F or higher occur on 5 to 10 days per year during the summer, whereas temperatures of 0° F or lower occur on approximately 12 days during the winter. Average seasonal snowfall is 150 to 200 inches. Snow cover persists from December through February, and monthly snowfalls of 25 inches or more are common. A total accumulation of 70 inches or more over two months is not unusual. The frost-free season in the vicinity of the site is about 160 days, with the last freeze in spring usually occurring in early to mid-May and the first~~last~~ freeze in autumn usually occurring in the first week of October. Persistent cloudiness in late autumn and winter is typical throughout Oswego County, while summers tend to be very sunny.

2.4.2 Topography and Drainage

The Cole-Zaiser site lies at the Southwestern edge of the Tug Hill Plateau within the eastern portion of the Erie-Ontario Plain physiographic province. The general topography of the area within two miles of the site consists of scattered low hills and ridges (mainly glacial drumlins as discussed below) interspersed with broad valleys that trend toward those of either the South Branch Little Salmon River or the North Branch Little Salmon River (north of Little Pond Road). Regional topographic conditions are included in the General Location Map provided as **Figure 1-1**. The site-specific topography, which was drawn based on June 1996 survey data, is shown in **Figure 2-2**.

The western end of the site is near the crest of a small knoll at an elevation of approximately 710 to 713 feet above mean sea level (msl) from which the surface slopes rather smoothly (averaging about 5 percent) to an elevation of approximately 690 feet msl at the eastern end. Surface runoff flows to the east-southeast and collects in either the ditch along Little Pond Road or the swale in the southeast corner of the property before leaving the site. Both runoff conveyances ultimately drain in the broad valley and then into the South Branch Little Salmon River about 2,800 feet southeast of Little Pond Road.

2.4.3 Regional Geology

Based upon published reports of regional geology (e.g., Ellis, 1981), the bedrock located beneath the site is comprised of nearly flat-lying, undifferentiated sedimentary rocks of the Queenston Formation and Medina Group. The Queenston Formation is composed of red shale and siltstone of Upper Ordovician age. The overlying Medina Group consist of Lower Silurian age red sandstone and shale. The rock types in the Queenston Formation and Medina Group are indicative of tidal flat and deltaic depositional environments of the Queenston delta and represent erosion of the Taconic highlands to the east. Bedrock in Oswego County dips to the southwest at approximately 50 feet per mile. The depth to bedrock is highly variable and reportedly ranges from 10 to 88 feet, with an average depth of approximately 43 feet.

The bedrock in the vicinity of the site is overlain by unconsolidated glacial deposits from the Pleistocene Epoch. These glacial deposits consist of lodgment and ablation tills and are characterized by poorly-sorted, variably-textured sediments that contain variable proportions of sand, silt, and gravel, with some clay and boulders. The 20 to 150-foot high drumlins that dominate the topography are predominately formed by lodgment till. The main axis of the drumlins is aligned with the direction of glacier flow: south-southeastward. The lower portion of the drumlins are typically covered with lake sediments or wetlands.

According to the Soil Survey Map for Oswego County (Rapparlie, 1981), the surficial soil at the site belongs to the Worth Series. This series is characterized by deep, well-drained, moderately coarse textured soils that have fragipan[1]. These soils were formed in glacial till derived from acidic sandstone and tend to be gently sloping to steep. They are found in convex areas of till plains at the higher elevations in Oswego County. The two specific soils on the site are very similar gravelly fine sandy loams, differentiated by slopes (i.e., gently-sloping in the northwestern corner and moderately-sloping farther to the east-southeast). These soils are considered to have a low erosion potential (Rapparlie, 1981), which is confirmed by field observations. Neither of the drainage conveyances on the site is noticeably incised. Both are vegetated swales with no evidence of past or current erosion.

2.4.4 Hydrogeology

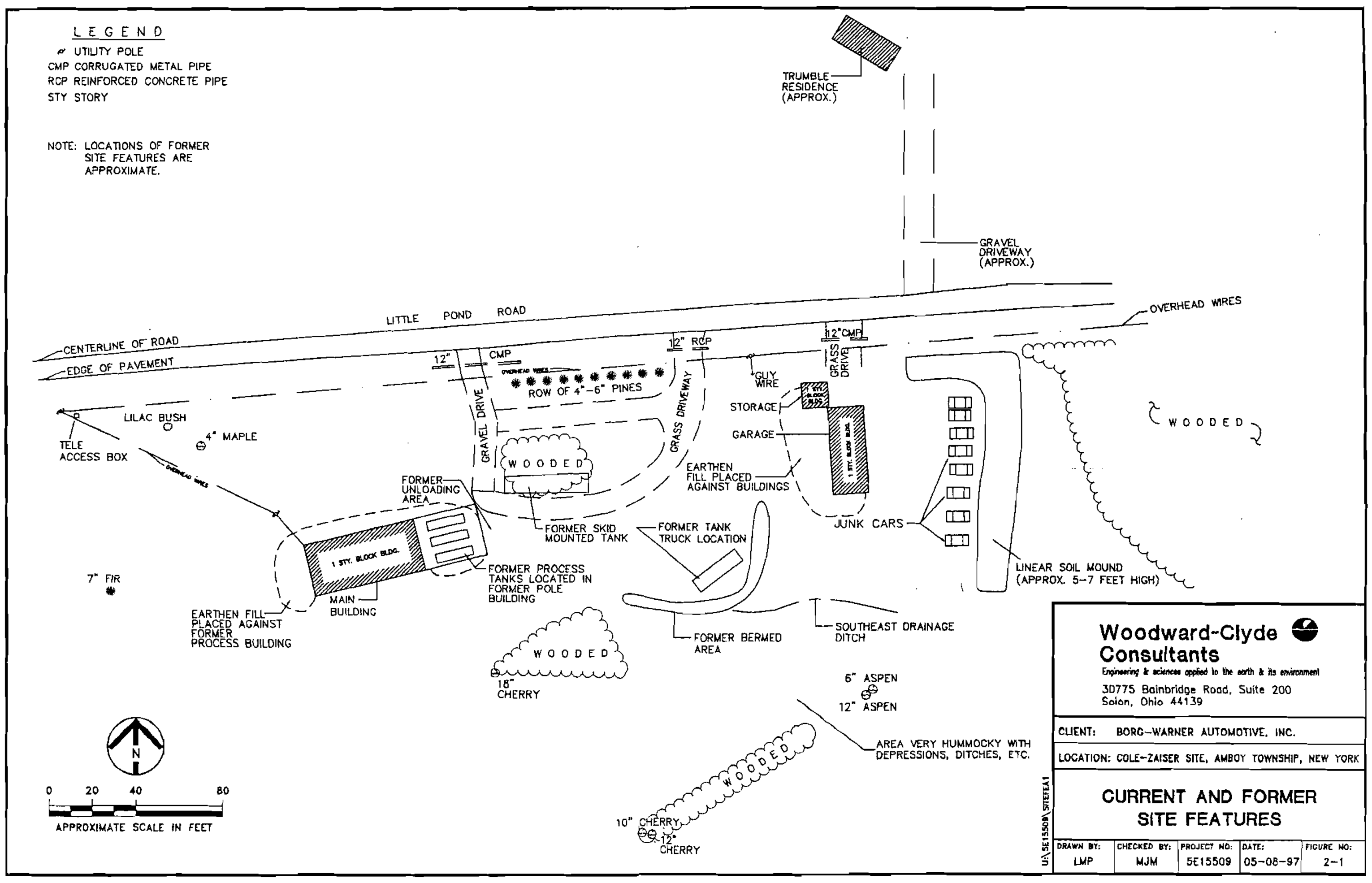
Groundwater occurs in both the glacial deposits and bedrock in Oswego County. Well yields from unconsolidated glacial deposits are highly variable. Yields in till units typically range from 0.25 to 1 gallon per minute (gpm). However, in areas with well-washed fluvial deposits, the well

---

[1] A loamy, brittle subsurface horizon low in porosity and organic-matter content, and low or moderate in clay but high in silt or very fine sand (Rapparlie, 1981).

yields may be up to 1,500 gpm. The water table in unconsolidated till deposits typically parallels the land surface at depths between 5 and 20 feet. Groundwater flow direction in the glacial deposits is dependent on local topography.

Regional bedrock groundwater flow has been reported to be toward the north. Groundwater flow through the bedrock is expected to be primarily through fractures, which are most numerous at shallow bedrock depths. Therefore, bedrock flow probably follows the bedrock surface. Bedrock yields in Oswego County range from 1 to 125 gpm with an average of approximately 10 gpm. Additional information regarding the hydrogeologic conditions in the vicinity of the site was obtained during the RI and is discussed in **Section 4.0**.



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Solon, Ohio 44139

CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

CURRENT AND FORMER SITE FEATURES

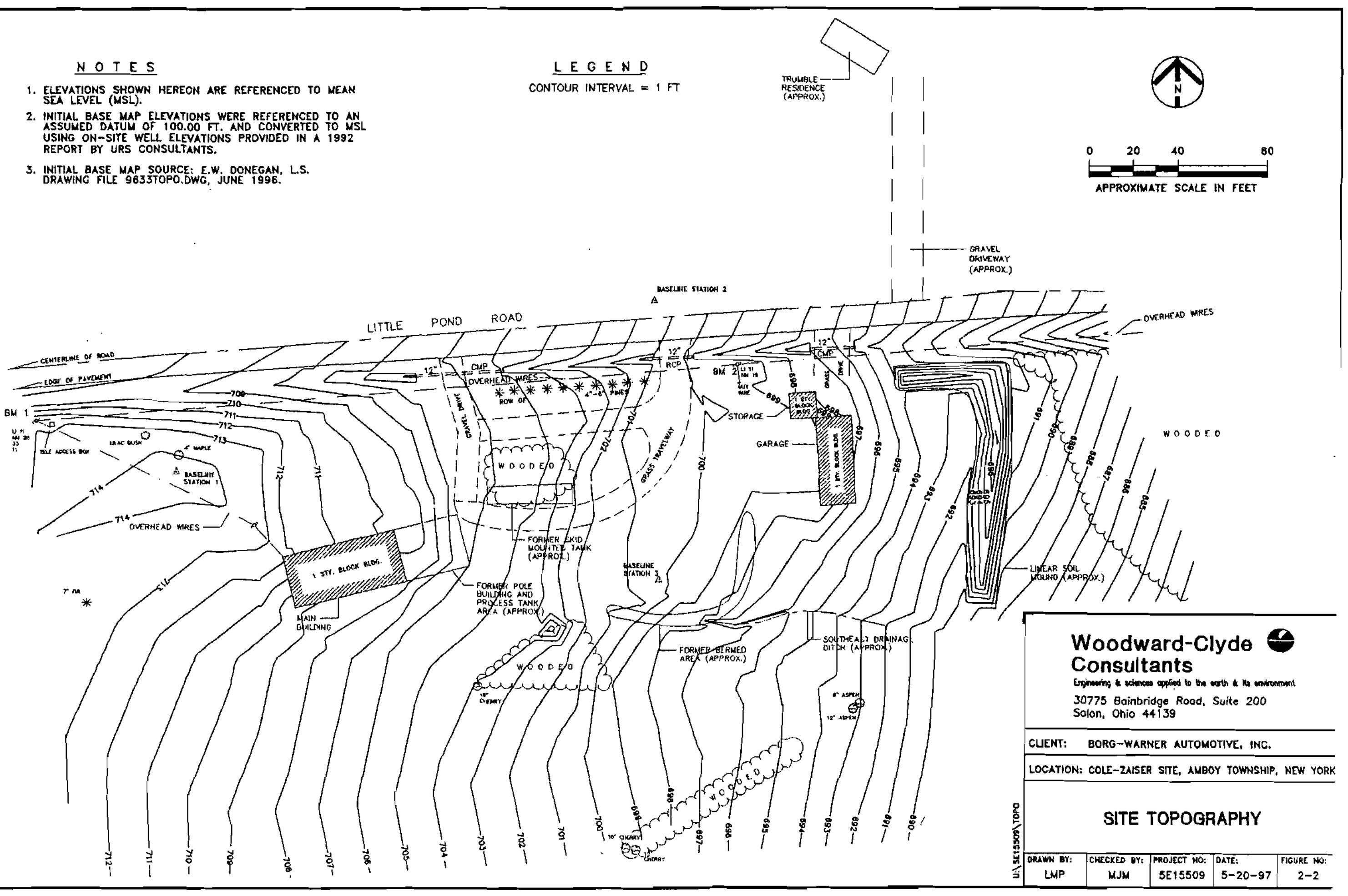
DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	05-08-97	2-1

NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERENCED TO MEAN SEA LEVEL (MSL).
2. INITIAL BASE MAP ELEVATIONS WERE REFERENCED TO AN ASSUMED DATUM OF 100.00 FT. AND CONVERTED TO MSL USING ON-SITE WELL ELEVATIONS PROVIDED IN A 1992 REPORT BY URS CONSULTANTS.
3. INITIAL BASE MAP SOURCE: E.W. DONEGAN, L.S. DRAWING FILE 9633TOPO.DWG, JUNE 1996.

LEGEND

CONTOUR INTERVAL = 1 FT



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LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SITE TOPOGRAPHY

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	2-2

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Site investigations that have been completed prior to the RI include a USEPA Potential Hazardous Waste Site Preliminary Assessment performed in January 1987 by NUS Corporation, and a NYSDEC Phase I Investigation was performed by URS Consultants (URS) in August 1987. No environmental sampling was conducted for either of these two studies. Additional assessment activities related to the Cole-Zaiser site that have included collection and analysis of environmental samples consist of:

- Limited soil and groundwater sampling by NYSDEC during 1987.
- Sample collection from the Lowes' on-site residential drinking water well by the Oswego County Health Department in 1987 and 1990.
- Soil and groundwater sampling as part of a Phase II investigation conducted by URS in 1991 and 1992.
- Sample collection from the Lowe and Trumble residential drinking water wells by the New York State Department of Health in 1992~~0~~.
- Additional sampling of the Trumble residential drinking water well by the ~~New York State Department of Health~~ NYSDEC following installation of a granular activated carbon system in 1993.

Sampling locations that were included in the above-referenced investigations are shown in **Figure 3-1**. The results are discussed in the following subsections.

3.1 NYSDEC SAMPLING

In September 1987, a surficial soil sample was collected by NYSDEC from the area east of the main building and analyzed for Target Compound List (TCL) volatiles and semivolatiles and Target Analyte List (TAL) metals. Two volatile organic compounds (VOCs), trichloroethene (TCE) and tetrachloroethene (PCE), were detected at concentrations of 4.6 and 11.7 µg/kg, respectively. One semivolatile organic compound (SVOC), di-n-butylphthalate, was detected at a concentration of 869 µg/kg.

A groundwater sample was also collected by NYSDEC from a former shallow dug well located in the southern portion of the circular area bounded by the driveway. It is unknown whether the well was purged prior to sampling. The sample was analyzed for TCL volatiles and semivolatiles and TAL metals. Detected VOCs and corresponding concentrations were:

- trans-1,2-Dichloroethene (trans-1,2-DCE) at 50 µg/l
- TCE at 11 µg/l
- PCE at 8.9 µg/l
- 1,1-Dichloroethane (1,1-DCA) at 3.8 µg/l
- Toluene at 1.5 µg/l

In addition to the VOCs, ten metals were detected in the NYSDEC groundwater sample. The concentrations of five of the ten metals were above NYSDEC Groundwater Quality Standards. The five metals and their concentrations are:

- Aluminum at 2,800 µg/l
- Barium at 4,660 µg/l
- Iron at 5,560 µg/l
- Lead at 26 µg/l
- Manganese at 6,270 µg/l

3.2 OSWEGO COUNTY HEALTH DEPARTMENT SAMPLING

The Oswego County Health Department sampled the Lowes' on-site residential well in May 1987 and November 1990 for aromatic and halogenated VOCs, polychlorinated biphenyls (PCBs), and general water quality parameters. The only compound detected during the 1987 sampling event was TCE at 2 µg/l. No compounds were detected during the 1990 sampling event.

3.3 URS PHASE II SAMPLING

Three overburden groundwater monitoring wells were installed and one soil boring was drilled during URS's 1991 and 1992 Phase II Investigation. Locations of the Phase II monitoring wells (MW-1, MW-2, and MW-3) and soil boring (EB-1) are shown in **Figure 3-1**.

3.3.1 Subsurface Soil Samples

Subsurface soil samples that were collected from each of the monitoring well locations and from soil boring EB-1 were analyzed for TCL parameters. Five VOCs were detected in a subsurface soil sample from MW-3. They consist of:

- 1,1 Dichloroethene (1,1-DCE) at 94 µg/kg
- Vinyl Chloride at 70 µg/kg
- 1,1,1-Trichloroethane (1,1,1-TCA) at 4 µg/kg
- 1,1-DCA at 3 µg/kg
- Toluene at 2 µg/kg

The sample from MW-3 was collected below the groundwater table at a depth of 10 to 12 feet. The only other VOC detected was methylene chloride at 5 µg/l from soil boring EB-1. This sample was collected from a depth of 7½ to 9½ feet, which was above the water table.

One SVOC, 2-methylnaphthalene, was detected at 39 µg/kg in the subsurface soil sample from MW-2. This sample was collected from a depth of 5 to 7 feet and chosen due to fuel odor from the sample. One pesticide, endrin, was also detected at 7.8 µg/kg in the soil sample collected from MW-2. PCB Aroclor-1254 was detected at 27 µg/kg in the subsurface soil sample collected from soil boring MW-1A. This location was not used for well installation and is approximately 30 feet west of existing monitoring well MW-1.

3.3.2 Groundwater Samples

In March 1992, URS Consultants collected groundwater samples from the three installed monitoring wells and analyzed them for TCL and TAL parameters. Six VOCs were detected in groundwater from MW-3. The VOCs and their concentrations are listed below:

- 1,2-Dichloroethene (1,2-DCE) at 3800 µg/l
- Vinyl Chloride at 400 µg/l
- Acetone at 350 µg/l
- 1,1-DCA at 120 µg/l
- 1,1,1-TCA at 110 µg/l
- Toluene at 64 µg/l

Toluene was also detected in the laboratory method blank sample.

PCB Aroclor-1254 and pesticide compound, alpha-BHC, were detected in groundwater from monitoring well MW-1 at 0.53 µg/l and 0.0059 µg/l, respectively. Metals analysis showed concentrations that exceeded NYSDEC guidance values in MW-2 (55.6 µg/l) and MW-3 (54.9 µg/l) for antimony and in MW-3 (10,100 µg/l) for manganese.

3.4 ~~NEW YORK STATE DEPARTMENT OF HEALTH~~ ADDITIONAL RESIDENTIAL WELL SAMPLING

The New York State Department of Health sampled groundwater from the Lowe and Trumble residential drinking water wells in August 1992~~0~~ after completion of the Phase II sampling. A 1992 Phase II Investigation Report prepared by URS Consultants incorrectly stated that the sampling was performed in 1990. Site-related VOCs were not detected in groundwater from the Lowes' well. Groundwater from the Trumble well contained the following VOCs:

- 1,1,1-TCA at 23 µg/l
- cis-1,2-DCE at 2 µg/l
- PCE at 4 µg/l
- TCE at 50 µg/l

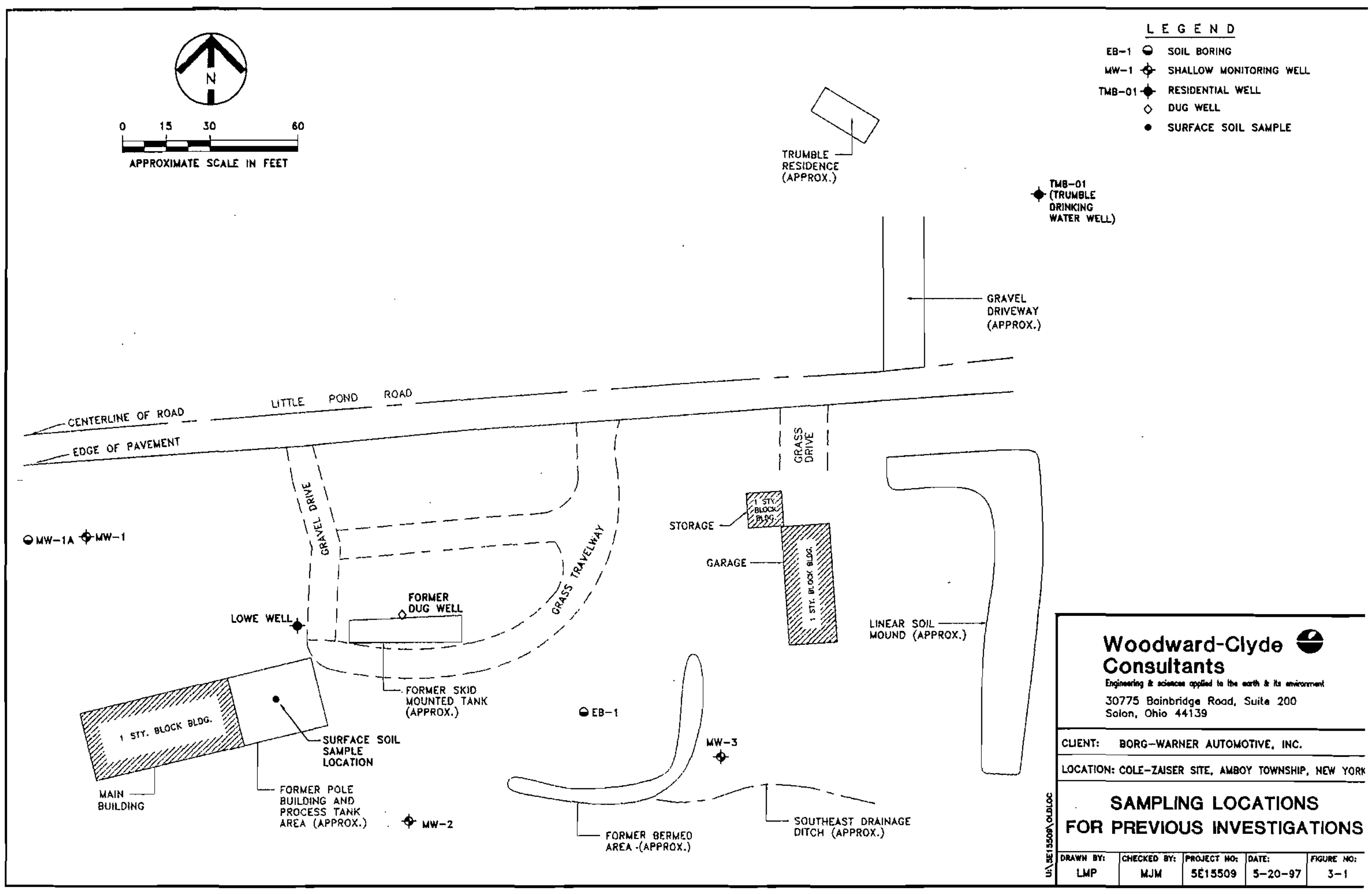
The NYSDEC~~New York State Department of Health~~ supplied bottled water to the Trumble residence from October 1992 to July 1994. A granular activated carbon system was installed on October 25, 1993. Samples from before and after the carbon treatment have been collected by the ~~New York State Department of Health~~ NYSDEC starting on October 28, 1993 and analyzed for VOCs . Results that have been obtained through October 8, 1996 are summarized in **Table 3-1**.

Results of the NYSDEC~~NYSDOH~~ sampling indicate that the post-treatment groundwater samples from the Trumble well did not contain any chemical compounds during any of the sampling events. Results for the pre-treatment samples indicate that six VOCs were detected during the first sampling event on October 28, 1993. During the second event (April 1994), four VOCs were detected in untreated water. During the five remaining sampling events, only three VOCs (1,1,1-TCA, PCE, and TCE) have been detected in the untreated water. Over time, the concentrations of 1,1,1-TCA and PCE appear to have decreased and leveled out at 6 µg/l and 1 µg/l, respectively. The concentration of TCE has ranged from 26 to 48 µg/l with no apparent trend.

TABLE 3-1
NYSDOH ANALYTICAL RESULTS FOR TRUMBLES' DRINKING WELL
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Date	Sample Type	Chemical Compound (µg/l)					
		1,1,1-TCA	1,1-DCA	1,1-DCE	Trans-1,2-DCE	PCE	TCE
10/28/93	R	22	1.1	1.6	2.1	6.6	48
	I	0.24	ND	ND	ND	ND	0.41
	F	ND	ND	ND	ND	ND	ND
4/94	R	12	ND	2.0	ND	0.7	38
	F	ND	ND	ND	ND	ND	ND
11/94	R	11	ND	ND	ND	3	29
	I	ND	ND	ND	ND	ND	ND
	F	ND	ND	ND	ND	ND	ND
5/4/95	R	8	ND	ND	ND	1.0	35
	I	ND	ND	ND	ND	ND	ND
	F	ND	ND	ND	ND	ND	ND
9/28/95	R	7	ND	ND	ND	1.0	30
	I	ND	ND	ND	ND	ND	ND
	F	ND	ND	ND	ND	ND	ND
6/6/96	R	6	ND	ND	ND	1.0	26
	I	ND	ND	ND	ND	ND	ND
	F	ND	ND	ND	ND	ND	ND
10/8/96	R	6	ND	ND	ND	1.0	33
	I	ND	ND	ND	ND	ND	ND
	F	ND	ND	ND	ND	ND	ND

NOTES:
NYSDOH = New York State Department of Health
R = Raw Water (before carbon filters)
I = Intermediate Water (between carbon filters)
F = Finished Water (after carbon filters)
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethene
Trans-1,2-DCE = Trans-1,2-dichlorethene
PCE = Tetrachloroethene
TCE = Trichloroethene
ND = Non-detected
Started delivery of Mountain Valley bottled water on 10/18/92.
Granular activated carbon system installed on 10/25/93.
Stopped delivery of bottled water on 7/15/94.



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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SAMPLING LOCATIONS FOR PREVIOUS INVESTIGATIONS

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	3-1

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Existing pre-RI data suggest that the major environmental concerns at the site are contaminated groundwater and potentially contaminated surficial and subsurface soils. These media were identified in the RI Work Plan as the primary focus of the RI. The RI scope of work also included a geophysical investigation to evaluate the possibility of former on-site landfilling.

The field activities required to complete the RI scope of work were conducted in four~~three~~ phases. The first phase included a geophysical survey and site walk through, Geoprobe® soil gas and groundwater sampling with on-site mobile laboratory analysis, and surface soil sampling. The resulting mobile laboratory and geophysical data were evaluated and used to select locations for the soil borings and monitoring wells installed during the second phase of field work. The third phase of work involved the installation, development, and sampling of additional monitoring wells to define the vertical extent of chemicals in groundwater. Two rounds of groundwater sampling were conducted using new and existing on-site and off-site wells. The fourth phase of the RI involved excavation of test pits to identify a potential source area. Sampling of selected on-site monitoring wells was also performed to further evaluate existing groundwater conditions. All samples were labeled according to the identification codes shown in **Table 4-1**.

The scope of the RI field activities and observations are discussed in the following subsections. Work was performed in general accordance with the RI Work Plan unless otherwise noted in this report.

4.1 GEOPHYSICAL INVESTIGATION

A geophysical investigation involving a magnetic detection survey was conducted at NYSDEC's request to evaluate the potential presence of buried metallic objects (e.g., drums). The survey was performed on June 19 and 20, 1996 using an EM-61 electromagnetic metal detector. The EM-61 is a time-domain metal detector which is designed to locate shallow ferrous and non-ferrous metallic features at depths of 10 feet or less. The detector induces eddy currents into nearby metallic objects by a pulsating magnetic field and measures the decay of these currents. The decay is directly proportional to the conductivity of subsurface metallic objects.

Prior to performing the geophysical survey, Woodward-Clyde set up a 20-foot grid over the entire site in order to identify the locations where the readings would be obtained and also to locate any surface features that could influence these measurements. **Figure 4-1** illustrates the layout of this grid, along with surface features that may have influenced the geophysical measurements, such as surface debris and the on-site buildings. Two key types of surface features were identified and consisted of:

- Metallic objects, consisting of abandoned cars and car parts, discarded household items, and groundwater monitoring well casings.
- Hummocky soils, consisting of small scale (1 to 2 foot) swales and soil piles in the southeast portion of the site. The origin of these hummocky soils are not known. No visible surface metal was observed in these locations.

Figure 4-2 depicts the EM-61 geophysical survey measurements. Several portions of the site exhibited elevated geophysical readings. The majority of the elevated readings are attributable to surface metallic debris and on-site buildings. However, three relatively small areas with anomalously high readings were detected in the southern portion of the site, as depicted on **Figure 4-2** (Anomalous Area Nos. 1, 2 and 3). The origin of these anomalous readings is not certain, since no readily visible metallic debris was observed near these areas. Subsequent RI sampling in the vicinity of anomalous areas did not indicate the presence of subsurface metallic debris. Thus, the anomalous readings are likely related to different soil types associated with the small scale swales and soil piles in these areas.

4.2 GEOPROBE® SOIL GAS SAMPLING

Geoprobe® soil gas samples were collected from 33 locations in the vicinity of suspected source areas (e.g., the former process area, the former berm area, and the former skid tank area) and outside the garage and storage buildings. The sampling was completed by Zebra Environmental of Inwood, New York (Zebra) with field oversight by Woodward-Clyde. The 33 soil gas sampling locations are presented on **Figure 4-3**.

Geoprobe® soil gas sampling involved hydraulically advancing a soil gas sampling probe to a point just above the water table. The sampling probe was then connected to an air sampling pump with Tygon® tubing. The pump was used to extract gases from the soil and into a Tedlar® bag. The sample (approximately 5 ml) was withdrawn from the Tedlar® bag using a syringe.

The soil gas samples were analyzed by Commonwealth Analytical of Westfield, Massachusetts (Commonwealth) using an on-site mobile laboratory. As specified in the RI Workplan, the analyses were performed by gas chromatography (GC) for the following VOCs:

- 1,1-DCA
- 1,1-DCE
- 1,1,1-TCA
- acetone
- benzene
- cis-1,2-DCE

- ethylbenzene
- PCE
- toluene
- total xylenes
- trans-1,2-DCE
- TCE
- vinyl chloride

The analytical results obtained for the soil gas samples were used as screening level data to determine the approximate extent of contamination, identify potential source areas, and provide guidance for the placement of soil borings and groundwater monitoring wells. Analytical results are discussed in **Section 5.1**.

4.3 GEOPROBE® GROUNDWATER SAMPLING

Geoprobe® groundwater samples were collected by Zebra Environmental at nine locations. The selected locations were in the immediate vicinity of locations with elevated soil gas concentrations or downgradient of suspected source areas. The Geoprobe® groundwater sampling locations are included in **Figure 4-3**.

The Geoprobe® groundwater sampling procedures involved hydraulically advancing a sampling probe through the soil to the water table. The probe was then driven an additional 12 to 24 inches and retracted. The groundwater sample was immediately transferred into two 40 ml vials. Each vial was inspected to ensure the absence of air bubbles. The samples were analyzed by GC using Commonwealth's on-site mobile laboratory for the parameters listed in **Section 4.2**. The Geoprobe® groundwater results were used in conjunction with soil gas analytical results to evaluate the approximate extent of contamination and provide guidance for the placement of confirmatory soil borings and groundwater monitoring wells. Analytical results are discussed in **Section 5.2**.

4.4 SURFACE SOIL SAMPLING

Surface soil samples were collected from a depth of 0 to 6 inches at the locations shown in **Figure 4-4**. The sampling locations were established to include:

- the former bermed area
- the former pole building and process tank area
- the linear mound east of the garage and storage building
- the skid mounted tank area
- the earthen fill from the north, east, and west side of the main building
- the southeast drainage area

As specified in the RI Work Plan, one surface soil~~the~~ sample (S-7) ~~from the southeast drainage area~~ was collected from the upslope portion of the southeast drainage area and approximately 2 feet downstream of where the drainpipe emerges into this area. ~~that leads to the southeast drainage ditch. One surface soil sample (S-7) was collected from this area.~~ Sampling in the remaining areas involved collection of several grab samples, which were screened in the field (by headspace) using an organic vapor analyzer (OVA). The OVA readings ranged from non-detect to 1.4 parts per million by volume (ppmv). The grab sample from each area that exhibited the highest OVA reading was submitted for laboratory analysis. The field screening procedure resulted in selection of seven additional surface soil samples (S-1, S-2, S-3, S-4, S-5, S-6, and S-8) for laboratory analysis.

All of the surface soil samples were collected using pre-cleaned, stainless steel, hand augers. The samples to be submitted for laboratory analysis were placed into stainless steel bowls. A portion of the sample to be analyzed for VOCs was then transferred directly into a laboratory-supplied container. The remaining soil in the bowl was then homogenized using a stainless steel spoon and placed into the laboratory-supplied containers for the remaining target compound list (TCL) and target analyte list (TAL) parameters.

The selected samples were placed in coolers, preserved with ice, and shipped off-site to Nytest Environmental, Inc. of Port Washington, New York (Nytest) for laboratory analysis. Analytical results are discussed in **Section 5.3**.

4.5 SOIL BORINGS

Eleven soil borings (B-1 through B-10 and B-7D) were advanced by Lahti Drilling Company of Kinsman, Ohio (Lahti) and Parratt-Wolff, Inc. of East Syracuse, New York (Parratt-Wolff) to depths ranging from 8 to 85 feet in potential areas of concern located at the site. Detailed boring logs are provided in **Appendix A**. The boring locations are presented in **Figure 4-5** and consist of the following:

- One boring (B-1) near pre-existing monitoring well MW-1
- One boring (B-2) near the former process area
- Three borings (B-3, B-4, and B-5) in potential areas of concern identified by the Geoprobe® soil gas and groundwater sampling
- One boring (B-6) downgradient from pre-existing monitoring well MW-3
- Two borings (B-7 and B-7D) between the potential on-site source areas and the Trumble residential drinking water well
- One boring (B-8) near the former bermed area

- Two borings (B-9 and B-10) south of the main building

The soil borings were advanced with either 4 ¼-inch or 6 ¼-inch inside diameter (ID) hollow stem augers. Split spoon samples were collected from designated intervals in accordance with the standard penetration test method (ASTM-D-1586-84). Soil samples were described and classified in general accordance with the Unified Soil Classification System (USCS) and field screened for headspace readings.

Selected soil samples from borings B-1 through B-9 were submitted for off-site laboratory analysis by Nytest. The remaining two borings B-10 and B-7D were advanced to investigate the depth to bedrock. Initially, boring B-10 was drilled for this purpose. The drilling activities at boring B-10 resulted in auger refusal at a depth of 31 feet. However, the observations made during subsequent drilling at boring B-7D identified soil to a depth of at least 85 feet. These observations indicate that the auger refusal at boring B-10 was likely due to the presence of a boulder in the unconsolidated glacial deposits that underlie the site. The termination depth of boring B-7D was due to the inability to further advance the augers. However, bedrock was not encountered and is expected to be located at a depth greater than 85 feet across the site.

The samples submitted for laboratory analysis were obtained from above the water table at depths ranging from 2 to 12 feet. At boring B-1, the samples were submitted from predetermined depth intervals of 1 to 3, 3 to 5, 5 to 7, and 11 to 13 feet. These samples were analyzed for PCBs and pesticides, since previous sampling indicated the presence of low levels of PCBs in a soil sample from nearby location MW-1A.

The selected samples from borings B-2 through B-9 were analyzed for TCL and TAL parameters. At each of these boring locations, one sample that was submitted from the sampling interval located immediately above the water table. A second sample was also analyzed from borings B-2 through B-8, based on elevated headspace readings in the shallower sampling intervals.

As a general procedure, the samples submitted from borings B-2 through B-9 included an unhomogenized aliquot, since mixing can cause volatilization, that was immediately transferred from the split spoon sampler into a laboratory-supplied container to be submitted for VOC analysis. The remaining portion of the sample was then placed into a stainless steel bowl and homogenized using a stainless steel spoon. The homogenized sample was transferred into laboratory-supplied containers and submitted to be analyzed for the remaining TCL and TAL parameters. The only deviation from these procedures involved the sample from B-4 which was inadvertently homogenized prior to collecting the portion to be analyzed for VOCs. Analytical results are presented in **Section 5.4**.

Soil cuttings that were generated during drilling were placed on a layer of plastic sheeting until the boring was complete. After the boring was completed, the cuttings were replaced in the boring in the order in which they were removed, unless the boring was converted to a monitoring well. In addition, boring B-7D was backfilled with a cement-bentonite grout due to the identified concentrations of VOCs in shallow groundwater at the adjacent monitoring well MW-6: The upper foot of each boring was filled with material that was consistent with the surrounding area.

4.6 SURVEYING

The nine new monitoring well locations were surveyed by E.W. Donegan Land Surveying of Mattydale, New York (Donegan). The ground surface elevations and top of PVC casing elevations were surveyed in reference to a benchmark with an assumed elevation of 100.00 feet. All survey elevations were measured to the nearest 0.01 ft. Woodward-Clyde later converted these elevations to mean sea level (msl) based on the known msl-elevations of MW-1, MW-2, and MW-3.

4.7 GROUNDWATER INVESTIGATIONS

Three shallow monitoring wells (MW-1, MW-2, and MW-3), the Lowes' former bedrock residential well, and the three residential wells on the Trumbles' property were in place prior to the start of the RI. Four additional shallow monitoring wells (MW-4, MW-5, MW-6, and MW-7) were installed during the Phase II portion of the RI in June 1996. The locations of these wells are presented in **Figure 4-5**. The additional (Phase III) field activities performed in December 1996 involved the installation of one intermediate (MW-7A) and four deep (MW-2A, MW-4A, MW-6A, and MW-7B) monitoring wells. Depths of the pre-existing and RI monitoring and residential wells are as follows:

Shallow Monitoring Wells
- MW-1 total depth of 24.8 feet
- MW-2 total depth of 23.0 feet
- MW-3 total depth of 18.8 feet
- MW-4 total depth of 17.6 feet
- MW-5 total depth of 17.5 feet
- MW-6 total depth of 17.5 feet
- MW-7 total depth of 16.2 feet

Intermediate/Deep Monitoring Wells
- MW-2A total depth of 54.8 feet
- MW-4A total depth of 49.1 feet
- MW-6A total depth of 55.5 feet
- MW-7A total depth of 27.9 feet
- MW-7B total depth of 55.1 feet

Residential Wells
- Lowe Well total depth of 76.5 feet
- Trumble Wells 1, 2, and 3 total depths of 12.7, 10.8, and 14.2 feet

Discussions of the well installation, development and sampling, and the groundwater elevation measurements and flow patterns are presented in the following subsections.

4.7.1 Monitoring Well Installation

Borings that were converted into monitoring wells during the RI were advanced using either 4 ¼-inch or 6 ¼-inch ID hollow stem augers. Following completion of drilling, a 2-inch ID Schedule 40 PVC riser with a 0.010-inch slotted PVC screen was installed through the augers at the bottom of the borehole. The screened intervals in the shallow wells were selected based on water level observations made during drilling and are designed to screen the water table while allowing for seasonal variations. The screens in the intermediate and deep wells were installed to evaluate the vertical distribution of chemical concentrations that were identified in the shallow wells.

Construction of the RI wells included installation of a sand pack in the annular space surrounding the screened section that extends from the bottom of the borehole to approximately two feet above the screened interval. A 1 to 2-foot thick bentonite pellet seal was placed on top of the sand pack. The annular space was then grouted to the surface, and a 4-inch diameter locking steel protective casing was installed to prevent tampering. A 2-inch diameter expansion cap was provided for each well. Monitoring well casings were surveyed for elevation and location.

4.7.2 Well Development

The pre-existing and newly installed on-site monitoring wells were developed to remove fines from the sand pack and minimize turbidity in groundwater samples. In general, the well development involved using clean, stainless steel bailers to remove at least five well volumes from each well. However, deep monitoring wells MW-4A and MW-7B were purged dry and recovered slowly prior to removing five well volumes. Development of these two wells was limited to three well volumes in MW-4A and one and one-half well volumes in MW-7A.

The well development activities included collection of field measurements for temperature, pH, conductivity, and turbidity. The measurements taken near development completion generally indicated stable temperature, pH, and conductivity readings. However, turbidity levels below the target of 50 NTUs could not be achieved. In fact, the turbidity measurements typically remained above the instrument measuring limit of 999 NTUs even after removal of more than 10 well volumes.

Each well was allowed to stabilize for at least 2 weeks prior to sampling. (Due to the turbid nature of the groundwater, the wells were left undisturbed for at least one hour following purging and prior to sampling to allow for potential settlement of suspended material.) The purging and sampling activities are discussed further in **Section 4.7.4**.

4.7.3 Groundwater Elevations and Flow Patterns

Following completion of well development in July 1996, the groundwater elevations were measured in the shallow monitoring wells (MW-1 through MW-7), the Lowe well, and the three Trumble residential wells. A second round of groundwater elevation measurements was collected in December 1996 and included the shallow monitoring wells and the five intermediate/deep monitoring wells (MW-2A, -4A, -6A, -7A, and -7B) that were installed at the site. A third round of groundwater elevations measurements was obtained in conjunction with the January 1997 sampling event. A fourth and fifth round of measurements was collected in May 1997 and October 1997, respectively. The January,~~ and~~ May, and October 1997 measurements included all of the on-site monitoring wells, the Lowe well, and the three Trumble residential wells.

Groundwater elevation measurements that were obtained during July 1996, December 1996, January 1997,~~ and~~ May 1997, and October 1997 are summarized in **Table 4-2**. Potentiometric surface maps that were created using groundwater levels collected from shallow monitoring wells are provided in **Figures 4-6 through 4-10**~~, 4-7, 4-8, and 4-9~~. Potentiometric surface maps based on the January,~~ and~~ May, and October 1997 water levels collected from the deep monitoring wells are presented in **Figures 4-11~~0~~ and 4-13~~1~~**.

Observation of the potentiometric surface maps indicates that the groundwater flow direction using data from both the shallow and deep wells is consistently toward the east-northeast. The calculated hydraulic gradient for the shallow well data is estimated at 0.04 feet per foot. The estimated hydraulic gradient for groundwater flow using the deep well data is 0.05 feet per foot.

4.7.4 Groundwater Purging and Sampling

Based on the total well depth and depth to water measurements, well volumes were calculated. Three to five wells volumes were then purged from each well, except for the Trumbles' drinking water well (TMB-01), using either a submersible pump, a centrifugal pump, or stainless steel or disposal high-density polyethylene (HDPE) bottom-loading bailers. During purging, pH, conductivity, temperature and turbidity were monitored following removal of each well volume. If a well could not yield three well volumes, it was purged until dry and allowed to recover for a period of less than 24 hours prior to sampling. Trumble Well TMB-01 was purged by opening the tap for approximately 5 minutes.

Groundwater sampling was performed in general accordance with the protocols identified in A Compendium of Superfund Field Operations Methods (USEPA, 1987) and the RCRA Groundwater Monitoring Draft Technical Guidance (USEPA, 1992b) . Samples were collected using stainless steel or disposable HDPE bottom-loading bailers and transferred into laboratory sample containers. Trumble well TMB-01 was sampled at a location prior to the activated carbon filter. Field indicator parameters (pH, conductivity, temperature and turbidity) were measured at the time of sampling. Sample containers were placed in coolers and preserved with ice prior to shipment off-site to Nytest.

The first round of groundwater samples were collected in July 1996 and were analyzed for TCL and TAL parameters. Based on a review of the July 1996 data, samples from the second round of groundwater sampling completed in January-February 1997 were analyzed for VOCs only. The analyte list for the second round of sampling was verbally agreed to prior to sampling by Mr. Jeff Edwards of the NYSDEC. The NYSDEC was formally notified of the analytical parameters for the second round of sampling in ~~the Work Plan~~ Addendum No. 1 to the RI Work Plan, submitted in January 1997. Addendum No. 2 to the RI Work Plan included a third round of sampling for selected shallow monitoring wells and one deep monitoring well (MW-4A). Analytical parameters for the third round of sampling included VOCs and selected additional parameters to be used in the evaluation of potential remedial alternatives as part of the Feasibility Study (FS) for the site.

4.8 TEST PIT EXCAVATIONS

Three test pits were excavated in the former bermed/lagoon area to address concerns raised by NYSDEC regarding the characterization of subsurface soil conditions and the potential presence of non-aqueous phase liquid (NAPL). The test pits were excavated by Parratt-Wolff and sampled by Woodward-Clyde personnel. All excavation activities were also observed by Mr. David Camp of the NYSDEC.

The test pits were spaced approximately 20 feet apart from one another and were divided into sections that ranged from approximately 10 to 15 feet in length. Excavation depths ranged from 5 to 9 feet. Initially, four test pits were proposed. However, only the three test pits were excavated due to the elevated organic vapor concentrations that were identified in the breathing zone during excavation of TP-3A. The work scope modification was verbally agreed to in the field by Mr. David Camp of the NYSDEC. The test pit locations are shown in **Figure 4-14**. Detailed test pit logs are provided in **Appendix A**.

Discrete soil samples were collected at depths ranging from 3 to 9 feet from each of the 10 to 15-foot-long test pit sections. Twelve samples were selected for laboratory analysis based on field observations. The sample selection was primarily based on the results of hydrophobic dye testing, which was done to facilitate visual identification of the potential presence of NAPL. Hydrophobic dye testing involved the addition of red Sudan IV dye to an aliquot of soil that was placed into a container and saturated with water. The dye was purchased in crystalline form and is insoluble in water, but soluble in most organic liquids. After placing dye into a sample container, the sample was covered, shaken, and examined. If NAPL is present, the sample is expected to turn red. Field screening also included collection headspace readings using a photoionization detector (PID). The field screening and analytical results are presented in **Section 5.6.2**.

Excavated soil from the test pits was placed onto plastic sheeting and returned to each test pit immediately after completing the excavation. No test pit was permitted to remain open overnight.

4.9 DECONTAMINATION PROCEDURES

Decontamination of equipment was performed in accordance with Section 7.0 of the October 1995 FSP. Procedures generally included using dedicated sampling equipment to the extent feasible to reduce the need for field decontamination. All non-dedicated equipment was thoroughly decontaminated prior to each use with a low-phosphate detergent wash and a distilled water rinse. To avoid cross-contamination, disposable gloves were worn by the sampling team and changed between sampling points. Heavy equipment was decontaminated prior to leaving the site.~~Waste generated during the RI was containerized in 55-gallon drums and temporarily stored on-site. The wastes consisted of soil cuttings, Geoprobe® liners, and water generated during well development, purging, and sampling and equipment decontamination. The investigation-derived waste will be characterized and consolidated for off-site disposal.~~

4.10 WASTE HANDLING

Waste generated during well development , purging, and sampling and equipment decontamination ~~the RI~~ was placed ~~containerized~~ in 55-gallon drums and temporarily stored on-site. Soil cuttings and Geoprobe® liners were placed in an on-site roll-off container. Plastic sheeting used during test pit excavation and soil samples that were subjected to hydrophobic dye testing or that were containerized and not submitted for laboratory analysis were placed in a 55-gallon drum. ~~The wastes consisted of soil cuttings, Geoprobe® liners, and water generated during well development, purging, and sampling and equipment decontamination.~~ The investigation-derived waste has been sampled and characterized for off-site disposal~~will be characterized and consolidated for disposal~~. Arrangements for off-site disposal are in progress.

4.11 QA/QC SAMPLING

Quality assurance/quality control (QA/QC) procedures were followed to assure that quality data were collected throughout the RI. The QA/QC procedures included the collection and analysis of field duplicates and decontamination/rinsate blanks. The samples submitted to Nytest also included matrix spikes, matrix spike duplicates (organics), and duplicates (metals). Trip blanks were included in each cooler with samples to be analyzed for VOCs. Chain-of-custody forms that accompanies each sample shipment are presented in **Appendix B**. The QA/QC samples were collected and analyzed in accordance with the frequencies summarized below:

- Field duplicates - one per 20 investigative samples
- Decontamination/rinsate blanks - one per 20 investigative samples
- Matrix spikes, matrix spike duplicates, duplicates - one per 20 investigative samples
- Trip blanks - one per cooler containing VOCs

QA/QC samples were not included in the test pit soil investigation due to the early termination of field work caused by elevated organic vapor concentrations in the breathing zone.

TABLE 4-1
SAMPLE IDENTIFICATION CODES
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

DIGIT 1
SAMPLE MATRIX

Code	Matrix
B	Soil Boring
S	Surface Soil
T	Test Pit Soil
G	Soil Gas
P	Geoprobe Groundwater
M	Monitoring Well
R	Residential Well
D	Decon Water
W	Purge Water
C	Rinse Water/Lab Water
I	Solid Waste

DIGITS 2 AND 3
SAMPLE LOCATION

DIGIT 4
SAMPLE TYPE

Code	Type
E	Environmental Sample
R	Field Replicate
B	Decon/Rinse Blank
T	Trip Blank
M	MS
U	MSD

DIGITS 5 AND 6
DEPTH OF TOP OF SAMPLE

Code	Depth
00	Surface Soil or Groundwater
01	1-3 feet
02	2-4 feet
03	3-5 feet, etc.

Example Sample Numbers:

G27E06	Environmental soil gas sample from location 27, from depth 6-8 feet.
M2AE00	Environmental monitoring well groundwater sample from location 2A. Depth is not applicable.

TABLE 4-2
SUMMARY OF GROUNDWATER ELEVATION MEASUREMENTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

WELL NO.	GROUND SURFACE ELEV.	ELEV. AT TOP OF RISER	TOTAL WELL DEPTH	ELEV. AT BOTTOM OF WELL	7/25/96		12/20/96	
					DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.
MW-1	712.0	714.35	24.8	687.20	18.90	695.45	19.04	695.31
MW-2	704.8	706.72	23.0	683.72	11.70	695.02	11.59	695.13
MW-2A	705.0	706.92	54.8	652.12	---	---	13.45	693.47
MW-3	697.6	698.77	18.8	679.97	8.16	690.61	7.24	691.53
MW-4	692.5	694.45	17.6	676.85	7.22	687.23	5.74	688.71
MW-4A	692.6	694.67	49.1	645.57	---	---	7.74	686.93
MW-5	692.6	694.66	17.5	677.16	10.30	684.36	9.32	685.34
MW-6	700.7	702.56	17.5	685.06	11.45	691.11	10.42	692.14
MW-6A	700.4	702.75	55.5	647.25	---	---	13.12	689.63
MW-7	701.6	703.76	16.2	687.56	10.80	692.96	10.15	693.61
MW-7A	701.8	703.73	27.9	675.83	---	---	10.05	693.68
MW-7B	701.0	703.45	55.1	648.35	---	---	15.00	688.45
TMB-1	682.0	685.46	12.7	672.77	3.65	681.81	NM	NM
TMB-2	690.5	691.08	10.8	680.26	3.75	687.33	NM	NM
TMB-3	689.8	691.10	14.2	676.90	4.35	686.75	NM	NM
LOWE	707.8	708.41	76.5	631.87	---	---	NM	NM

NOTES:

1. Elevations referenced to mean sea level (msl).
2. Total well depths referenced to ground surface.
3. "---" indicates well not installed at time of measurement.
4. "NM" indicates water level not measured.

TABLE 4-2
SUMMARY OF GROUNDWATER ELEVATION MEASUREMENTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

WELL NO.	GROUND SURFACE ELEV.	ELEV. AT TOP OF RISER	TOTAL WELL DEPTH	ELEV. AT BOTTOM OF WELL	1/22/97		5/30/97	
					DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.
MW-1	712.0	714.35	24.8	687.20	18.00	696.35	17.72	696.63
MW-2	704.8	706.72	23.0	683.72	10.80	695.92	10.51	696.21
MW-2A	705.0	706.92	54.8	652.12	13.20	693.72	12.90	694.02
MW-3	697.6	698.77	18.8	679.97	7.15	691.62	7.10	691.67
MW-4	692.5	694.45	17.6	676.85	5.95	688.50	6.31	688.14
MW-4A	692.6	694.67	49.1	645.57	6.80	687.87	6.80	687.87
MW-5	692.6	694.66	17.5	677.16	9.70	684.96	9.98	684.68
MW-6	700.7	702.56	17.5	685.06	10.42	692.14	10.22	692.34
MW-6A	700.4	702.75	55.5	647.25	13.68	689.07	12.91	689.84
MW-7	701.6	703.76	16.2	687.56	9.77	693.99	9.63	694.13
MW-7A	701.8	703.73	27.9	675.83	9.70	694.03	9.62	694.11
MW-7B	701.0	703.45	55.1	648.35	12.18	691.27	11.60	691.85
TMB-1	682.0	685.46	12.7	672.77	3.60	681.86	3.68	681.78
TMB-2	690.5	691.08	10.8	680.26	2.20	688.88	3.72	687.36
TMB-3	689.8	691.10	14.2	676.90	2.90	688.20	4.18	686.92
LOWE	707.8	708.41	76.5	631.87	15.70	692.71	15.60	692.81

NOTES:

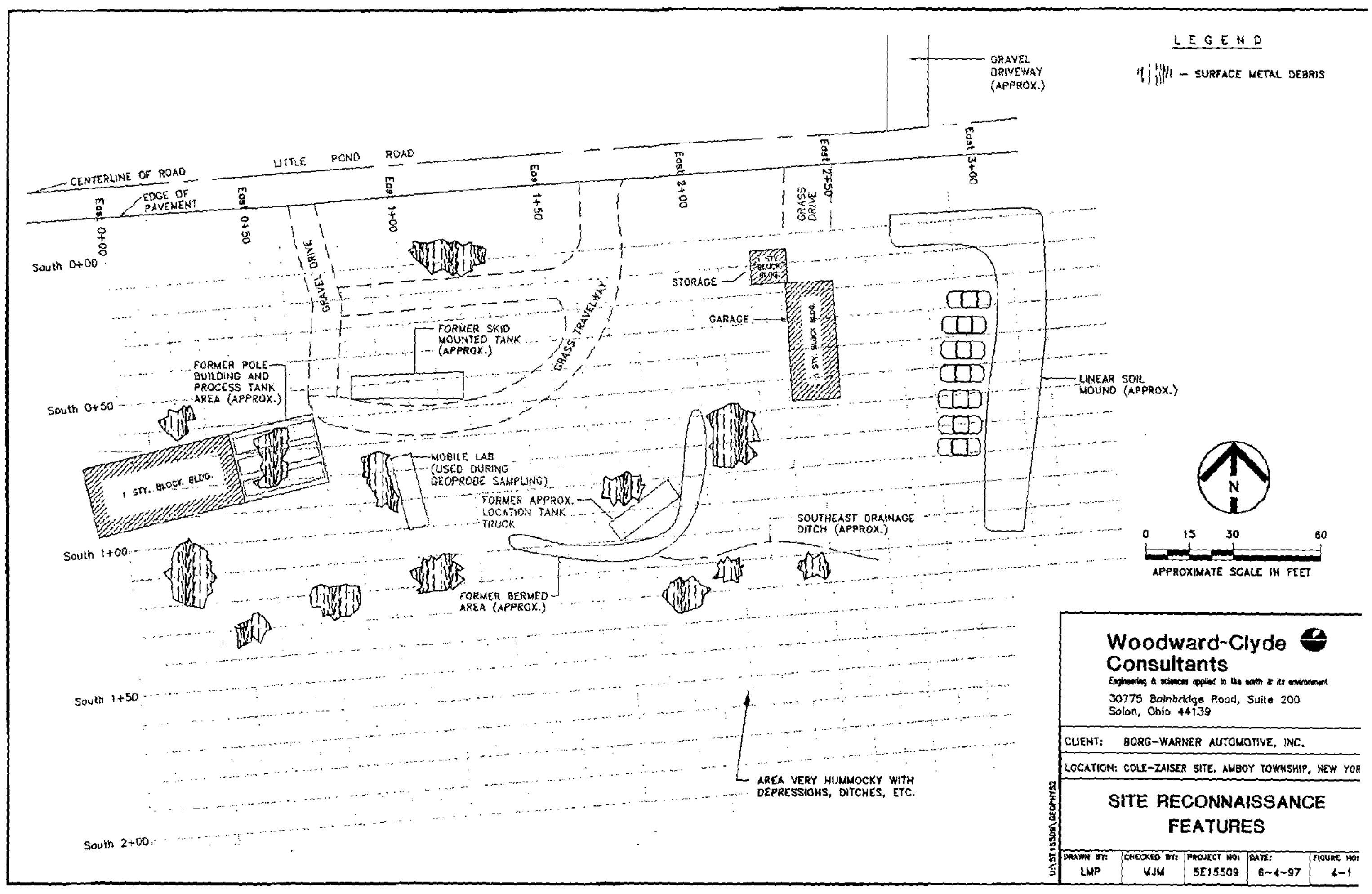
1. Elevations referenced to mean sea level (msl).
2. Total well depths referenced to ground surface.
3. "---" indicates well not installed at time of measurement.
4. "NM" indicates water level not measured.

TABLE 4-2
SUMMARY OF GROUNDWATER ELEVATION MEASUREMENTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

WELL NO.	GROUND SURFACE ELEV.	ELEV. AT TOP OF RISER	TOTAL WELL DEPTH	ELEV. AT BOTTOM OF WELL	10/27/97	
					DEPTH TO WATER	WATER ELEV.
MW-1	712.0	714.35	24.8	687.20	22.56	691.79
MW-2	704.8	706.72	23.0	683.72	15.79	690.93
MW-2A	705.0	706.92	54.8	652.12	17.68	689.24
MW-3	697.6	698.77	18.8	679.97	11.14	687.63
MW-4	692.5	694.45	17.6	676.85	8.72	685.73
MW-4A	692.6	694.67	49.1	645.57	9.32	685.35
MW-5	692.6	694.66	17.5	677.16	11.70	682.96
MW-6	700.7	702.56	17.5	685.06	14.54	688.02
MW-6A	700.4	702.75	55.5	647.25	16.14	686.61
MW-7	701.6	703.76	16.2	687.56	14.40	689.36
MW-7A	701.8	703.73	27.9	675.83	14.31	689.42
MW-7B	701.0	703.45	55.1	648.35	15.43	688.02
TMB-1	682.0	685.46	12.7	672.77	3.56	681.90
TMB-2	690.5	691.08	10.8	680.26	3.80	687.28
TMB-3	689.8	691.10	14.2	676.90	4.63	686.47
LOWE	707.8	708.41	76.5	631.87	19.60	688.81

NOTES:

1. Elevations referenced to mean sea level (msl).
2. Total well depths referenced to ground surface.
3. "---" indicates well not installed at time of measurement.
4. "NM" indicates water level not measured.



Woodward-Clyde Consultants
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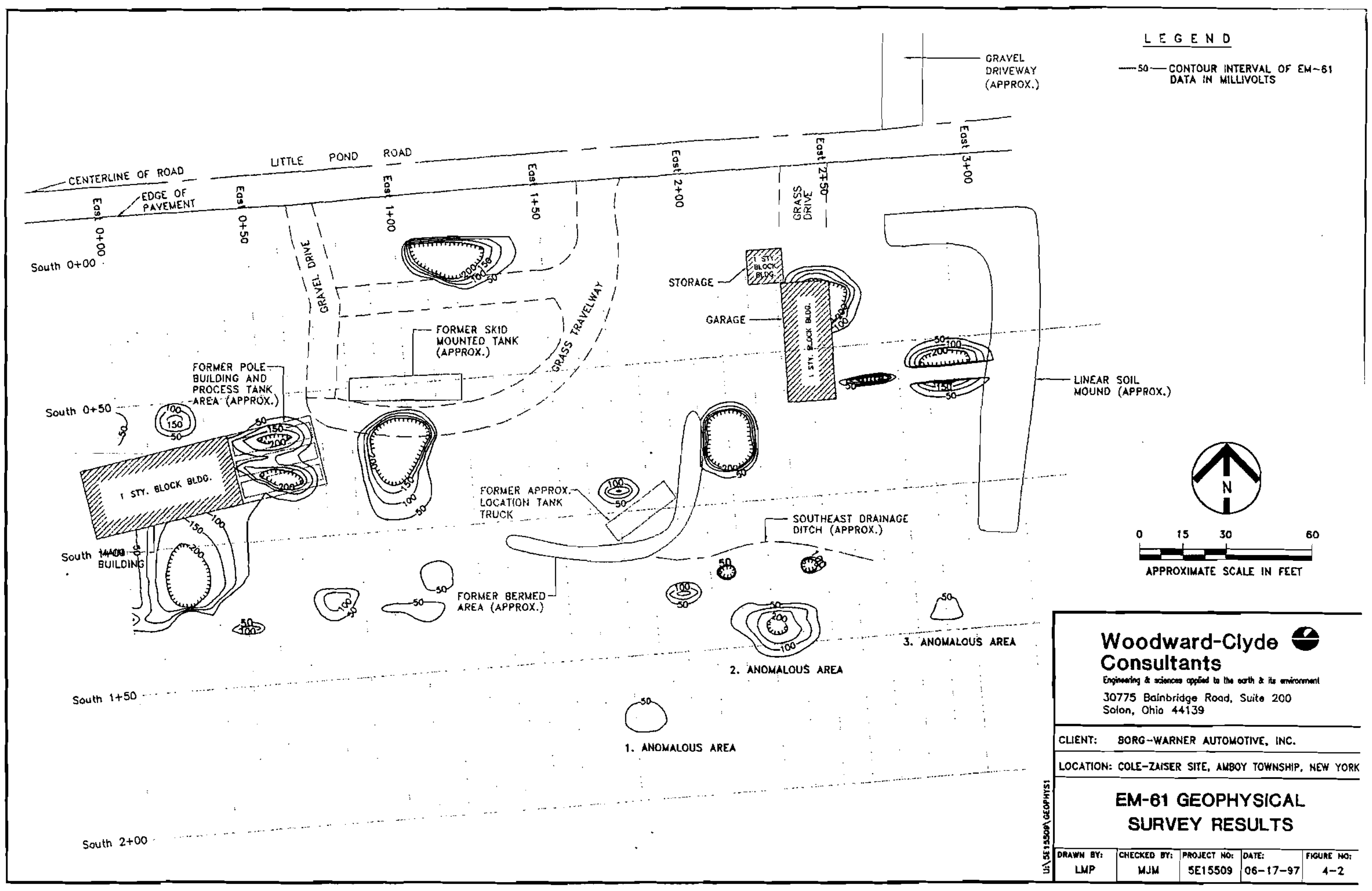
30775 Bainbridge Road, Suite 200
Solon, Ohio 44139

CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YOR

SITE RECONNAISSANCE FEATURES

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	6-4-97	4-1



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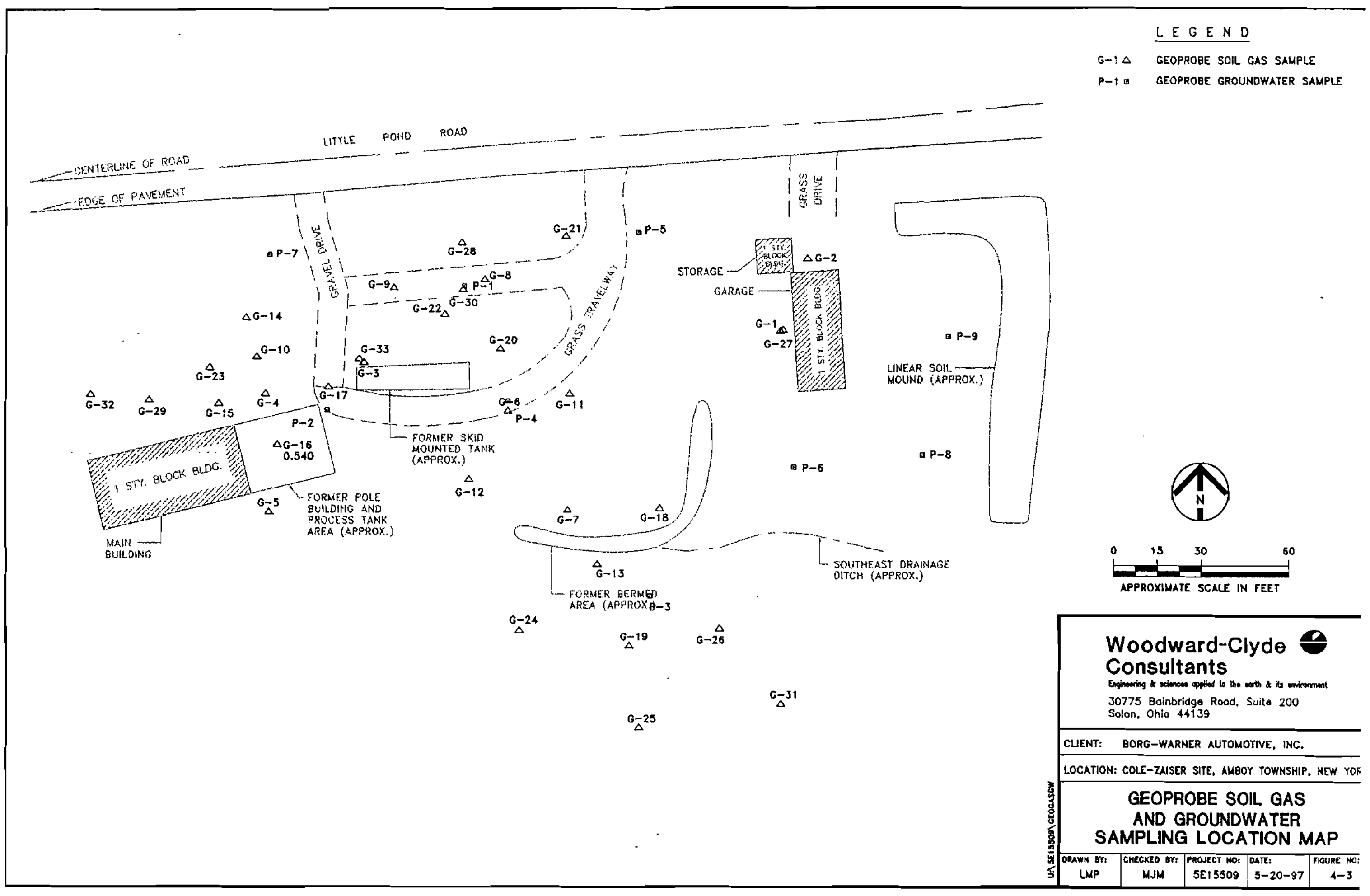
EM-61 GEOPHYSICAL SURVEY RESULTS

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	06-17-97	4-2



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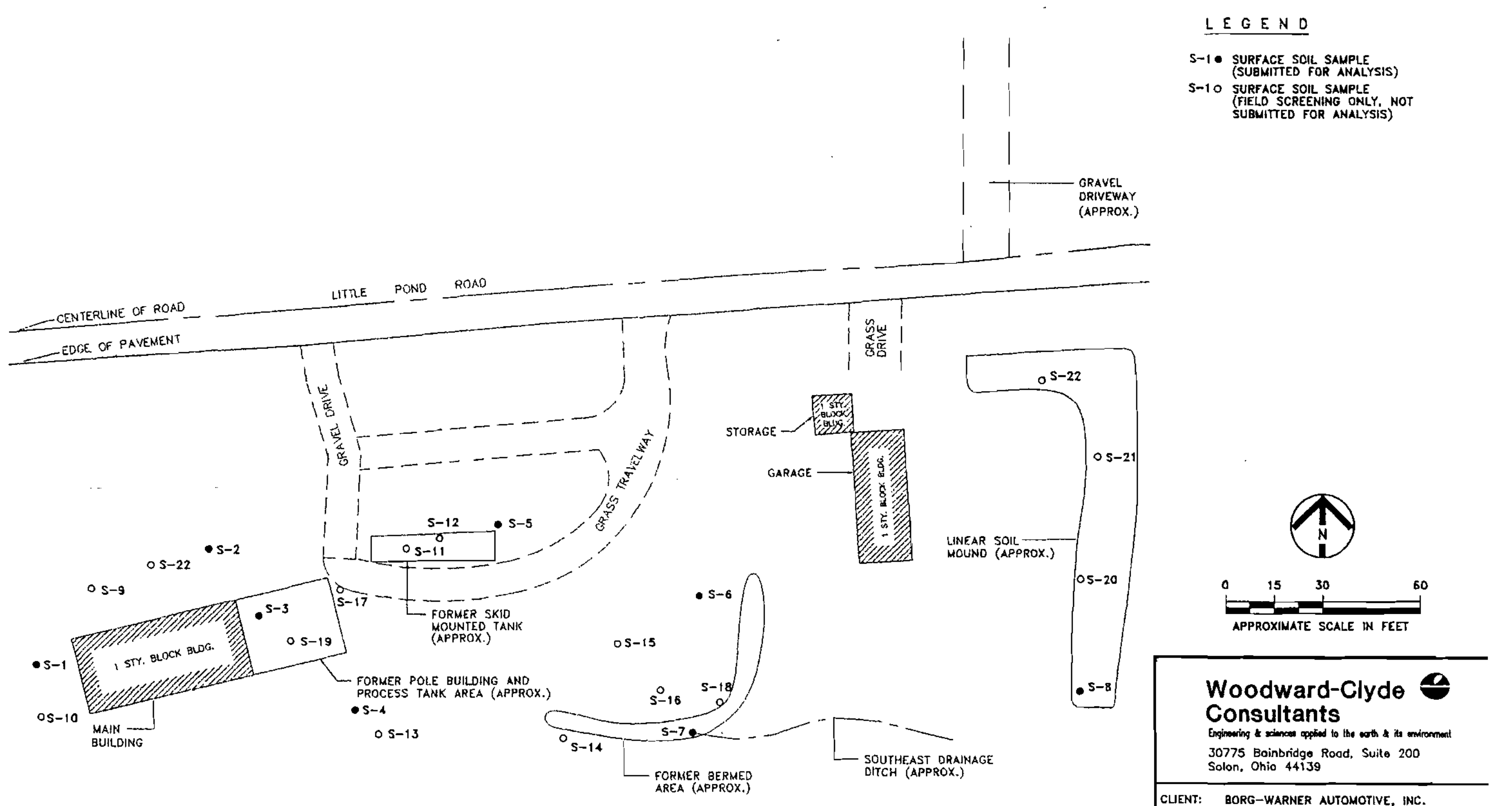
GEOPROBE SOIL GAS AND GROUNDWATER SAMPLING LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	4-3



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SURFACE SOIL SAMPLING LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	4-4

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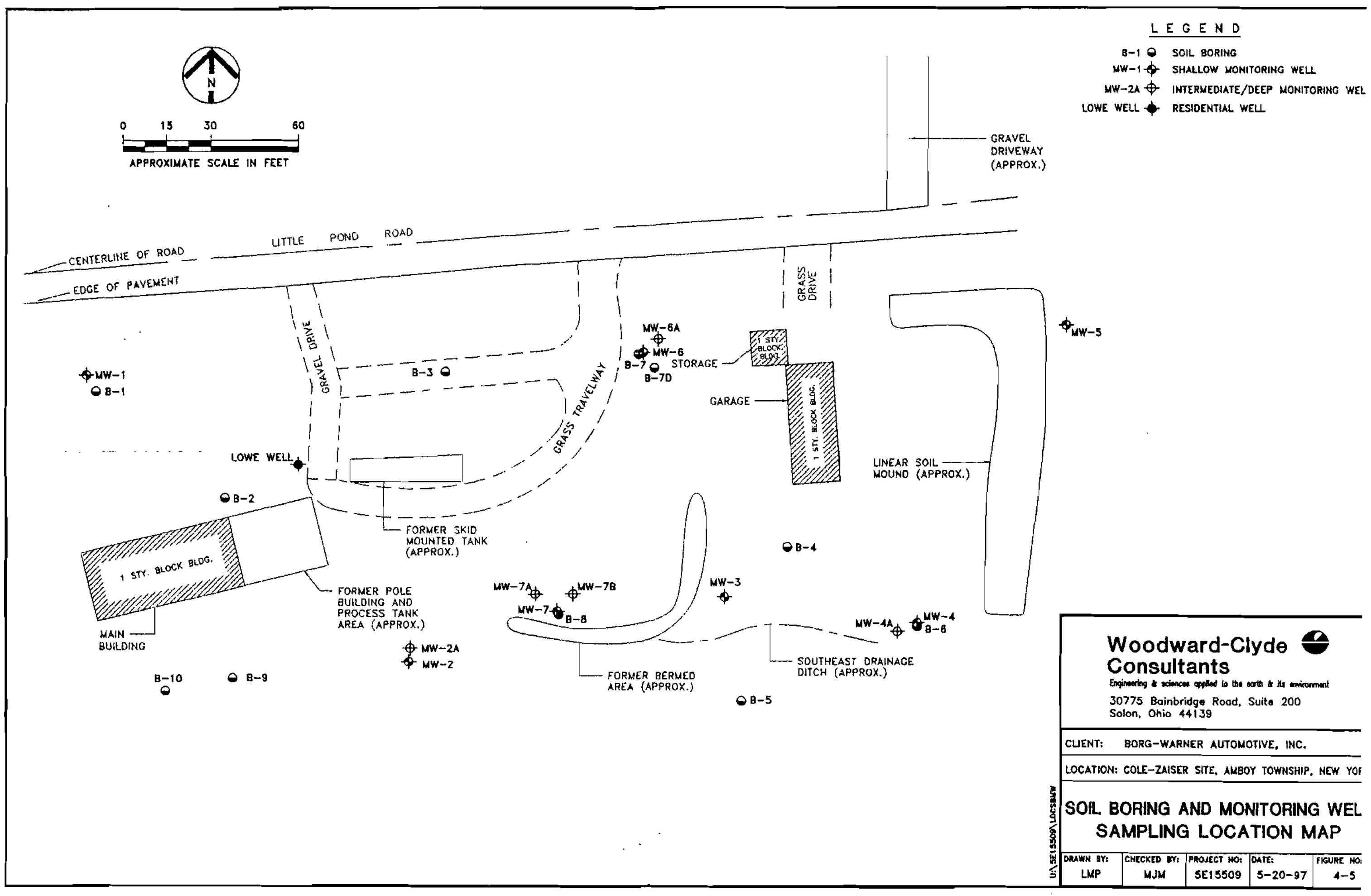

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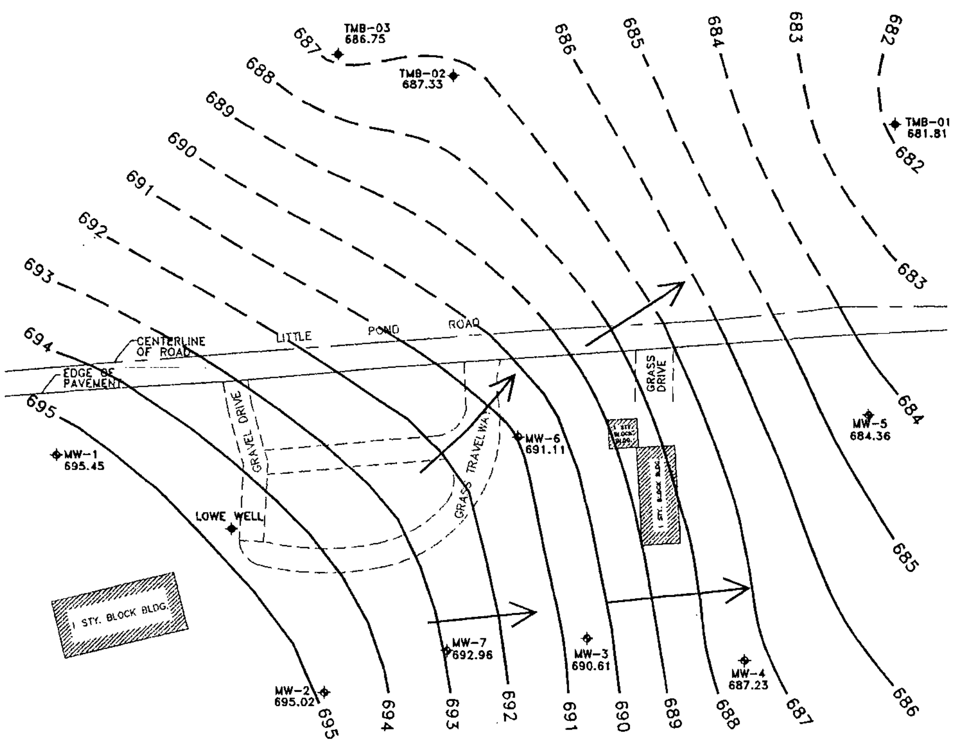
CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YOF

SOIL BORING AND MONITORING WEL
SAMPLING LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	4-5



LEGEND

MW-1 ⌖	MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
695.45	GROUNDWATER ELEVATION MEASURED ON JULY 25, 1996
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATION FOR LOWE WELL NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

N

0 20 40 80

APPROXIMATE SCALE IN FEET

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LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SHALLOW GROUNDWATER ELEVATIONS AND FLOW MAP JULY 25, 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-6

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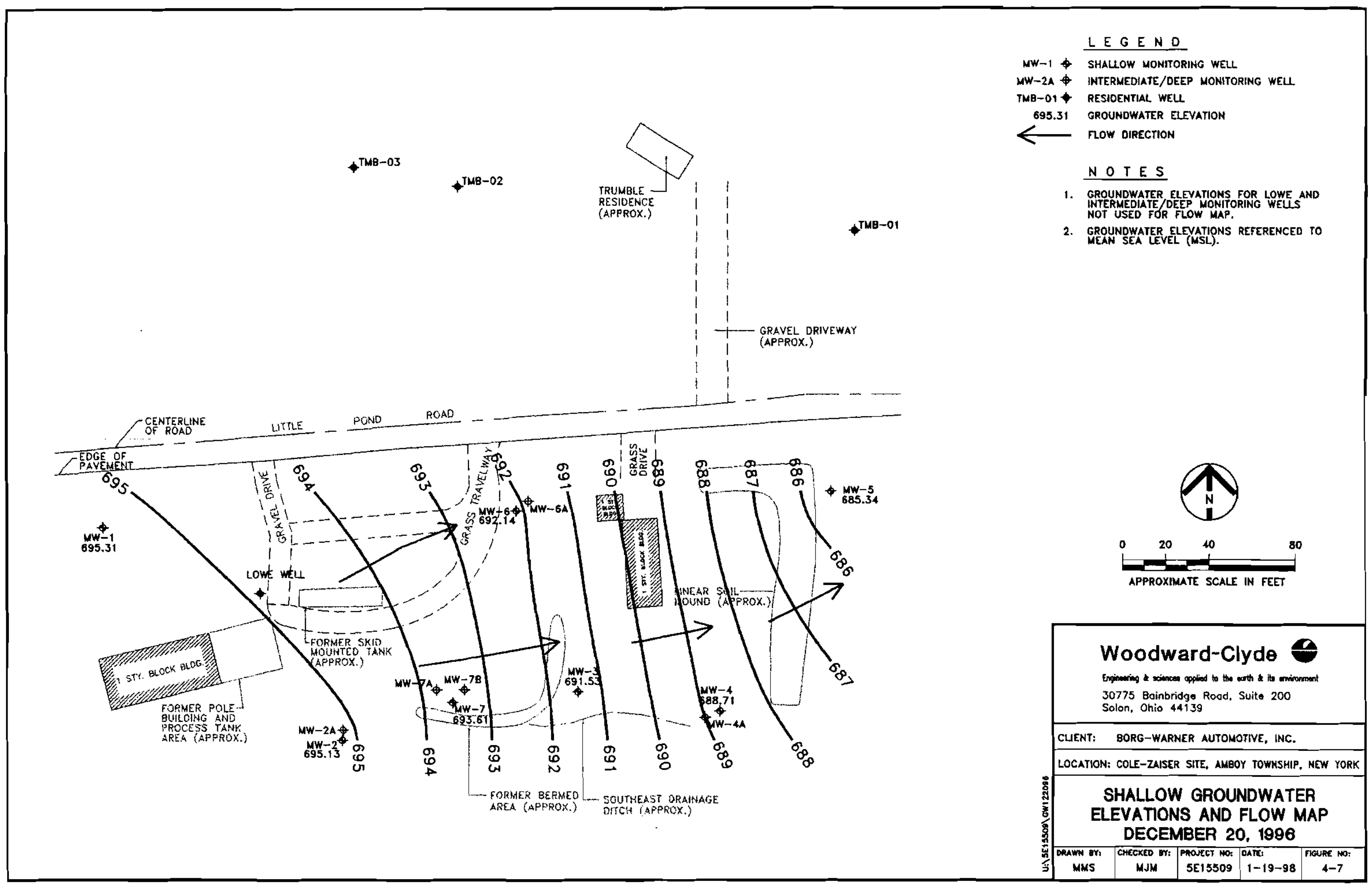

LEGEND

MW-1 ⊕	SHALLOW MONITORING WELL
MW-2A ⊕	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
695.31	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND INTERMEDIATE/DEEP MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

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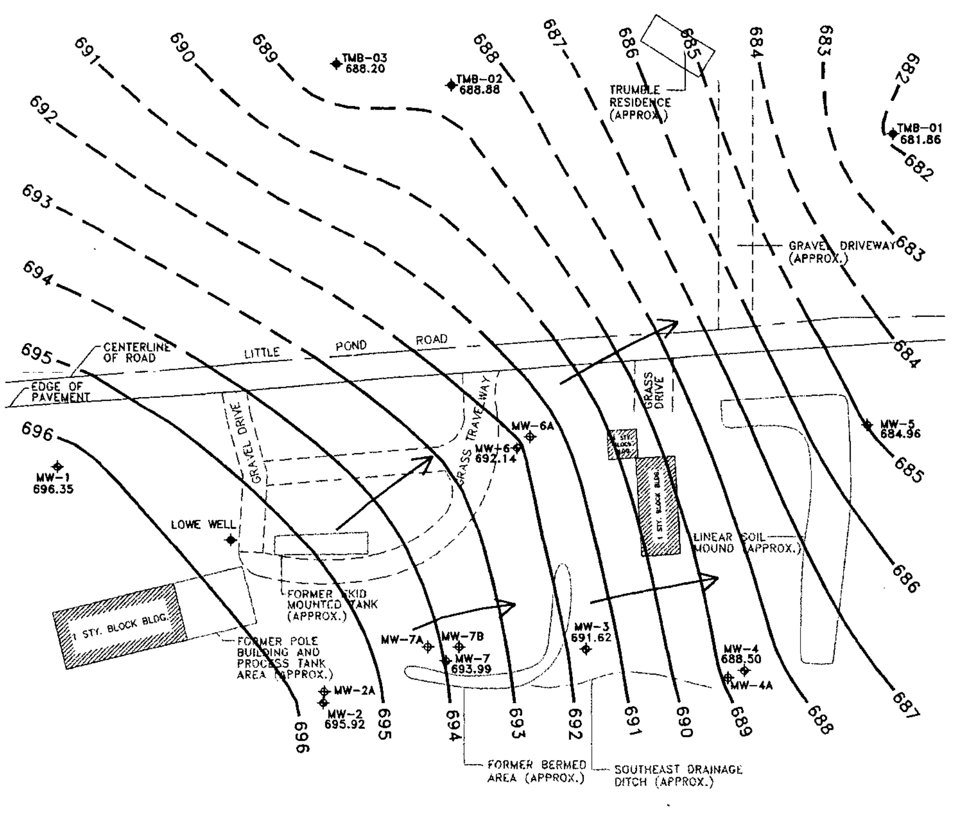
SHALLOW GROUNDWATER ELEVATIONS AND FLOW MAP DECEMBER 20, 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
MMS	MJM	5E15509	1-19-98	4-7



LEGEND

MW-1 ⌖	SHALLOW MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
696.35	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND INTERMEDIATE/DEEP MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

N

0 20 40 80

APPROXIMATE SCALE IN FEET

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SHALLOW GROUNDWATER ELEVATIONS AND FLOW MAP JANUARY 22, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-8

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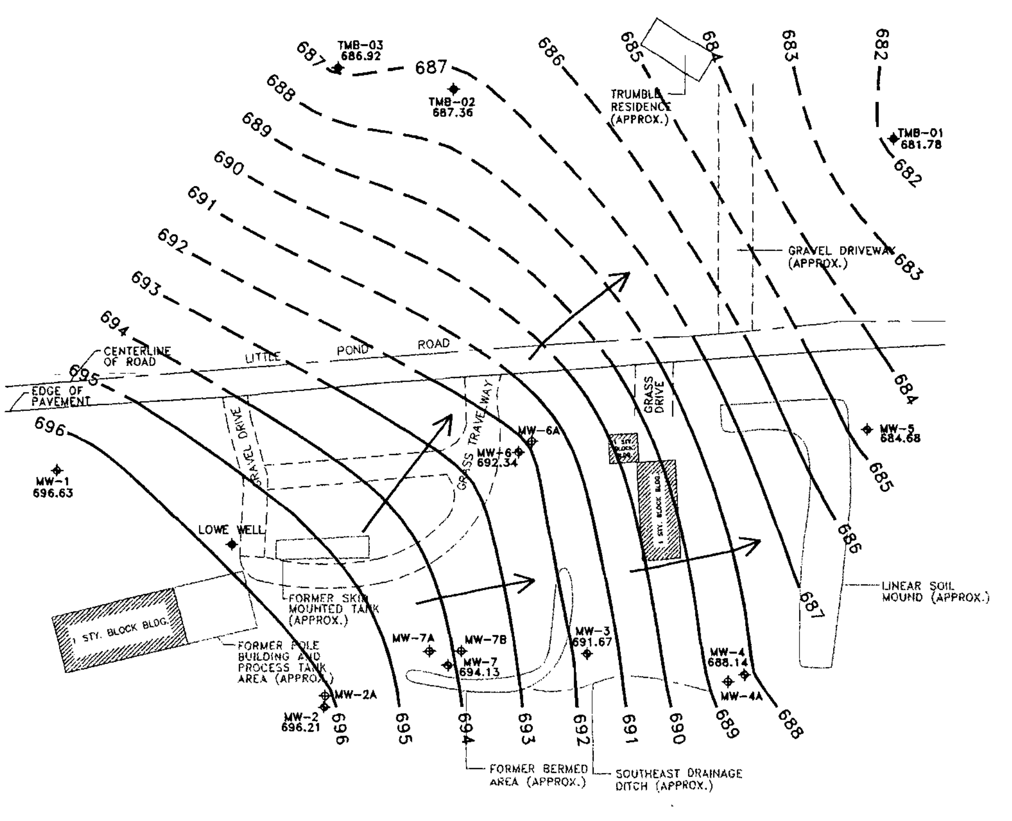
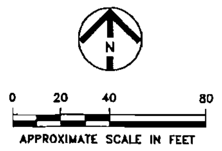


LEGEND

MW-1 ⊕ SHALLOW MONITORING WELL
MW-2A ⊕ INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆ RESIDENTIAL WELL
696.63 GROUNDWATER ELEVATION
← FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND INTERMEDIATE/DEEP MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).



APPROXIMATE SCALE IN FEET

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SHALLOW GROUNDWATER ELEVATIONS AND FLOW MAP
MAY 30, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-9

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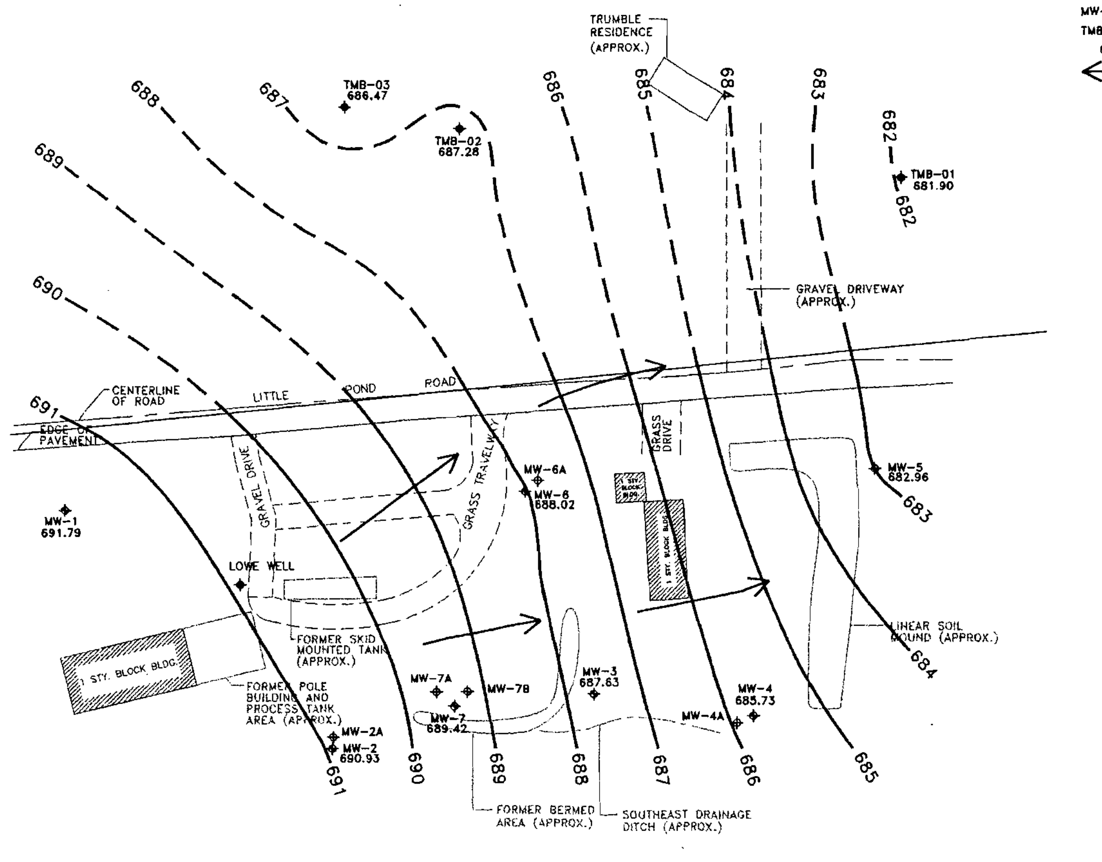

LEGEND

MW-1 ⌖	SHALLOW MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
691.79	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND INTERMEDIATE/DEEP MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

N

0 20 40 80

APPROXIMATE SCALE IN FEET

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

SHALLOW GROUNDWATER ELEVATIONS AND FLOW MAP OCTOBER 27, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
MMS	MJM	5E15509	02-12-98	4-10

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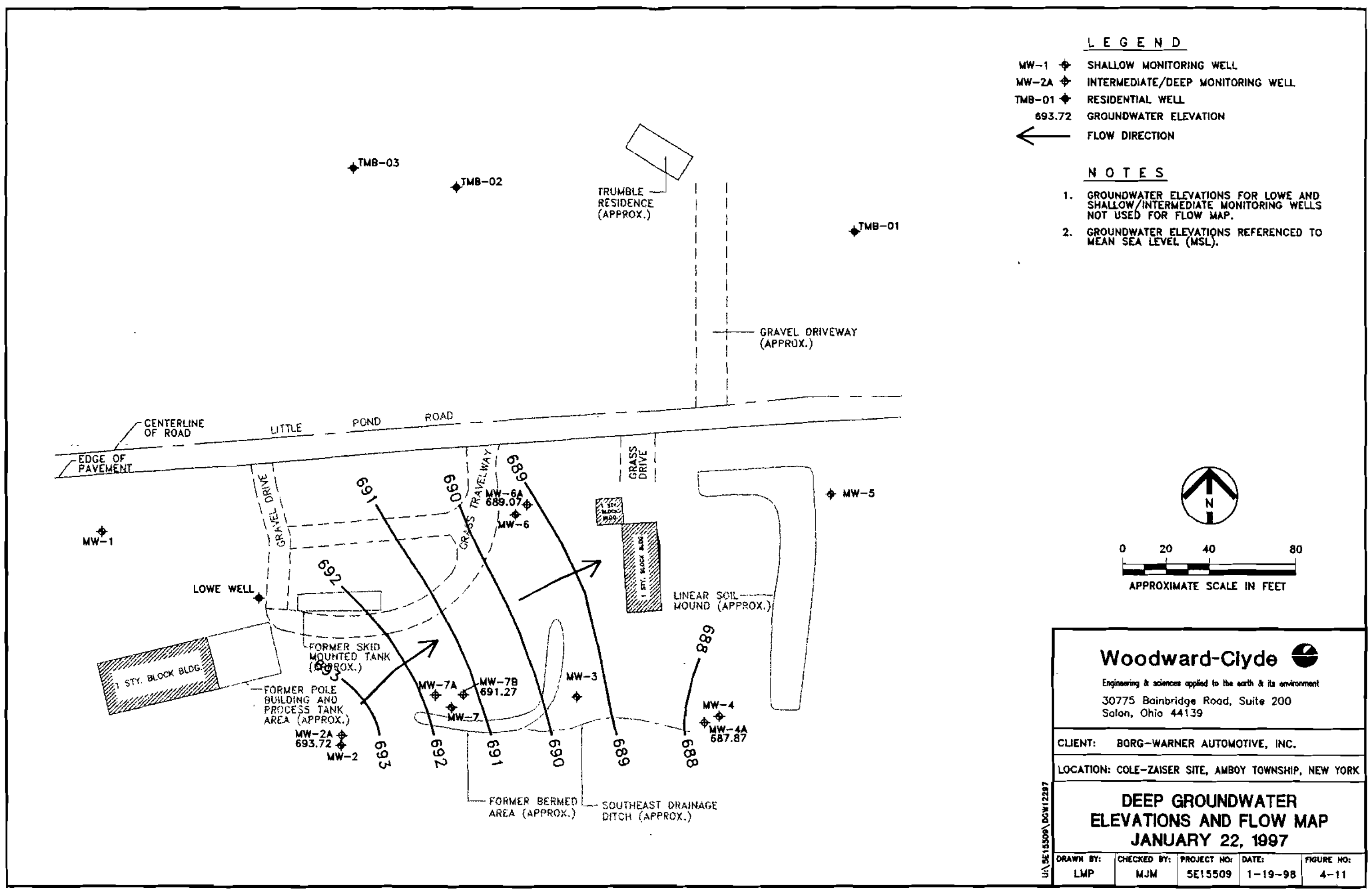

LEGEND

MW-1 ⌖	SHALLOW MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
693.72	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND SHALLOW/INTERMEDIATE MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

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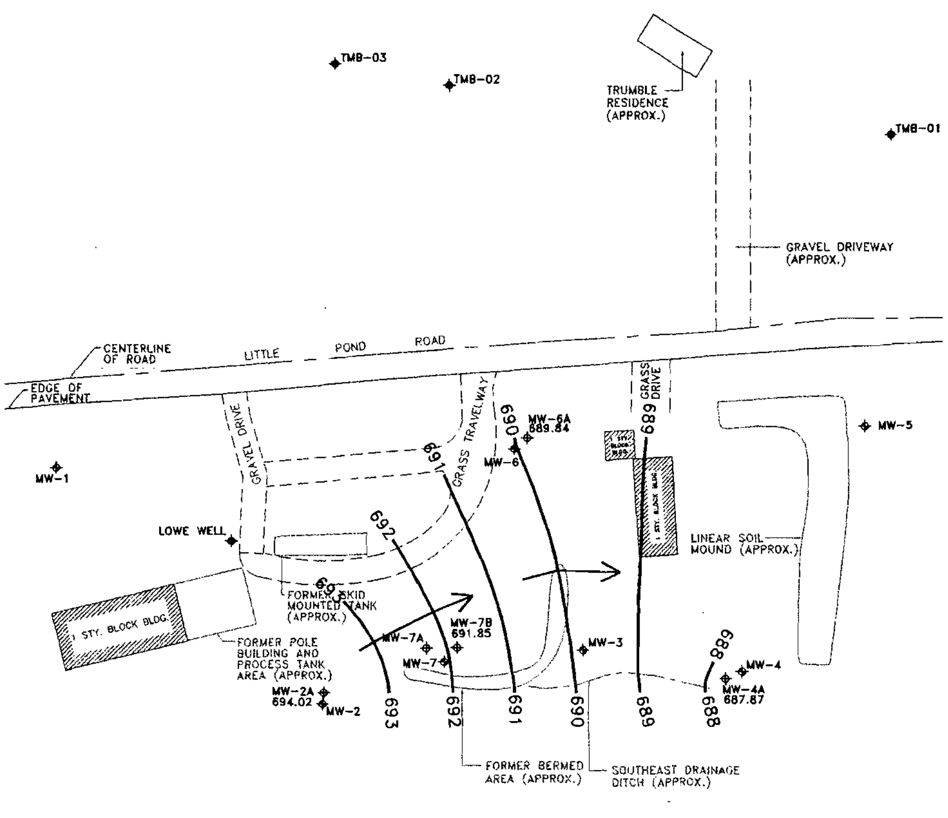
DEEP GROUNDWATER ELEVATIONS AND FLOW MAP JANUARY 22, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-11



LEGEND

MW-1 ⌖	SHALLOW MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
694.02	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND SHALLOW/INTERMEDIATE MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).

N

0 20 40 80

APPROXIMATE SCALE IN FEET

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

DEEP GROUNDWATER ELEVATIONS AND FLOW MAP
MAY 30, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-12

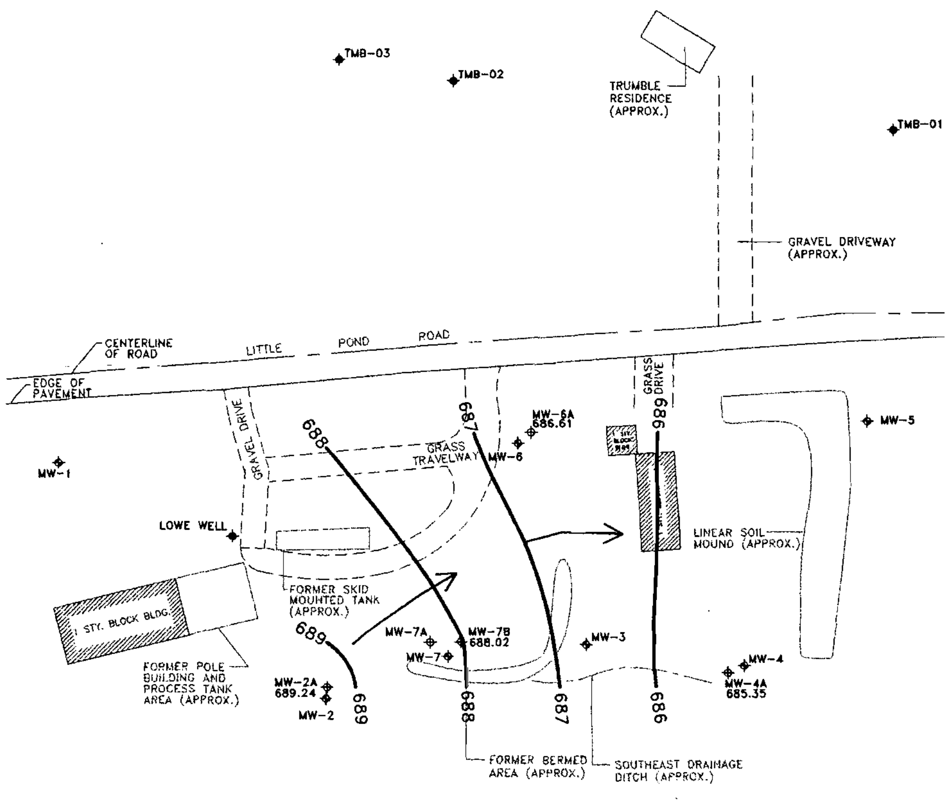
U:\5E15509\DGW53097

LEGEND

MW-1 ⌖	SHALLOW MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
689.24	GROUNDWATER ELEVATION
←	FLOW DIRECTION

NOTES

1. GROUNDWATER ELEVATIONS FOR LOWE AND SHALLOW/INTERMEDIATE MONITORING WELLS NOT USED FOR FLOW MAP.
2. GROUNDWATER ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).



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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

DEEP GROUNDWATER ELEVATIONS AND FLOW MAP OCTOBER 27, 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
MMS	MJM	5E15509	01-19-98	4-13

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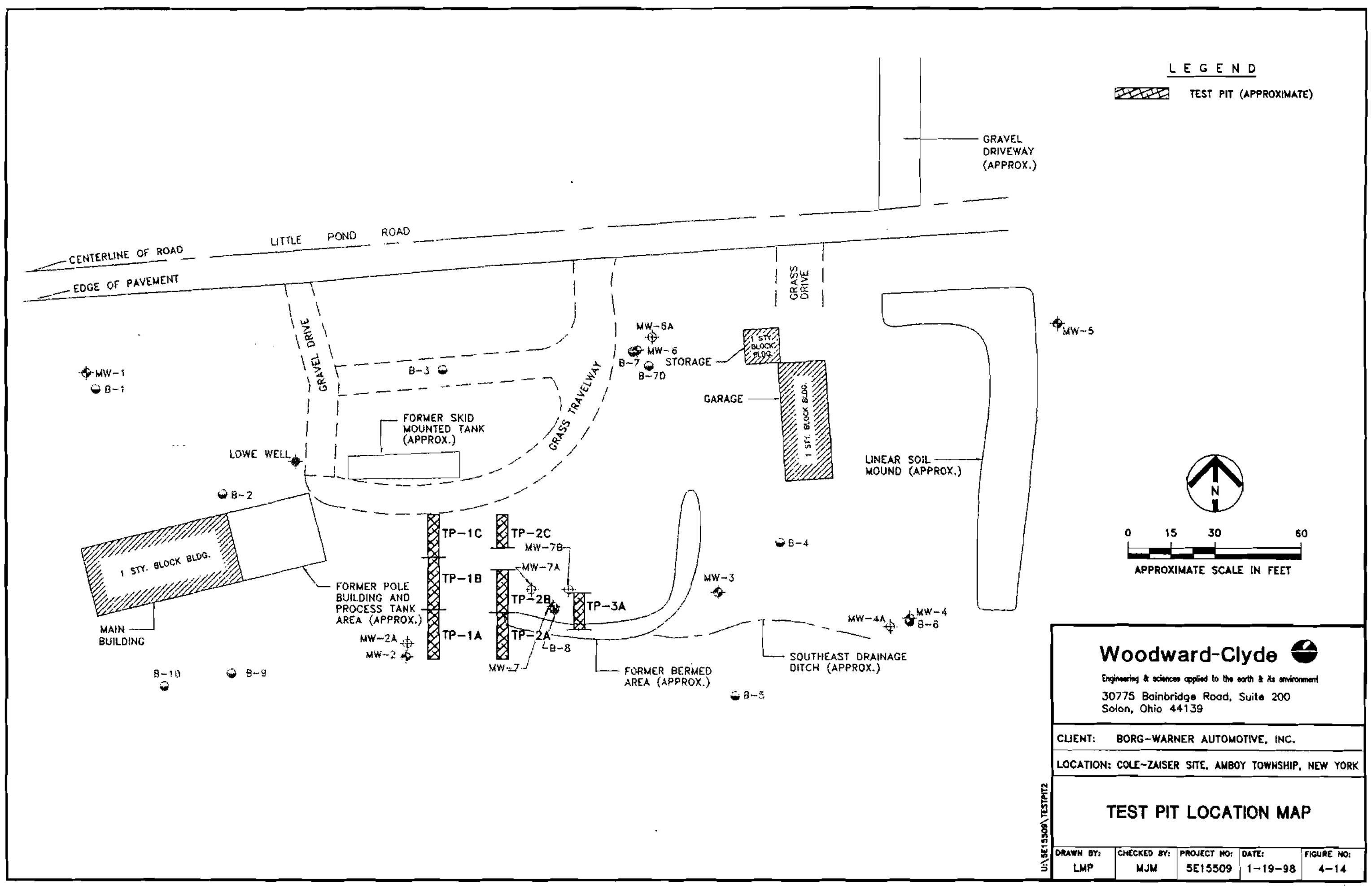

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LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

TEST PIT LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	1-19-98	4-14

The data collected as part of the RI are summarized in the following sections. Results of soil, soil gas, and groundwater sampling indicate some localized surficial soil contamination at low concentrations, consistent with the information available about the operation of the site. Soil samples collected from soil borings contained low levels of a few VOCs, also consistent with knowledge of site operations. Soil gas sampling, soil sampling, and groundwater sampling were successful in defining a localized area of groundwater contaminated with volatile organic compounds. Test pit soil sampling identified a source area upgradient of the localized area of groundwater contamination. The data from all media sampled are presented in tabular and graphic form in this section, Sections 6 and 7 evaluate the potential impacts to human health and the environment, and Section 8 discusses the conclusions and recommendations resulting from the RI.

Laboratory data sheets for the soil gas, soil, and groundwater samples collected at the Cole-Zaiser site in 1996 and 1997 are provided in **Appendix C**. The Geoprobe® soil and groundwater samples were analyzed by Commonwealth's mobile laboratory according to their standard operating procedures (SOPs). The soil boring, surface soil, test pit soil, monitoring well, and residential well samples were analyzed by Nytest using NYSDEC ASP Methodologies.

5.1 DATA VALIDATION

Complete data validation was performed on all the RI samples submitted for analysis. QC data included field duplicates, decontamination/rinsate blanks, trip blanks, matrix spikes/duplicates, and surrogates. Upon completion of the data validation, the results reported for the analyses were accepted. The completeness of this data set, defined as the percentage of valid analytical results including estimated (J or UJ) values, is 98.3 percent. This percentage exceeds the methods' historical completeness range of 80 to 85 percent. A detailed discussion regarding the accuracy, precision, and representativeness of the data is presented in the data validation report in **Appendix D**. Appropriate data qualifiers identified during data validation have been incorporated into the summary tables presented in this report.

5.2 DATA SUMMARIES

Summary tables of the validated data were prepared for each media and are presented in **Tables 5-1 through 5-10~~8~~**. The summaries are limited to the chemicals detected in at least one sample of each given media. Sample locations, field identifications, sample depth (if applicable), analytical results, detection limits, and qualifiers are provided in each table. Separate results are listed for duplicate samples. Potential groundwater Quality Standards (GWQSs) and Soil Cleanup Objectives (SCOs) that have been published by NYSDEC are also included where appropriate. Chemical concentrations that exceed the NYSDEC criteria are highlighted in bold. Additional discussion of the data in relation to the NYSDEC criteria is provided with the evaluation of potential human and ecological receptors in **Sections 6.0 and 7.0**. Results are not included in the summary tables for laboratory QC compounds and results associated with matrix spikes (MS), matrix spike duplicates (MSDs), surrogate compounds, re-extractions, and dilutions.

Information provided in the data summary tables indicates that the detection limit for VOCs analyzed by ASP 91-1 is 10µg/l, while the corresponding NYSDEC GWQS for several VOCs is 5 µg/l or less. However, chemicals that were detected at concentrations between 1 and 10 µg/l have been reported by the laboratory and qualified with a "J", indicating an estimated value. The "J" qualifier is used when mass spectral data indicates the presence of a compound that meets identification criteria, but the results are less than the sample quantitation limit and greater than one.

In addition to the data summary tables, **Figures 5-1 through 5-6~~8~~ and Figures 5-8 through 5-12** were prepared to highlight the detected VOCs and metals that were identified at concentrations above NYSDEC criteria. If the sample contained a duplicate, the maximum concentration at the specific location and depth (if applicable) is posted on the figure. Laboratory QC compounds such as MS, MSDs, and surrogate compounds are not included. Additional information regarding the chemicals detected in each media is provided in the following sections.

5.3 GEOPROBE® SOIL GAS ANALYTICAL RESULTS

Analytical results for the Geoprobe® soil gas samples indicate that 11 different VOCs were detected at 16 of the 33 sampling locations. The results for each of the 33 locations (designated as G-1 through G-33) are summarized in **Table 5-1**. The detected VOCs and their maximum concentrations (in parts per million vapor) are as follows:

- 1,1,1-TCA (8.421)
- 1,1-DCA (3.394)
- 1,1-DCE (11.315)
- cis-1,2-DCE (34.639)
- Ethylbenzene (0.444)
- PCE (28.337)
- Toluene (2.435)
- Total xylenes (3.339)
- trans-1,2-DCE (0.346)
- TCE (7.695)
- Vinyl chloride (50.581)

As shown in **Figure 5-1**, the soil gas analytical results generally define the lateral limits of VOCs in the vadose zone at the site and suggest that VOCs have not migrated to the vadose zone off-site. Toluene, ethylbenzene, and total xylenes were detected at only one location (G-7) located near the former bermed area. The sample from location G-7 also contained the greatest number of chlorinated VOCs. The highest concentrations of VOCs were identified in the samples from G-7 and G-13, both of which are located near the former bermed area.

5.4 GEOPROBE® GROUNDWATER ANALYTICAL RESULTS

Nine Geoprobe® groundwater sampling locations (designated as P-1 through P-6) were selected based on the Geoprobe® soil gas sample results. The groundwater samples were analyzed for the same VOCs as the soil gas. Analytical results for the six VOCs that were detected in at least one sample are summarized in **Table 5-2**. The detected VOCs and their maximum concentrations (in mg/l) are as follows:

- 1,1,1-TCA (0.18)
- 1,1-DCA (0.12)
- Acetone (2.0)
- cis-1,2-DCE (2.200)
- PCE (0.008)
- Vinyl Chloride (1.100)

All of the detected VOCs, except acetone, were also identified in the soil gas samples. As shown in **Figure 5-2**, the Geoprobe® groundwater data generally defines the lateral limits of VOCs in shallow groundwater. Specifically, no VOCs were detected in four of the perimeter samples located to the south, west, and east of the former site operations areas. However, detectable concentrations of 1,1,1-TCA and cis-1,2-DCE were identified in the sample from P-5, which is located closest to the north property boundary (Little Pond Road). The greatest number of VOCs and the highest VOC concentrations were generally identified in the sample from location P-6, which is located approximately 30 feet downgradient of the former bermed area.

5.5 SURFACE SOIL ANALYTICAL RESULTS

Results of the TCL organic analyses performed on the eight surface soil samples collected during the RI are summarized in **Table 5-3**. The results indicate that eight VOCs, six SVOCs, and three pesticides/PCBs were detected in surface soil. The detected VOCs are also listed next to each sample location in **Figure 5-3**. The detected TCL organics and their maximum concentrations (in µg/kg) are as follows:

VOCs
- 2-Butanone (12)
- Acetone (30)
- Benzene (2)
- Chloroform (2)
- Methylene Chloride (20)
- PCE (7)
- Toluene (2)
- Total Xylenes (3)

SVOCs
- 4-Chloro-2-methylphenol (38)
- bis(2-Ethylhexyl)phthalate (100)
- Di-n-butylphthalate (450)
- Fluoranthene (140)
- Pentachlorophenol (260)
- Phenanthrene (52)

Pesticides/PCBs
- 4,4'-DDE (1.1)
- Aroclor-1254 (590)
- Aroclor-1254 (52)

As shown in **Figure 5-3**, the detected VOCs were identified at relatively uniform concentrations across the site. Additionally, the VOC concentrations were typically reported as estimated values below the laboratory quantitation limit (10 to 14 µg/kg). The concentrations of SVOCs and pesticides/PCBs also were commonly reported as estimated values. None of the TCL organics data indicated the presence of anomalously high concentrations in the surface soil samples.

Analysis of the surface soil samples also included the TAL inorganics. Results of these analyses are summarized in **Table 5-4**. Detectable concentrations were identified for 20 of the 23 metals analyzed. Ten of the 20 metals were identified at concentrations that exceed the corresponding NYSDEC SCO in at least one sample. Maximum concentrations (in mg/kg) of the 10 metals are as follows:

- Arsenic (8.5)
- Beryllium (0.22)
- Cadmium (1.4)
- Chromium (14.2)
- Copper (557)
- Iron (22,000)

- Lead (217)
- Mercury (0.5)
- Nickel (18.8)
- Zinc (105)

The distribution and concentrations of the 10 metals that exceed the corresponding NYSDEC SCOs are shown in **Figure 5-4**. Most of these metals (e.g., beryllium, cadmium, chromium, iron, mercury, nickel, and zinc) were consistently identified at concentrations close to or above the NYSDEC SCO. The consistent distribution of these metals across the site suggests that the identified ~~naturally high~~ concentrations of some metals may not be associated with historical site operations ~~exist in the surface soils at this site~~.

5.6 SUBSURFACE SOIL ANALYTICAL RESULTS

Subsurface soil samples were collected from soil borings at various locations across the site and test pits located in the former bermed/lagoon area. The results of both sets of subsurface soil data are discussed in the following subsections.

5.6.1 Soil Borings

Results of TCL organic analyses performed on the subsurface soil samples indicate that nine VOCs, seven SVOCs and eleven pesticides/PCBs were detected at one or more of the soil boring locations. Concentrations of detected compounds are summarized in **Tables 5-5 and 5-6**. Detected VOC concentrations are also listed next to their corresponding boring locations in **Figure 5-5**. The detected TCL organic compounds and their maximum concentrations (in µg/kg) are as follows:

VOCs
- 1,1,1-TCA (1)
- 1,2-DCE (4)
- Acetone (8)
- Ethylbenzene (2)
- Methylene Chloride (9)
- PCE (7)
- Toluene (2)
- TCE (1)
- Total Xylenes (11)

SVOCs
- 2-Methylnaphthalene (79)
- Bis(2-ethylhexyl)phthalate (380)

- Di-n-butylphthalate (58)
- Diethylphthalate (1,100)
- Fluoranthene (56)
- Phenanthrene (92)
- Pyrene (40)

Pesticides/PCBs
- 4,4'-DDE (2.9)
- alpha-BHC (1)
- Aroclor-1248 (3,400)
- Aroclor-1254 (11)
- Aroclor-1260 (580)
- delta-BHC (2.1)
- Dieldrin (3.6)
- Endosulfan I (1.1)
- Endrin (4)
- Heptachlor (1.5)
- Heptachlor epoxide (2.2)

As shown in **Figure 5-4**, the detected VOCs were only reported as estimated values below the laboratory quantitation limit (11 to 12 µg/kg). The detected concentrations of SVOCs and pesticides/PCBs also were commonly reported as estimated values. None of the TCL organic data indicated any anomalously high concentrations in soil boring samples.

In addition to the TCL organics, 20 metals and cyanide were detected in subsurface soils. Analytical results are summarized in **Table 5-7**. Five of the 20 metals were identified at concentrations that exceed the corresponding NYSDEC SCO in at least one sample. Maximum concentrations (in mg/kg) of the five metals are as follows:

- Beryllium (0.28)
- Chromium (10.6)
- Iron (14,700)
- Mercury (0.56)
- Zinc (34.2)

The distribution and concentrations of the five metals that exceed the corresponding NYSDEC SCOs are shown in **Figure 5-6**. In general, the results indicate that these metals were consistently identified at concentrations close to or above their NYSDEC SCOs. ~~As such, these results may be indicative of high natural concentrations.~~ The consistent distribution of these metals across the site suggest that the identified concentrations may not be associated with historical operations.

5.6.2 Test Pits

Twelve test pit soil samples were selected for laboratory analysis based on the results of hydrophobic dye testing and headspace analyses performed in the field. Results of the field screening performed on 20 test pit soil samples are summarized in **Figure 5-7**. The field screening indicated positive dye test results for 11 of the 20 samples. The positive dye test results were commonly associated with elevated headspace readings, ranging from 16 to 250 parts per million vapor (ppmv).

Laboratory analytical results for the 12 test pit soil samples that were selected based on the field screening data are presented in **Table 5-8** and discussed below in **Section 5.6.2.1**. Comparisons of the analytical results to the field screening data are provided in **Section 5.6.2.2**. Evaluation of the detected concentrations with respect to threshold concentrations for NAPL is discussed in **Section 5.6.2.3**.

5.6.2.1 Summary of Analytical Results

The analytical results obtained for the test pit soil samples indicate that four VOCs were detected at concentrations that exceeded the NYSDEC SCOs in at least one of the 12 samples submitted. These compounds and their maximum concentrations (in µg/kg) are as follows:

VOCs
- 1,1,1-TCA (2,700)
- 1,2-DCE (2,300)
- Toluene (2,100)
- Total Xylenes (50,000)

Figure 5-8 presents the concentrations of the four referenced VOCs that were identified at each sampling location. Observation of **Figure 5-8** indicates that exceedances of the NYSDEC SCOs were identified in 3 of the 12 selected samples. These three samples are located at relatively shallow (3 feet or 6 feet) depths in a limited area in the southern sections of Test Pits 1 and 2 (TP-1A and TP-2A). No other exceedances were identified.

5.6.2.2 Field Screening and Analytical Data Comparison

Comparisons of the field screening results to analytical data indicate that detectable VOC concentrations were identified in samples with positive dye test responses and elevated PID readings. However, the detected concentrations are not indicative of the presence of NAPL. Relationships between the field screening results and the analytical data are discussed below for each test pit section.

TP-1A: The soil sample collected 3 feet had a positive dye test result, a PID reading of 200 ppmv and VOC concentrations exceeding the NYSDEC SCOs. The samples collected from 5 feet and 8 feet also had positive dye test results, but were found to have VOC concentrations below the NYSDEC SCOs. The VOC concentrations in the 8-foot sample were slightly higher than the concentrations in the 5-foot sample.

TP-1B: The soil sample collected from 6 feet yielded a negative dye test response and a PID reading of 5 ppmv. No VOCs were detected in this sample. Field screening results for the sample collected from 9 feet indicated a positive dye response and a PID reading of 20 ppmv. Six VOCs were detected in the sample from 9 feet, but were all at concentrations significantly lower than the NYSDEC SCOs.

TP-2A: VOC concentrations exceeding the NYSDEC SCOs were detected in the samples collected from 3 feet and 6 feet in this test pit. The detected VOC concentrations were significantly lower in the sample collected from 8 feet and did not exceed the NYSDEC SCOs. All three samples had positive dye test responses. The PID readings for the 3-foot, 6-foot, and 8-foot samples were 55, 60, and 250 ppmv, respectively.

TP-2B: The samples collected from 3 feet and 5 feet had positive dye test results and PID readings of 50 and 60 ppmv, respectively. Up to eight different VOCs were detected in these two samples, but were all at concentrations significantly lower than the NYSDEC SCOs.

TP-3A: The sample collected from 3 feet had a positive dye test response and a PID reading of 70 ppmv. VOCs concentrations that were identified in this sample were below the NYSDEC SCOs. The sample collected from 6 feet had a negative dye test result and a lower PID reading (18 ppmv). One VOC (acetone) was detected in the deeper (6-foot) sample at a concentration well below the NYSDEC SCO.

5.6.2.3 Evaluation of NAPL Indicators

The field screening and analytical data comparisons indicate that, in general, the samples with positive dye test responses also contained detectable concentrations of VOCs. However, the detected concentrations are at least three orders-of-magnitude lower than the 10,000 mg/kg threshold criterion specified by Cohen and Mercer (1993) as indicative of NAPL. Comparison of the maximum total VOC concentrations that were identified in the test pit soil samples to the 10,000 mg/kg concentration is provided in **Figure 5-9**. As shown in **Figure 5-9**, the maximum total VOC concentration is 57 mg/kg in the 3-foot sample from TP-1A. This concentration is well below the 10,000 mg/kg threshold value.

A more conservative approach to estimate soil concentrations indicative of NAPL is based on pore space and specific gravity. Assuming that the soil has a porosity of 30 percent, a specific gravity of 2.63, and that NAPL occupies only 1 percent of the pore space, the VOC concentrations would be expected to range from approximately 1,400 mg/kg for a NAPL with a specific gravity of 0.86 to 2,200 mg/kg for a NAPL with a specific gravity of 1.34. The assumed range of NAPL specific gravity values includes the VOCs that have been identified at the Cole-Zaiser site. As shown on **Figure 5-9**, the maximum total VOC concentration detected at the Cole-Zaiser site is well below the calculated values for NAPL based on pore space and specific gravity.

While Cohen and Mercer (1993) indicates that false positives are not expected with hydrophobic dye testing, the analytical results indicate that the positive responses were commonly associated with low concentrations of VOCs in the test pit soil samples. All of the detected VOC concentrations are well below the threshold criteria for NAPL, as described above. Therefore, the site-specific data indicate that the positive dye test responses correlate with the detection of VOCs and not with the presence of NAPL.

In summary, the analytical results from the test pit investigation do not indicate the presence of NAPL in the former bermed/lagoon area. However, the results are sufficient to delineate a limited area of elevated VOC concentrations in soil at relatively shallow depths, ranging from approximately 3 to 6 feet. These VOC concentrations represent a source area contributing to observed shallow groundwater contamination at the site.

5.7 MONITORING AND RESIDENTIAL WELL ANALYTICAL RESULTS

Analytical results for the three~~two~~ rounds of groundwater samples that were collected during the RI are summarized in **Tables 5-10 and 5-13~~8~~**. The results for the first round include VOC, SVOC, pesticide/PCB, and metals data for seven shallow on-site monitoring wells (MW-1 through MW-7), the Lowe Well, and the three Trumble residential wells (TMB-01 through TMB-03). The second round of data include VOC analytical results for the monitoring and residential wells included in the first round, plus the five additional monitoring wells (MW-2A, -4A, -6A, -7A, and -7B) that were installed at the site in December 1996. The results listed for the third round include VOC data for the six shallow on-site monitoring wells (MW-2, MW-3, MW-4, MW-5, MW-6, and MW-7) and one deep monitoring well (MW-4A) that were included in the October 1997 sampling event.

5.7.1 July 1996 Sampling Event

Results of TCL organic analyses performed on the first round of groundwater sampling indicated detectable concentrations of nine VOCs and two SVOCs. No detectable concentrations of pesticides/PCBs were identified. Results of the TAL inorganic analyses indicated the presence of 20 out of the 23 metals analyzed. The specific parameters identified are discussed in the following subsections.

5.7.1.1 VOC Results

The detected VOC concentrations are listed next to the well locations in **Figure 5-10~~7~~**. The VOCs and their maximum concentrations (in µg/l) are as follows:

- 1,1,1-TCA (840)
- 1,1-DCA (100)
- 1,1-DCE (11)
- 1,2-DCE (10,000)
- Carbon Disulfide (3)
- PCE (490)
- Toluene (17)
- TCE (280)
- Vinyl Chloride (150)

As shown in **Figure 5-10~~7~~**, the highest VOC concentrations were generally found at MW-7, which is located near the former bermed area. No VOCs were identified in upgradient monitoring well MW-1. Estimated concentrations from 2 to 3 µg/l were identified in upgradient well MW-2 and downgradient well MW-5. No VOCs were detected in the Lowe Well or two of the three Trumble Wells (TMB-02 and TMB-03). Detectable concentrations of 1,1,1-TCA (3 µg/l) and TCE (13 µg/l) were identified in the untreated sample from Trumble well TMB-01.

5.7.1.2 SVOC Results

Two SVOCs were detected at estimated concentrations ranging from 1 to 5 µg/l. The detected SVOCs and their maximum concentrations (in µg/l) are as follows:

- 4-Chloro-3-Methylphenol (5)
- Diethylphthalate (3)

One of these SVOCs was detected at four of the eleven groundwater sampling locations. The four locations are monitoring wells MW-3, MW-6, and MW-7 and Trumble well TMB-03.

5.7.1.3 Metals Results

Analysis of the July 1996 groundwater samples indicated detectable concentrations of 20 metals. Concentrations of five of the 20 metals exceeded the NYSDEC GWQSs for protection of drinking water sources in two or more samples. Maximum concentrations (in µg/l) of these five metals are as follows:

- Aluminum (48,700)
- Iron (97,200)
- Lead (36)
- Magnesium (125,000)
- Manganese (11,400)

The distribution and concentrations of the above-referenced metals are shown in **Figure 5-11~~8~~**. Results for the on-site shallow monitoring wells (MW-1 through MW-7) indicate consistently high concentrations of aluminum, iron, magnesium, and manganese. The consistent results may suggest that naturally high concentrations of these metals exist in the shallow groundwater at the site.

5.7.2 January-February 1997 Sampling Event

Analytical results for the second round of groundwater sampling indicate that 13 VOCs were detected in at least one sample. The detected VOCs and their maximum concentrations (in µg/l) are as follows:

- 1,1,1-TCA (670)
- 1,1-DCA (280)
- 1,1-DCE (14)
- 1,2-DCE (20,000)
- Acetone (51)
- Benzene (23)
- Carbon Disulfide (3)
- Ethylbenzene (1)
- PCE (50)
- Toluene (47)
- TCE (270)
- Vinyl Chloride (2,200)
- Total Xylenes (2)

The detected VOCs are listed next to each well location in **Figure 5-12~~9~~**. As shown in **Figure 5-12~~9~~**, no VOCs were identified in upgradient monitoring wells MW-2 and MW-2A, downgradient monitoring wells MW-5 and MW-6A, the Lowe Well, or Trumble Well TMB-02.

Estimated concentrations ranging from 2 to 5 µg/l were identified in the samples from upgradient monitoring well MW-1, downgradient monitoring wells MW-4 and MW-7B, and Trumble Well TMB-03. Detectable concentrations of 1,1,1-TCA (2 µg/l), 1,2-DCE (2 µg/l), and TCE (28 µg/l) were identified in the untreated sample from Trumble well TMB-01.

The results for the shallow monitoring wells and residential wells that were resampled during the January-February 1997 event are generally consistent with those obtained in the previous (July 1996) sampling event. The highest VOC concentrations were again found at MW-7. Increased concentrations were found at MW-3, which is immediately downgradient of MW-7 and the former bermed area. However, approximately 65 feet downgradient of MW-3, the VOC concentrations at MW-4 decreased. The January-February 1997 results for MW-6, located between the former operations areas and Little Pond Road, were consistent with the previous results and continued to show the highest concentrations of 1,1,1-TCA. The 670 to 840 µg/l concentration of 1,1,1-TCA at MW-6 is significantly greater than the 2 µg/l concentration identified approximately 200 feet downgradient at TMB-01. The results for TMB-01 are consistent with NYSDOH quarterly sampling data presented in **Table 3-1**, which~~1, which~~ indicate TCE concentrations ranging from 26 to 48 µg/l.

The intermediate and deep monitoring wells contained significantly lower concentrations than the corresponding shallow monitoring wells. For example, MW-7 (6.5 to 16.5 feet in depth) contained 20,000 µg/l of 1,2-DCE, while intermediate well MW-7A (25 to 27.5 feet in depth) contained only 11 µg/l. In addition, a 5 µg/l concentration of 1,2-DCE was detected in deep monitoring well MW-7B, which has a screened interval from 45 to 55 feet. The only deep monitoring well with a chemical concentration exceeding a NYSDEC GWQS is monitoring well MW-4A, with 23 µg/l of benzene. However, benzene was not identified at shallow monitoring well MW-4 or at upgradient monitoring locations.

5.7.3 October 1997 Sampling Event

Analytical results for the third round of groundwater sampling indicate that 11 VOCs were detected in at least one sample. The detected VOCs and their maximum concentrations (in µg/l) are as follows:

- 1,1,1-TCA (160)
- 1,1-DCA (160)
- 1,1-DCE (4)
- 1,2-DCE (5,400)
- Carbon Disulfide (4)
- Ethylbenzene (2)

- PCE (34)
- Toluene (14)
- TCE (24)
- Vinyl Chloride (2,900)
- Total Xylenes (4)

The detected VOCs are listed next to each well location in **Figure 5-13**. Analytical results are relatively consistent with the results for previous sampling events. Specific observations related to the individual wells are provided below.

MW-2: No VOCs were identified in this upgradient monitoring well, which is consistent with previous sampling results.

MW-3: Concentrations of VOCs detected in monitoring well MW-3 are relatively consistent with the previous (January-February 1997) sampling event. MW-3, which is located immediately downgradient of the former bermed/lagoon area, contained the highest concentrations of the majority of the VOCs identified during October 1997 sampling event.

MW-4: The VOC concentrations in monitoring well MW-4, which is located downgradient of MW-3, were similar to the July 1996 concentrations. However, the identified concentrations showed an increase from the concentrations that were identified in the previous (January-February 1997) sample results.

MW-5: Three VOCs were detected in downgradient monitoring well MW-5, which represents an increase from the non-detect results obtained in January 1997. However, results from July 1996 also identified the presence of VOCs in MW-5.

MW-6 and MW-7: The VOC concentrations in monitoring well MW-6 generally showed a slight decrease over the three sampling events. The VOC concentrations in monitoring well MW-7, which contained the highest results in both January 1997 and July 1996, also decreased for the October 1997 sampling event.

MW-4A: Monitoring well MW-4A was sampled to verify the presence or absence of benzene. The October 1997 analytical results did not indicate the presence of benzene in MW-4A or in any of the other monitoring wells sampled.

5.7.4 Potential NAPL Considerations

The analytical results provided in previous sections indicate that 20 mg/l of 1,2-DCE was the maximum concentration of an individual VOC identified in groundwater samples collected during the RI. Evaluation of the potential presence of NAPL at the Cole-Zaiser site included comparing the maximum detected concentration of 1,2-DCE to published data regarding solubility limits for the cis- and trans- isomers of this compound. Groundwater concentrations as low as 1 percent of the effective solubility are commonly used to suggest the possible presence of NAPL.

Comparison of the 20 mg/l concentration of 1,2-DCE to the solubility limits recently published by Pankow and Cherry (1996), indicates that this maximum concentration represents 0.3 to 0.6 percent of its pure phase solubility. The existence of NAPL would not be expected based on these calculations. Although it is acknowledged that some sources have provided a solubility value for 1,2-DCE as low as 600 mg/l, the additional RI observations do not provide evidence to support the existence of NAPL. In particular, the absence of significant quantities of VOCs in the vadose zone soil, the absence of vertical migration of contaminants in the vicinity of the former lagoon/bermed area, and the absence of any visual observations of free phase product support the conclusion that NAPL is not present in the subsurface at the Cole-Zaiser site.

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	G01E09	G02E06	G03E09	G04E09	G05E09	G06E09
Location	G-1	G-2	G-3	G-4	G-5	G-6
Sample Type	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Sample Depth (feet)	9-11	6-8	9-11	9-11	9-11	8-10
Sample Date	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96
Units	ppm	ppm	ppm	ppm	ppm	ppm
ASP Volatiles						
1,1,1-Trichloroethane	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.017
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.023
1,1 Dichloroethene	0.005 U	0.005 U	0.005 U	0.069	0.005 U	0.005 U
cis-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.046
Ethylbenzene	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Toluene	0.219 U	0.097 U	0.122 U	0.097 U	0.097 U	0.097 U
Total Xylenes	0.127 U	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U
Trichloroethene	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Vinyl Chloride	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.686

NOTES: Compounds only listed if detected in at least one sample.

U - Non-detected at presented quantitation (QL).

Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter} * 0.0224 \text{ cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	G07E03	G08E09	G09E07	G10E11	G11E08	G12E06
Location	G-7	G-8	G-9	G-10	G-11	G-12
Sample Type	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Sample Depth (feet)	3-5	8-10	7-9	11-13	8-10	6-8
Sample Date	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96
Units	ppm	ppm	ppm	ppm	ppm	ppm
ASP Volatiles						
1,1,1-Trichloroethane	8.421	0.387	0.003 U	0.003 U	0.003 U	0.003 U
1,1-Dichloroethane	3.394	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,1 Dichloroethene	11.315	0.046	0.005 U	0.046	0.005 U	0.005 U
cis-1,2-Dichloroethene	34.639	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Ethylbenzene	0.444	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.346	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.013 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Toluene	2.435	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U
Total Xylenes	3.339	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U
Trichloroethene	0.017 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Vinyl Chloride	50.581	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation (QL).
Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter} * 0.0224 \text{ cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Depth (feet) Sample Date Units	G13E05 G-13 Soil Gas 5-7 6/19/96 ppm	G14E10 G-14 Soil Gas 10-12 6/20/96 ppm	G15E09 G-15 Soil Gas 9-11 6/20/96 ppm	G16E09 G-16 Soil Gas 9-11 6/20/96 ppm	G17E09 G-17 Soil Gas 9-11 6/20/96 ppm	G18E07 G-18 Soil Gas 7-9 6/20/96 ppm
ASP Volatiles						
1,1,1-Trichloroethane	0.135	0.003 U	0.034	0.101	0.003 U	0.003 U
1,1-Dichloroethane	0.023 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,1 Dichloroethene	0.023 U	0.005 U	1.409	0.439	0.005 U	0.005 U
cis-1,2-Dichloroethene	4.849	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Ethylbenzene	0.423 U	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.023 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Tetrachloroethene	28.337	0.003 U	0.003 U	0.013	0.003 U	0.003 U
Toluene	0.487 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U
Total Xylenes	0.845 U	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U
Trichloroethene	7.695	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Vinyl Chloride	0.036 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation (QL).
Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter} * 0.0224\ \text{cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	G19E02	G20E05	G21E08	G22E08	G23E09	G24E03
Location	G-19	G-20	G-21	G-22	G-23	G-24
Sample Type	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Sample Depth (feet)	2-4	5-7	8-10	8-10	9-11	3-5
Sample Date	6/20/96	6/20/96	6/20/96	6/20/96	6/20/96	6/20/96
Units	ppm	ppm	ppm	ppm	ppm	ppm
ASP Volatiles						
1,1,1-Trichloroethane	0.034	0.067	0.003 U	0.421	0.003 U	0.003 U
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,1 Dichloroethene	0.005 U	0.005 U	0.005 U	0.139	0.831	0.005 U
cis-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Ethylbenzene	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.003 U	0.003 U	0.003 U	0.216	0.003 U	0.003 U
Toluene	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U
Total Xylenes	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U
Trichloroethene	0.003 U	0.003 U	0.003 U	0.462	0.003 U	0.003 U
Vinyl Chloride	0.072	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation (QL).
Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter} * 0.0224 \text{ cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	G25E04	G26E03	G27E06	G28E08	G29E09	G30E04
Location	G-25	G-26	G-27	G-28	G-29	G-30
Sample Type	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas	Soil Gas
Sample Depth (feet)	4-6	3-5	6-8	8-10	9-10	4-6
Sample Date	6/20/96	6/20/96	6/20/96	6/20/96	6/20/96	6/20/96
Units	ppm	ppm	ppm	ppm	ppm	ppm
ASP Volatiles						
1,1,1-Trichloroethane	0.003 U	0.003 U	0.003 U	0.472	0.003 U	0.003 U
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,1 Dichloroethene	0.005 U	0.005 U	0.005 U	0.023	0.323	0.005 U
cis-1,2-Dichloroethene	0.005 U	0.092	0.005 U	0.005 U	0.005 U	0.005 U
Ethylbenzene	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.003 U	0.688	0.003 U	0.003 U	0.003 U	0.003 U
Toluene	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U
Total Xylenes	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U	0.169 U
Trichloroethene	0.003 U	1.317	0.003 U	0.003 U	0.003 U	0.003 U
Vinyl Chloride	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation (QL).
Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter * 0.0224 cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-1
GEOPROBE SOIL GAS ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Depth (feet) Sample Date Units	G31E03 G-31 Soil Gas 3-5 6/21/96 ppm	G32E08 G-32 Soil Gas 8-10 6/21/96 ppm	G33E08 G-33 Soil Gas 8-10 6/21/96 ppm
ASP Volatiles			
1,1,1-Trichloroethane	0.003 U	0.003 U	0.003 U
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U
1,1 Dichloroethene	0.005 U	0.005 U	0.600
cis-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U
Ethylbenzene	0.085 U	0.085 U	0.085 U
trans-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.003 U	0.003 U	0.003 U
Toluene	0.097 U	0.097 U	0.097 U
Total Xylenes	0.169 U	0.169 U	0.169 U
Trichloroethene	0.003 U	0.003 U	0.003 U
Vinyl Chloride	0.007 U	0.007 U	0.007 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation (QL).
Laboratory results converted to parts per million (ppm) as follows:

$$\text{ppm} = \frac{\text{mg/cu. meter} * 0.0224 \text{ cu. meter/mole}}{\text{molecular weight (mg/mole)}}$$

TABLE 5-2
GEOPROBE GROUNDWATER ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	P01E13	P02E13	P03E10	P04E10	P05E10	P06E10
Location	P-1	P-2	P-3	P-4	P-5	P-6
Sample Type	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth	13-15	13-15	10-12	10-12	10-12	10-12
Sample Date	06/20/96	06/20/96	06/20/96	06/20/96	06/21/96	06/21/96
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
ASP Volatiles						
1,1,1-Trichloroethane	0.008	0.028	0.005 U	0.005	0.180	0.180
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U	0.010	0.005 U	0.120
Acetone	0.100 U	0.100 U	0.100 U	0.120	0.100 U	2.000
cis-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U	0.005 U	0.010	2.200
Tetrachloroethene	0.006	0.008	0.005 U	0.005 U	0.005 U	0.100 U
Vinyl Chloride	0.005 U	0.005 U	0.005 U	0.160	0.005 U	1.100

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation limit (QL).

TABLE 5-2
GEOPROBE GROUNDWATER ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	P07E13	P08E10	P09E10
Location	P-7	P-8	P-9
Sample Type	Groundwater	Groundwater	Groundwater
Sample Depth	13-15	10-12	10-12
Sample Date	06/21/96	06/21/96	06/21/96
Units	mg/l	mg/l	mg/l
ASP Volatiles			
1,1,1-Trichloroethane	0.005 U	0.005 U	0.005 U
1,1-Dichloroethane	0.005 U	0.005 U	0.005 U
Acetone	0.100 U	0.100 U	0.100 U
cis-1,2-Dichloroethene	0.005 U	0.005 U	0.005 U
Tetrachloroethene	0.005 U	0.005 U	0.005 U
Vinyl Chloride	0.005 U	0.005 U	0.005 U

NOTES: Compounds only listed if detected in at least one sample.
U - Non-detected at presented quantitation limit (QL).

TABLE 5-3
SURFACE SOIL VOC, SVOC, AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	S01E00	S02E00	S03E00	S04E00	S04R00
Location	Soil Cleanup	S-1	S-2	S-3	S-4	S-4 Dup.
Sample Type	Objectives [(1)]	Soil	Soil	Soil	Soil	Soil
Sample Date		06/27/96	06/27/96	06/27/96	06/27/96	06/27/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Volatiles						
2-Butanone	300	12 UJ	3 J	11 UJ	10 UJ	11 UJ
Acetone	200	8 J	30	5 J	4 J	3 J
Benzene	60	12 U	12 U	11 U	10 U	11 U
Chloroform	300	12 U	12 U	2 J	10 U	11 U
Methylene Chloride	100	10 J	9 J	12 J	10 J	10 J
Tetrachloroethene	1,400	12 U	12 U	3 J	2 J	1 J
Toluene	1,500	12 U	12 U	2 J	10 U	1 J
Xylene (total)	1,200	12 U	12 U	11 U	10 U	11 U
ASP Semivolatiles						
4-Chloro-3-methylphenol	240 or QL	400 U	400 U	380 U	350 U	360 U
Bis(2-ethylhexyl)phthalate	50,000	75 J	64 J	87 J	76 J	87 J
Di-n-butylphthalate	8,100	400 U	400 U	380 U	350 U	360 U
Fluoranthene	50,000	400 U	400 U	380 U	350 U	360 U
Pentachlorophenol	1,000 or QL	950 U	260 J	910 U	830 U	860 U
Phenanthrene	50,000	400 U	400 U	380 U	350 U	360 U
ASP Pesticides/PCB						
4,4'-DDE	2,100	1.1 J	5.3 UJ	3.7 U	3.4 U	3.5 U
Aroclor-1254	1,000	39 UJ	96	37 U	34 U	35 U
Aroclor-1260	1,000	39 UJ	39 U	15 J	24 J	22 J

NOTES: Compounds only listed if detected in at least one sample.
QL - Quantitation Limit
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.

TABLE 5-3
SURFACE SOIL VOC, SVOC, AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	S05E00	S06E00	S07E00	S08E00	S01B00
Location	Soil Cleanup	S-5	S-6	S-7	S-8	Field Blank
Sample Type	Objectives (1)	Soil	Soil	Soil	Soil	Water
Sample Date		06/27/96	06/27/96	06/27/96	06/27/96	06/26/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L
ASP Volatiles						
2-Butanone	300	11 UJ	11 UJ	14 U	11 UJ	10 U
Acetone	200	3 J	11 UJ	14 UJ	8 J	10 U
Benzene	60	11 U	11 U	2 J	11 U	10 U
Chloroform	300	11 U	11 U	2 J	2 J	10 U
Methylene Chloride	100	11 UJ	11 UJ	20 J	9 J	10 UJ
Tetrachloroethene	1,400	11 U	7 J	3 J	3 J	10 U
Toluene	1,500	11 U	2 J	2 J	2 J	10 U
Xylene (total)	1,200	11 U	11 U	14 U	3 J	10 U
ASP Semivolatiles						
4-Chloro-3-methylphenol	240 or QL	370 U	38 J	480 UJ	360 UJ	10 U
Bis(2-ethylhexyl)phthalate	50,000	94 J	370 U	480 UJ	100 J	10 U
Di-n-butylphthalate	8,100	370 U	370 U	450 J	360 U	10 U
Fluoranthene	50,000	370 U	370 U	140 J	84 J	10 U
Pentachlorophenol	1,000 or QL	880 U	880 U	1100 U	870 UJ	26 UJ
Phenanthrene	50,000	370 U	370 U	52 J	360 UJ	10 U
ASP Pesticides/PCB						
4,4'-DDE	2,100	3.6 U	16 UJ	23 UJ	4.4 U	0.1 UJ
Aroclor-1254	1,000	36 U	320 J	590 J	36 U	1 UJ
Aroclor-1260	1,000	36 U	36 UJ	47 U	52 J	1 UJ

NOTES: Compounds only listed if detected in at least one sample.
QL - Quantitation Limit
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.

TABLE 5-4
SURFACE SOIL INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	S01E00	S02E00	S03E00	S04E00	S04R00
Location	Soil Cleanup	S-1	S-2	S-3	S-4	S-4 Dup.
Sample Type	Objectives (1)	Soil	Soil	Soil	Soil	Soil
Sample Date		06/27/96	06/27/96	06/27/96	06/27/96	06/27/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Inorganics						
Aluminum	SB	8,790	9,010	9,780	4,500	5,290
Arsenic	7.5 or SB	1.2 U	1.7 J	3.4	1.1 U	1 U
Barium	300 or SB	38.5 J	42.7 J	27.5 J	16.6 J	20.7 J
Beryllium	0.16 or SB	0.15 J	**0.19 J**	**0.21 J**	0.09 J	0.12 J
Cadmium	1 or SB	0.3 J	0.31 J	0.38 J	0.31 J	0.22 J
Calcium		989 J	645 J	837 J	482 J	398 J
Chromium	10 or SB	7	8.3	7.7	6.4	5.6
Cobalt	30 or SB	3.7 J	6.7 J	4.7 J	2.5 J	3.1 J
Copper	25 or SB	**29.8**	**83.8**	**104**	**32.4**	**28.2**
Cyanide		0.61 UJ	0.58 UJ	0.56 UJ	0.57 UJ	0.49 UJ
Iron	2,000 or SB	**12,900**	**22,000**	**15,500**	**11,700**	**11,500**
Lead	SB (2)	13 U	39.8	10.7 U	54.7	43.2
Magnesium	SB	1,840	1,610	2,250	1,210	1,470
Manganese	SB	478	627	816	324	355
Mercury	0.1	**0.16**	**0.26**	**0.21**	0.1 U	**0.12**
Nickel	13 or SB	6.9 J	9.9	9.1	6.2 J	7.7 J
Potassium	SB	1,560	1,080 J	716 J	447 J	526 J
Selenium	2 or SB	1 U	1.6 J	0.87 U	0.87 U	1 J
Vanadium	150 or SB	13.8	16.2	16.9	8.6 J	10.1
Zinc	20 or SB	**38.1**	**55.6**	**48.3**	**48.8**	**44.9**

NOTES: Compounds only listed if detected in at least one sample.
SB - Site Background
Bold indicates concentration exceed NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg.

TABLE 5-4
SURFACE SOIL INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	S05E00	S06E00	S07E00	S08E00	S01B00
Location	Soil Cleanup	S-5	S-6	S-7	S-8	Field Blank
Sample Type	Objectives (1)	Soil	Soil	Soil	Soil	Water
Sample Date		06/27/96	06/27/96	06/27/96	06/27/96	06/26/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/L
Inorganics						
Aluminum	SB	6,750	7,350	8,840	8,010	133 U
Arsenic	7.5 or SB	**8.5**	2.4	2.1 J	2.5	5.2 U
Barium	300 or SB	17 J	45.8	57.5	56.1	13 U
Beryllium	0.16 or SB	**0.22 J**	**0.22 J**	**0.2 J**	0.16 J	0.2 U
Cadmium	1 or SB	0.29 J	**1.4**	**1.1 J**	0.41 J	0.51 J
Calcium		2,030	1,200	3,210	1,500	286 J
Chromium	10 or SB	6.3	**14.2**	9.1	7.5	8.3 U
Cobalt	30 or SB	4.6 J	5.4 J	5.6 J	3.3 J	2.1 U
Copper	25 or SB	19.2	**557 J**	**71.4**	15.9	7.6 J
Cyanide		0.52 UJ	7.4 J	2 J	0.54 U	10 U
Iron	2,000 or SB	**12,900**	**19,700**	**18,500**	**11,500**	102
Lead	SB (2)	16 U	**217**	**78.3**	45.4	18.5
Magnesium	SB	2,990	2,690	2,080	1,500	354 U
Manganese	SB	456	579	1,370	638	2.2 J
Mercury	0.1	**0.16**	**0.14**	**0.19**	**0.5**	0.2 U
Nickel	13 or SB	11.2	**18.8**	10 J	5.8 J	6.9 J
Potassium	SB	999 J	696 J	764 J	1,570	426 U
Selenium	2 or SB	0.92 U	1.3	1.4	0.86 U	4.3 U
Vanadium	150 or SB	12.2	13.3	16.8	13.7	2.3 U
Zinc	20 or SB	**36.2**	**105 J**	**70**	**78.3**	**22.9**

NOTES: Compounds only listed if detected in at least one sample.
SB - Site Background
Bold indicates concentration exceed NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg.

TABLE 5-5
SOIL BORING VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B02E08	B02E10	B03E04	B03E08	B04E02
Location	Soil Cleanup	B-2	B-2	B-3	B-3	B-4
Sample Type	Objectives (1)	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		8-10 ft.	10-12 ft.	4-6 ft.	8-10 ft.	2-4 ft.
Sample Date		06/24/96	06/24/96	06/25/96	06/25/96	06/25/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Volatiles						
1,1,1-Trichloroethane	800	11 U	11 U	12 U	11 U	12 U
1,2-Dichloroethene (total)	300 (2)	11 U	11 U	1 J	11 U	2 J
Acetone	200	11 U	5 J	12 UR	4 J	12 UR
Ethylbenzene	5,500	11 U	11 U	12 U	11 U	12 U
Methylene Chloride	100	11 UJ	11 UJ	12 UJ	11 UJ	14 U
Tetrachloroethene	1,400	11 U	11 U	12 U	11 U	2 J
Toluene	1,500	11 U	11 U	12 U	11 U	12 U
Trichloroethene	700	11 U	11 U	12 U	11 U	12 U
Xylene (total)	1,200	11 U	11 U	12 U	11 U	12 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Soil cleanup objective is for trans-1,2-dichloroethene only.

TABLE 5-5
SOIL BORING VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B04E06	B05E04	B05E06	B06E04	B06E06
Location	Soil Cleanup	B-4	B-5	B-5	B-6	B-6
Sample Type	Objectives (1)	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		6-8 ft.	4-6 ft.	6-8 ft.	4-6 ft.	6-8 ft.
Sample Date		06/25/96	06/25/96	06/25/96	06/25/96	06/25/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Volatiles						
1,1,1-Trichloroethane	800	11 U	11 U	12 U	11 U	11 U
1,2-Dichloroethene (total)	300 (2)	11 U	11 U	12 U	11 U	11 U
Acetone	200	11 UR	11 UR	12 UR	11 UR	8 J
Ethylbenzene	5,500	11 U	11 U	12 U	11 U	11 U
Methylene Chloride	100	11 U	12 U	12 UJ	11 UJ	11 UJ
Tetrachloroethene	1,400	1 J	7 J	6 J	3 J	11 U
Toluene	1,500	11 U	11 U	12 U	11 U	11 U
Trichloroethene	700	11 U	11 U	1 J	11 U	11 U
Xylene (total)	1,200	11 U	11 U	12 U	11 U	11 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Soil cleanup objective is for trans-1,2-dichloroethene only.

TABLE 5-5
SOIL BORING VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Depth Sample Date Units	NYS DEC Soil Cleanup Objectives (1) ug/kg	B07E06 B-7 Soil Boring 6-8 ft. 06/26/96 ug/kg	B07R06 B-7 Dup. Soil Boring 6-8 ft. 06/26/96 ug/kg	B07E08 B-7 Soil Boring 8-10 ft. 06/26/96 ug/kg	B08E04 B-8 Soil Boring 4-6 ft. 06/26/96 ug/kg	B08E06 B-8 Soil Boring 6-8 ft. 06/26/96 ug/kg
ASP Volatiles						
1,1,1-Trichloroethane	800	11 U	11 U	11 U	11 U	12 U
1,2-Dichloroethene (total)	300 (2)	11 U	11 U	11 U	11 U	4 J
Acetone	200	11 U	11 U	11 U	7 J	6 J
Ethylbenzene	5,500	11 U	11 U	11 U	11 U	12 U
Methylene Chloride	100	11 UJ	11 UJ	11 UJ	11 UJ	12 UJ
Tetrachloroethene	1,400	11 U	11 U	11 U	11 U	12 UJ
Toluene	1,500	11 U	11 U	11 U	11 U	12 U
Trichloroethene	700	11 U	11 U	11 U	11 U	12 U
Xylene (total)	1,200	11 U	11 U	11 U	11 U	12 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Soil cleanup objective is for trans-1,2-dichloroethene only.

TABLE 5-5
SOIL BORING VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B09E04	B08B06
Location	Soil Cleanup	B-9	Field Blank
Sample Type	Objectives (1)	Soil Boring	Water
Sample Depth		4-6 ft..	
Sample Date		06/27/96	06/26/96
Units	ug/kg	ug/kg	ug/L
ASP Volatiles			
1,1,1-Trichloroethane	800	1 J	10 U
1,2-Dichloroethene (total)	300 (2)	11 UJ	10 U
Acetone	200	11 U	10 U
Ethylbenzene	5,500	2 J	10 U
Methylene Chloride	100	9 J	10 U
Tetrachloroethene	1,400	11 U	10 U
Toluene	1,500	2 J	10 U
Trichloroethene	700	11 U	10 U
Xylene (total)	1,200	11 J	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Soil cleanup objective is for trans-1,2-dichloroethene only.

TABLE 5-6
SOIL BORING SVOC AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B01E01	B01E03	B01E05	B01E11	B02E08
Location	Soil Cleanup	B-1	B-1	B-1	B-1	B-2
Sample Type	Objectives [(1)]	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		1-3 ft.	3-5 ft.	5-7 ft.	11-13 ft.	8-10 ft.
Sample Date		06/24/96	06/24/96	06/24/96	06/24/96	06/24/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Semivolatiles						
2-Methylnaphthalene	36,400					370 U
bis(2-Ethylhexyl)phthalate	50,000					110 J
Di-n-butylphthalate	8,100					370 U
Diethylphthalate	7,100					370 U
Fluoranthene	50,000					370 U
Phenanthrene	50,000					370 U
Pyrene	50,000					370 U
ASP Pesticides/PCBs						
4,4'-DDE	2,100	3.7 U	3.7 U	3.9 U	3.8 U	20 U
alpha-BHC	110	1.9 U	1.9 U	2 U	2 U	1.9 U
Aroclor-1248	1,000 - 10,000 (2)	37 U	37 U	39 U	38 U	1,400 E
Aroclor-1254	1,000 - 10,000 (2)	37 U	37 U	39 U	38 U	36 U
Aroclor-1260	1,000 - 10,000 (2)	37 U	37 U	39 U	38 U	36 U
delta-BHC	300	1.9 U	1.9 U	2 U	2 U	1.9 U
Dieldrin	44	3.6 J	3.7 U	3.9 U	3.8 U	3.6 U
Endosulfan I	900	1.9 U	1.9 U	2 U	2 U	4.3 U
Endrin	100	3.7 U	3.7 U	3.9 U	3.8 U	3.6 U
Heptachlor	100	1.9 U	1.9 U	2 U	2 U	9.9 U
Heptachlor epoxide	20	1.9 U	1.9 U	2 U	2 U	1.9 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) 1,000 ug/kg for surface soil and 10,000 ug/kg for subsurface soil.

TABLE 5-6
SOIL BORING SVOC AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Depth Sample Date Units	NYS DEC Soil Cleanup Objectives (1) ug/kg	B02E10 B-2 Soil Boring 10-12 ft. 06/24/96 ug/kg	B03E04 B-3 Soil Boring 4-6 ft. 06/25/96 ug/kg	B03E08 B-3 Soil Boring 8-10 ft. 06/25/96 ug/kg	B04E02 B-4 Soil Boring 2-4 ft. 06/25/96 ug/kg	B04E06 B-4 Soil Boring 6-8 ft. 06/25/96 ug/kg
ASP Semivolatiles						
2-Methylnaphthalene	36,400	380 U	390 U	370 U	390 U	380 U
bis(2-Ethylhexyl)phthalate	50,000	66 J	51 J	370 U	390 U	91 J
Di-n-butylphthalate	8,100	380 U	390 U	370 U	390 U	380 U
Diethylphthalate	7,100	380 U	390 U	370 U	390 U	380 U
Fluoranthene	50,000	380 U	390 U	370 U	390 U	380 U
Phenanthrene	50,000	380 U	390 U	370 U	390 U	380 U
Pyrene	50,000	380 U	390 U	370 U	390 U	380 U
ASP Pesticides/PCBs						
4,4'-DDE	2,100	3.8 UJ	3.9 UR	3.7 U	3.9 U	3.8 U
alpha-BHC	110	2 UJ	2 UR	1.9 U	2 U	2 U
Aroclor-1248	1,000 - 10,000 (2)	28 J	39 UR	37 U	42 J	38 U
Aroclor-1254	1,000 - 10,000 (2)	38 UJ	39 UR	37 U	39 U	38 U
Aroclor-1260	1,000 - 10,000 (2)	38 UJ	39 UR	45	39 U	38 U
delta-BHC	300	2 UJ	2 UR	1.9 U	2 U	2 U
Dieldrin	44	3.8 UJ	3.9 UR	3.7 U	3.9 U	3.8 U
Endosulfan I	900	2 UJ	2 UR	1.9 U	2 U	2 U
Endrin	100	3.8 UJ	3.9 UR	3.7 U	3.9 U	3.8 U
Heptachlor	100	2 UJ	2 UR	1.9 U	2 U	2 U
Heptachlor epoxide	20	2 UJ	2 UR	1.9 U	2 U	2 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) 1,000 ug/kg for surface soil and 10,000 ug/kg for subsurface soil.

TABLE 5-6
SOIL BORING SVOC AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B05E04	B05E06	B06E04	B06E06	B07E06
Location	Soil Cleanup	B-5	B-5	B-6	B-6	B-7
Sample Type	Objectives (1)	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		4-6 ft.	6-8 ft.	4-6 ft.	6-8 ft.	6-8 ft.
Sample Date		06/25/96	06/25/96	06/25/96	06/25/96	06/26/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Semivolatiles						
2-Methylnaphthalene	36,400	380 U	400 U	380 U	380 U	370 U
bis(2-Ethylhexyl)phthalate	50,000	270 J	380 J	380 U	80 J	140 J
Di-n-butylphthalate	8,100	380 U	400 U	380 U	53 J	370 U
Diethylphthalate	7,100	380 U	1,100	380 U	120 J	370 U
Fluoranthene	50,000	380 U	400 U	380 U	44 J	370 U
Phenanthrene	50,000	380 U	400 U	380 U	92 J	370 U
Pyrene	50,000	380 U	400 U	380 U	38 J	370 U
ASP Pesticides/PCBs						
4,4'-DDE	2,100	3.8 U	3.9 UJ	3.7 UJ	2.9 J	3.7 UR
alpha-BHC	110	2 U	2 UJ	1.9 UJ	1 J	1.9 UR
Aroclor-1248	1,000 - 10,000 (2)	38 U	39 UJ	37 UJ	37 UJ	37 UR
Aroclor-1254	1,000 - 10,000 (2)	38 U	11 J	37 UJ	37 UJ	37 UR
Aroclor-1260	1,000 - 10,000 (2)	38 U	39 UJ	37 UJ	37 UJ	37 UR
delta-BHC	300	2 U	2 UJ	1.9 UJ	2.1 J	1.9 UR
Dieldrin	44	3.8 U	3.9 UJ	3.7 UJ	3.7 UJ	3.7 UR
Endosulfan I	900	2 U	2 UJ	1.9 UJ	1.1 J	1.9 UR
Endrin	100	3.8 U	3.9 UJ	4 J	1.7 J	3.7 UR
Heptachlor	100	2 U	2 UJ	1.9 UJ	1.5 J	1.9 UR
Heptachlor epoxide	20	2 U	2 UJ	2.2 J	1.9 UJ	1.9 UR

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) 1,000 ug/kg for surface soil and 10,000 ug/kg for subsurface soil.

TABLE 5-6
SOIL BORING SVOC AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B07R06	B07E08	B08E04	B08E06	B09E04
Location	Soil Cleanup	B-7 Dup.	B-7	B-8	B-8	B-9
Sample Type	Objectives (1)	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		6-8 ft.	8-10 ft.	4-6 ft.	6-8 ft.	4-6 ft.
Sample Date		06/26/96	06/26/96	06/26/96	06/26/96	06/27/96
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
ASP Semivolatiles						
2-Methylnaphthalene	36,400	370 U	370 U	370 U	79 J	370 U
bis(2-Ethylhexyl)phthalate	50,000	130 J	240 J	49 J	140 J	88 J
Di-n-butylphthalate	8,100	370 U	370 U	370 U	58 J	370 UJ
Diethylphthalate	7,100	370 U	370 U	370 U	390 U	370 U
Fluoranthene	50,000	370 U	370 U	370 U	56 J	370 UJ
Phenanthrene	50,000	370 U	370 U	370 U	46 J	370 UJ
Pyrene	50,000	370 U	370 U	370 U	40 J	370 UJ
ASP Pesticides/PCBs						
4,4'-DDE	2,100	42 UJ	3.7 U	2.1 J	42 UJ	3.7 UJ
alpha-BHC	110	1.9 UJ	1.9 U	1.9 U	2 UJ	1.9 UJ
Aroclor-1248	1,000 - 10,000 (2)	2,800 EJ	37 U	120	3,400 EJ	37 UJ
Aroclor-1254	1,000 - 10,000 (2)	37 UJ	37 U	37 U	38 UJ	37 UJ
Aroclor-1260	1,000 - 10,000 (2)	580 J	37 U	37 U	38 UJ	37 UJ
delta-BHC	300	1.9 UJ	1.9 U	1.9 U	2 UJ	1.9 UJ
Dieldrin	44	3.7 UJ	3.7 U	3.7 U	3.8 UJ	3.7 UJ
Endosulfan I	900	6.8 UJ	1.9 U	1.9 U	9.4 UJ	1.9 UJ
Endrin	100	3.7 UJ	3.7 U	3.7 U	3.8 UJ	3.7 UJ
Heptachlor	100	14 UJ	1.9 U	1.9 U	14 UJ	1.9 UJ
Heptachlor epoxide	20	1.9 UJ	1.9 U	1.9 U	2.2 UJ	1.9 UJ

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) 1,000 ug/kg for surface soil and 10,000 ug/kg for subsurface soil.

TABLE 5-6
SOIL BORING SVOC AND PESTICIDE/PCB ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B08B06
Location	Soil Cleanup	Field Blank
Sample Type	Objectives (1)	Water
Sample Depth		
Sample Date		06/26/96
Units	ug/kg	ug/L
ASP Semivolatiles		
2-Methylnaphthalene	36,400	10 U
bis(2-Ethylhexyl)phthalate	50,000	10 U
Di-n-butylphthalate	8,100	10 U
Diethylphthalate	7,100	10 U
Fluoranthene	50,000	10 U
Phenanthrene	50,000	10 U
Pyrene	50,000	10 U
ASP Pesticides/PCBs		
4,4'-DDE	2,100	0.1 U
alpha-BHC	110	0.05 U
Aroclor-1248	1,000 - 10,000 (2)	1 U
Aroclor-1254	1,000 - 10,000 (2)	1 U
Aroclor-1260	1,000 - 10,000 (2)	1 U
delta-BHC	300	0.05 U
Dieldrin	44	0.1 U
Endosulfan I	900	0.05 U
Endrin	100	0.1 U
Heptachlor	100	0.05 U
Heptachlor epoxide	20	0.05 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
R - Data unusable due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) 1,000 ug/kg for surface soil and 10,000 ug/kg for subsurface soil.

TABLE 5-7
SOIL BORING INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B02E08	B02E10	B03E04	B03E08	B04E02	B04E06
Location	Soil Cleanup	B-2	B-2	B-3	B-3	B-4	B-4
Sample Type	Objectives [(1)]	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		8-10 ft.	10-12 ft.	4-6 ft.	8-10 ft.	2-4 ft.	6-8 ft.
Sample Date		06/24/96	06/24/96	06/25/96	06/25/96	06/25/96	06/25/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Inorganics							
Aluminum	SB	3,880	4,030	9,100	4,510	6,330	5,790
Arsenic	7.5 or SB	1 U	1.1 U	2 J	1.1 U	1.2 U	1.3 J
Barium	300 or SB	26.9 J	22.5 J	24.6 J	22.3 J	13.3 J	29.7 J
Beryllium	0.16 or SB	0.16 J	**0.17 J**	**0.22 J**	0.16 J	0.13 J	**0.27 J**
Cadmium	1 or SB	0.1 U	0.11 U	0.18 J	0.11 U	0.14 J	0.13 J
Calcium		1,110	1,250	1,350	856 J	467 J	974 J
Chromium	10 or SB	5.4	6	**10.6**	6.5	7.1	8.4
Cobalt	30 or SB	3.6 J	3.6 J	4.3 J	3.8 J	3.5 J	4.7 J
Copper	25 or SB	3.4 J	2.9 J	7.4	3.1 J	3.2 J	5.1 J
Cyanide		0.44 U	0.62 U	0.62 U	0.54 U	0.63 U	0.67 U
Iron	2,000 or SB	**8,530**	**8,890**	**14,700**	**9,440**	**8,810**	**11,800**
Lead	SB (2)	2.8 U	2.8 U	16 U	2.3 U	3.8 U	4 U
Magnesium	SB	2,190	2,120	2,120	2,080	1,720	2,180
Manganese	SB	347	322	359	269	193	418
Mercury	0.1	0.11 U	0.11 U	**0.14**	0.11 U	0.12 U	0.11 U
Nickel	13 or SB	8.6	8.4 J	8 J	8 J	7 J	10.3
Potassium	SB	596 J	731 J	680 J	850 J	640 J	977 J
Sodium	SB	174 U	188 U	204 U	190 U	204 U	198 U
Thallium	SB	1.5 U	1.7 U	1.8 U	1.7 U	1.8 U	2.4
Vanadium	150 or SB	6.4 J	7.4 J	16.5	8.2 J	10.2 J	12
Zinc	20 or SB	15.8	15.7	**34.2**	15.6	**28.8**	**22**

NOTES: Compounds only listed if detected in at least one sample.
SB - Site Background
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg.

TABLE 5-7
SOIL BORING INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC Soil Cleanup Objectives (1)	B05E04	B05E06	B06E04	B06E06	B07E06	B07E08
Location		B-5	B-5	B-6	B-6	B-7	B-7
Sample Type		Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Soil Boring
Sample Depth		4-6 ft.	6-8 ft.	4-6 ft.	6-8 ft.	6-8 ft.	8-10 ft.
Sample Date		06/25/96	06/25/96	06/25/96	06/25/96	06/26/96	06/26/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Inorganics							
Aluminum	SB	5,730	4,100	7,350	6,280	4,140	5,770
Arsenic	7.5 or SB	1.7 J	1.3 J	1.8 J	1.2 U	1.1 U	1.1 U
Barium	300 or SB	18.5 J	17.2 J	23.6 J	19.7 J	22 J	27.9 J
Beryllium	0.16 or SB	**0.19 J**	0.15 J	**0.28 J**	**0.19 J**	0.15 J	**0.19 J**
Cadmium	1 or SB	0.24 J	0.97 J	0.11 U	0.11 U	0.11 U	0.11 U
Calcium		677 J	673 J	790 J	587 J	1,060 J	968 J
Chromium	10 or SB	7.7	6.1	8.5	7.2	7.4	8.6
Cobalt	30 or SB	4.2 J	3.5 J	5 J	4.2 J	3.4 J	3.7 J
Copper	25 or SB	11.3	4.7 J	3.6 J	3.8 J	3.1 J	3.2 J
Cyanide		0.54 U	1.6	0.55 U	0.55 U	0.51 U	2.6 U
Iron	2,000 or SB	**11,900**	**7,690**	**13,000**	**10,500**	**9,380**	**10,500**
Lead	SB (2)	10.5 U	4.4 U	2.9 U	2.5	3.2 U	4.4 U
Magnesium	SB	1,910	1,650	2,940	2,270	1,920	2,110
Manganese	SB	325	289	243	163	307	320
Mercury	0.1	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U
Nickel	13 or SB	8.3 J	7.4 J	11.2	8.8 J	7.2 J	7.8 J
Potassium	SB	672 J	646 J	1,310	1,170	769 J	1,120
Sodium	SB	191 U	211 U	190 U	199 U	194 U	195 U
Thallium	SB	1.7 U	1.9 J	1.7 UJ	1.7 UJ	1.7 UJ	2 J
Vanadium	150 or SB	11.3	7.3 J	11.8	10.1 J	8 J	10.6 J
Zinc	20 or SB	**20.4**	14.8	**20.5**	17.2	14.8	18.9

NOTES: Compounds only listed if detected in at least one sample.
SB - Site Background
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg.

TABLE 5-7
SOIL BORING INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYS DEC	B07R06	B08E04	B08E06	B09E04	B08B06
Location	Soil Cleanup	B-7 DUP.	B-8	B-8	B-9	Field Blank
Sample Type	Objectives (1)	Soil Boring	Soil Boring	Soil Boring	Soil Boring	Water
Sample Depth		6-8 ft.	4-6 ft.	6-8 ft.	4-6 ft.	
Sample Date		06/26/96	06/26/96	06/26/96	06/27/96	06/26/96
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/L
Inorganics						
Aluminum	SB	4,950	5,370	4,930	4,730	133 U
Arsenic	7.5 or SB	1.1 U	1.1 U	1.1 U	1.1 U	5.2 U
Barium	300 or SB	24.9 J	15.2 J	39 J	30.8 J	13 U
Beryllium	0.16 or SB	**0.19 J**	**0.23 J**	**0.21 J**	**0.19 J**	0.2 U
Cadmium	1 or SB	0.11 U	0.12 J	0.11 U	0.11 U	0.5 U
Calcium		1,030 J	786 J	1,070 J	958 J	775 J
Chromium	10 or SB	10	7.7	5.2	5.3	8.3 U
Cobalt	30 or SB	3.6 J	4.1 J	3.7 J	3.4 J	2.1 U
Copper	25 or SB	3.6 J	5.8	9.3 J	3.6 J	6 J
Cyanide		0.54 U	0.57 U	0.64 U	0.55 UJ	10 U
Iron	2,000 or SB	**10,100**	**10,400**	**9,860**	**9,180**	208
Lead	SB (2)	3 U	3.6 U	2.1 UJ	2.4 UJ	15.2
Magnesium	SB	2,110	2,240	2,260	2,040	1,230 J
Manganese	SB	319	166	241	296	5 J
Mercury	0.1	**0.56**	0.11 U	0.12 U	**0.21**	0.2 U
Nickel	13 or SB	7.9 J	9.2	7.6 J	7.5 J	4.2 U
Potassium	SB	1,040 J	1,020 J	1,050 J	836 J	426 U
Sodium	SB	196 U	186 U	195 U	195 U	9,440
Thallium	SB	1.7 UJ	1.6 UJ	1.7 U	1.7 U	7.8 U
Vanadium	150 or SB	9.3 J	9.9 J	8.6 J	7.3 J	2.3 U
Zinc	20 or SB	16.2	**22.5**	15.7 J	15.5 J	11.6 J

NOTES: Compounds only listed if detected in at least one sample.
SB - Site Background
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg.

TABLE 5-8
TEST PIT SOIL VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Depth Sample Date Units	NYS DEC Soil Cleanup Objectives [(1)] ug/kg	T1AE03 TP-1A Test Pit Soil 3 ft. 10/28/97 ug/kg	T1AE05 TP-1A Test Pit Soil 5 ft. 10/28/97 ug/kg	T1AE08 TP-1A Test Pit Soil 8 ft. 10/28/97 ug/kg	T1BE06 TP-1B Test Pit Soil 6 ft. 10/28/97 ug/kg
ASP Volatiles					
1,1,1-Trichloroethane	800	110	59 U	7 J	11 U
1,1,2,2-Tetrachloroethane		70 U	59 U	56 U	11 U
1,1,2-Trichloroethane		70 U	59 U	56 U	11 U
1,1-Dichloroethane	200	150	59 U	56 U	11 U
1,2-Dichloroethene (total)	300 (2)	**2,200**	59 U	56 U	11 U
2-Butanone		76	59 U	56 U	11 U
2-Hexanone		70 U	59 U	56 U	11 U
Acetone	200	180	11 J	56 U	11 U
Benzene	60	16 J	59 U	56 U	11 U
Chlorobenzene		70 U	59 U	56 U	11 U
Dibromochloromethane		600	59 U	56 U	11 U
Ethylbenzene	5,500	1,300	9 J	33 J	11 U
Methylene Chloride	100	70 U	59 U	56 U	11 U
Styrene		70 U	59 U	56 U	11 U
Tetrachloroethene	1,400	1,200	59 U	120	11 U
Toluene	1,500	**1,800 J**	59 U	47 J	11 U
trans-1,3-Dichloropropene		70 U	59 U	56 U	11 U
Trichloroethene	700	77	59 U	56 U	11 U
Vinyl Chloride		46 J	59 U	56 U	11 U
Xylene (total)	1,200	**50,000 EJ**	140	380	11 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Soil Cleanup Objective.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E- Result reported from secondary dilution analysis.
(1) Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, as published by NYSDEC, January 24, 1994.
(2) Soil cleanup objective is for trans-1,2-dichloroethene only.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	M01E00	M01E00	M02E00	M02E00	M02E00
Location	Groundwater	MW-1	MW-1	MW-2	MW-2	MW-2
Sample Type	Quality STDs (1)	Water	Water	Water	Water	Water
Sample Date		07/26/96	01/23/97	07/26/96	01/23/97	10/27/97
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	5	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	10 U	10 U	2 J	10 U	10 U
Acetone	50	10 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 U	10 UJ	10 U	10 UJ	10 U
Carbon Disulfide	50	10 U	3 J	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 UJ	10 U	10 UJ	10 U	10 U
Tetrachloroethene	5	10 U	10 U	10 U	10 U	10 U
Toluene	5	10 U	10 UJ	10 U	10 UJ	10 U
Trichloroethene	5	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	2	10 U	10 UJ	10 U	10 UJ	10 U
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	M2AE00	M03E00	M03E00	M03E00	M04E00
Location	Groundwater	MW-2A	MW-3	MW-3	MW-3	MW-4
Sample Type	Quality STDs [1]	Water	Water	Water	Water	Water
Sample Date		2/7/97	07/26/96	01/23/97	10/27/97	07/26/96
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	**36**	**40**	**93**	1 J
1,1-Dichloroethane	5	10 U	**100**	**90 J**	**160**	2 J
1,1-Dichloroethene	5	10 U	10 U	2 J	4 J	10 U
1,2-Dichloroethene (total)	5 (2)	10 U	**930 E**	**2,100 E**	**5,400 E**	**38**
Acetone	50	11 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 UJ	10 U	10 UJ	10 U	10 U
Carbon Disulfide	50	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	2 J	10 U
Methylene Chloride	5	10 U	10 UJ	10 U	10 U	10 UJ
Tetrachloroethene	5	10 U	**6 J**	**30**	**34**	1 J
Toluene	5	10 UJ	10 U	2 J	**14**	10 U
Trichloroethene	5	10 U	3 J	**14 J**	**18**	1 J
Vinyl Chloride	2	10 U	**120**	**2,200 EJ**	**2,900 E**	**20**
Xylene (total)	5	10 U	10 U	10 U	4 J	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Date Units	NYSDEC Groundwater Quality STDs (1) ug/L	M04E00 MW-4 Water 01/23/97 ug/L	M04E00 MW-4 Water 10/27/97 ug/L	M4AE00 MW-4A Water 01/23/97 ug/L	M4AE00 MW-4A Water 10/27/97 ug/L	M05E00 MW-5 Water 07/26/96 ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	2 J	10 U	10 U	3 J
1,1-Dichloroethane	5	10 U	4 J	10 U	10 U	3 J
1,1-Dichloroethene	5	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	2 J	**48**	10 U	10 U	2 J
Acetone	50	10 U	10 U	15	10 U	10 U
Benzene	0.7	10 UJ	10 U	**23 J**	10 U	10 U
Carbon Disulfide	50	3 J	10 U	10 U	4 J	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 U	10 U	10 U	10 U	10 UJ
Tetrachloroethene	5	10 U	10 U	10 U	10 U	10 U
Toluene	5	10 UJ	10 U	10 UJ	10 U	10 U
Trichloroethene	5	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	2	10 UJ	**60**	10 U	10 U	10 U
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Date Units	NYSDEC Groundwater Quality STDs [(1)] ug/L	M05E00 MW-5 Water 01/23/97 ug/L	M05E00 MW-5 Water 10/27/97 ug/L	M06E00 MW-6 Water 07/26/96 ug/L	M06E00 MW-6 Water 01/23/97 ug/L	M06E00 MW-6 Water 10/27/97 ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	**24**	**840 E**	**670 E**	**160**
1,1-Dichloroethane	5	10 U	3 J	**43**	**31** J	**48**
1,1-Dichloroethene	5	10 U	10 U	**11**	5 J	3 J
1,2-Dichloroethene (total)	5 (2)	10 U	10 U	**20**	**16**	**10**
Acetone	50	10 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 UJ	10 U	10 U	10 UJ	10 U
Carbon Disulfide	50	10 U	10 U	3 J	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 U	10 U	10 UJ	10 U	10 U
Tetrachloroethene	5	10 U	1 J	**6 J**	5 J	4 J
Toluene	5	10 UJ	10 U	10 U	10 UJ	10 U
Trichloroethene	5	10 U	10 U	4 J	2 J	3 J
Vinyl Chloride	2	10 UJ	10 U	1 J	**3 J**	**26**
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	M6AE00	M07E00	M07R00	M07E00	M07R00
Location	Groundwater	MW-6A	MW-7	MW-7 Dup.	MW-7	MW-7 Dup.
Sample Type	Quality STDs (1)	Water	Water	Water	Water	Water
Sample Date		01/23/97	07/26/96	07/26/96	01/23/97	01/23/97
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	**92**	**100**	**440 EJ**	**460 EJ**
1,1-Dichloroethane	5	10 U	**91**	**100**	**270 EJ**	**280 EJ**
1,1-Dichloroethene	5	10 U	4 J	3 J	**11**	**14**
1,2-Dichloroethene (total)	5 (2)	10 U	**8,700 E**	**10,000 E**	**20,000 E**	**20,000 E**
Acetone	50	10 U	10 U	10 U	10 U	**51**
Benzene	0.7	10 UJ	10 U	10 U	**2 J**	**2 J**
Carbon Disulfide	50	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	1 J
Methylene Chloride	5	10 U	10 UJ	10 UJ	10 U	10 U
Tetrachloroethene	5	10 U	**430 EJ**	**490 E**	**50**	**32**
Toluene	5	10 UJ	**14**	**17**	**29 J**	**47 J**
Trichloroethene	5	10 U	**200**	**280 EJ**	**270 EJ**	**270 EJ**
Vinyl Chloride	2	10 UJ	**150**	**150**	**790 EJ**	**410 EJ**
Xylene (total)	5	10 U	10 U	10 U	10 U	2 J

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Date Units	NYSDEC Groundwater Quality STDs (1) ug/L	M07E00 MW-7 Water 10/28/97 ug/L	M07R00 MW-7 Water 10/28/97 ug/L	M7AE00 MW-7A Water 01/23/97 ug/L	M7BE00 MW-7B Water 01/23/97 ug/L	RLWE00 LOWE WELL Water 07/26/96 ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	**100**	**94**	10 U	10 U	10 U
1,1-Dichloroethane	5	**52**	**47**	10 U	10 U	10 U
1,1-Dichloroethene	5	2 J	2 J	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	**2,500 EJ**	**2,900 E**	**11**	5 J	10 U
Acetone	50	10 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 U	10 U	10 UJ	10 UJ	10 U
Carbon Disulfide	50	10 U	10 U	2 J	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 U	10 U	10 U	10 U	10 UJ
Tetrachloroethene	5	**25**	**24**	10 U	10 U	10 U
Toluene	5	10 U	10 U	10 UJ	10 UJ	10 U
Trichloroethene	5	**24**	**22**	10 U	10 U	10 U
Vinyl Chloride	2	**110**	**98**	10 UJ	10 UJ	10 U
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	RLWE00	RT1E00	RT1E00	RT2E00	RT2E00
Location	Groundwater	LOWE WELL	TMB-01	TMB-01	TMB-02	TMB-02
Sample Type	Quality STDs (1)	Water	Water	Water	Water	Water
Sample Date		01/23/97	07/26/96	01/23/97	07/26/96	01/23/97
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	3 J	2 J	10 U	10 U
1,1-Dichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	5	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	10 U	10 U	2 J	10 U	10 U
Acetone	50	10 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 UJ	10 U	10 UJ	10 U	10 UJ
Carbon Disulfide	50	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 U	10 UJ	10 U	10 UJ	10 U
Tetrachloroethene	5	10 U	10 U	10 U	10 U	10 U
Toluene	5	10 UJ	10 U	10 UJ	10 U	10 UJ
Trichloroethene	5	10 U	**13**	**28 J**	10 U	10 U
Vinyl Chloride	2	10 UJ	10 U	10 UJ	10 U	10 UJ
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID Location Sample Type Sample Date Units	NYSDEC Groundwater Quality STDs [(1)] ug/L	RT3E00 TMB-03 Water 07/26/96 ug/L	RT3E00 TMB-03 Water 01/23/97 ug/L	M07B00 Field Blank Water 07/26/96 ug/L	M01B00 Field Blank Water 01/23/97 ug/L	M03B00 Field Blank Water 01/26/97 ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	5	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	10 U	2 J	10 U	10 U	10 U
Acetone	50	10 U	10 U	10 U	10 U	10 U
Benzene	0.7	10 U	10 UJ	10 U	10 U	10 U
Carbon Disulfide	50	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	10 UJ	10 U	10 UJ	2 J	4 J
Tetrachloroethene	5	10 U	10 U	10 U	10 U	10 U
Toluene	5	10 U	10 UJ	10 U	10 U	10 U
Trichloroethene	5	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	2	10 U	10 UJ	10 U	10 U	10 U
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-9
MONITORING AND RESIDENTIAL WELL GROUNDWATER VOC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	M03B00	M01T00	C00T00	C00T00	TRPBLK
Location	Groundwater	Field Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank
Sample Type	Quality STDs (1)	Water	Water	Water	Water	Water
Sample Date		10/28/97	07/26/96	01/23/97	2/7/97	10/27/97
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Volatiles						
1,1,1-Trichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	5	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	5	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	5 (2)	10 U	10 U	10 U	10 U	10 U
Acetone	50	10 U	10 U	10 U	14 UJ	10 U
Benzene	0.7	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	50	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	5	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5	4 J	10 U	10 U	4 J	4 J
Tetrachloroethene	5	10 U	10 U	10 U	10 U	10 U
Toluene	5	10 U	10 U	10 U	10 U	10 U
Trichloroethene	5	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	2	10 U	10 U	10 U	10 U	10 U
Xylene (total)	5	10 U	10 U	10 U	10 U	10 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
E - Result reported from secondary dilution analysis.
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for cis or trans 1,2-dichloroethene.

TABLE 5-10
MONITORING AND RESIDENTIAL WELL GROUNDWATER SVOC AND INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	M01E00	M02E00	M03E00	M04E00	M05E00
Location	Groundwater	MW-1	MW-2	MW-3	MW-4	MW-5
Sample Type	Quality STDs $^{(1)}$	Water	Water	Water	Water	Water
Sample Date		07/26/96	07/26/96	07/26/96	07/26/96	07/26/96
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Semivolatiles						
4-Chloro-3-methylphenol	1 (2)	10 U	10 U	1 J	10 UJ	10 U
Bis(2-ethylhexyl)phthalate	50	10 UJ	10 U	10 UJ	10 UJ	10 U
Diethylphthalate	50 (G)	10 U	10 U	10 U	10 UJ	10 U
Inorganics						
Aluminum	100	**8,450**	**6,290**	**16,500**	**33,500**	**27,200**
Arsenic	25	5.2 UJ	5.2 UJ	5.2 U	5.2 UJ	12.8 J
Barium	1,000	109 J	94.4 J	348	220	396
Beryllium	3 (G)	0.23 J	0.2 U	0.51 J	1.5 J	1.4 J
Cadmium	10	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Calcium		51,300	66,700	91,700	41,200	152,000
Chromium	50	40 J	14.9 J	39.5	38.6 J	41.2
Cobalt		7.8 J	5.9 J	16.5 J	24.5 J	25.2 J
Copper	200	15.3 J	13.4 J	32.3	39.6	35.9
Iron	300	**17,500**	**11,900**	**34,700**	**53,400**	**60,100**
Lead	25	6.1 J	2.2 U	9.8 J	8.6 J	9.7 J
Magnesium	35,000	23,100	28,800	34,900	24,600	**49,900**
Manganese	300	**793**	**670**	**10,100**	**11,400**	**3,470**
Mercury	2	0.33	0.39	0.2 U	0.27	0.24
Nickel		37.2 J	22.7 J	51.6	64	64.9
Potassium		5,710	2,380 J	21,900	8,870	32,000
Sodium	20,000	1,370 J	6,840	12,500	3,460 J	2,580 J
Thallium	4 (G)	7.8 U	7.8 U	7.8 U	7.8 U	7.8 U
Vanadium		13.1 J	9.7 J	26 J	41.7 J	43.7 J
Zinc	300	93.2 U	86.6 U	133 U	165 U	179 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for total chlorinated phenols.
(G) Guidance value.

TABLE 5-10
MONITORING AND RESIDENTIAL WELL GROUNDWATER SVOC AND INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

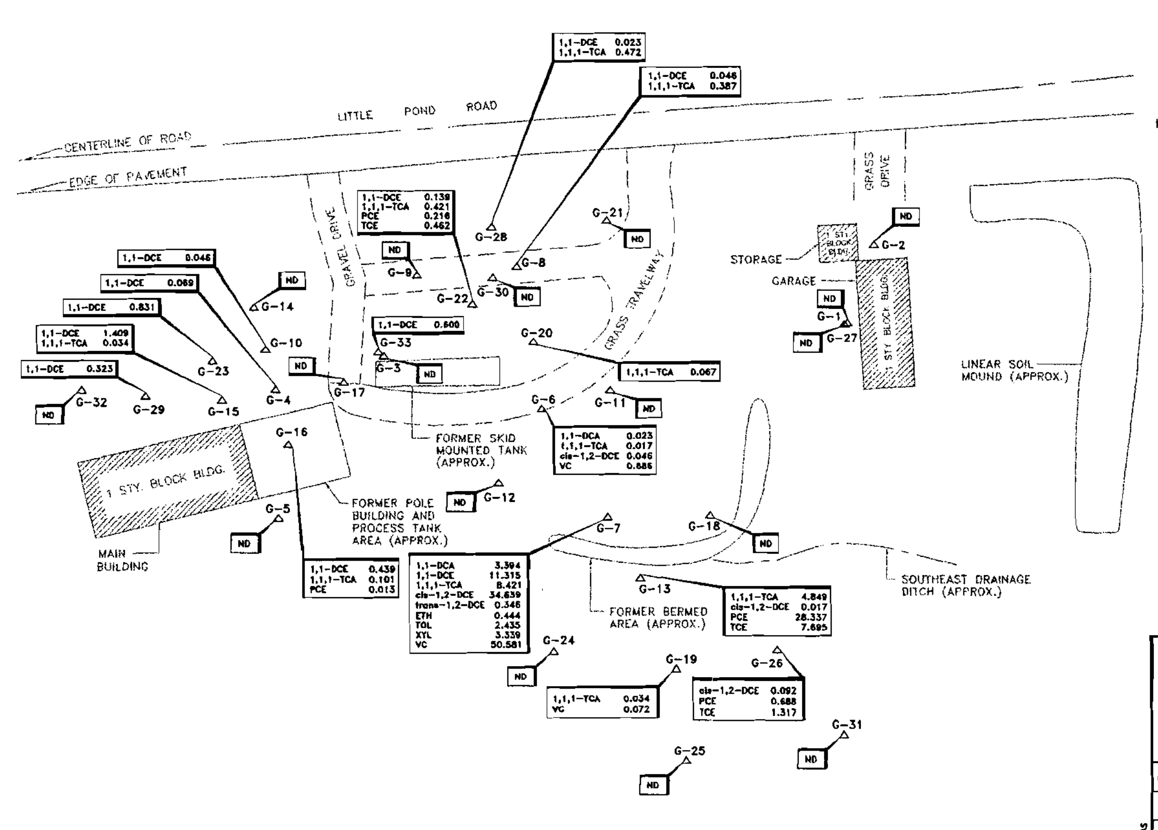
Sample ID	NYSDEC	M06E00	M07E00	M07R00	RLWE00	RT1E00
Location	Groundwater	MW-6	MW-7	MW-7 Dup.	LOWE WELL	TMB-01
Sample Type	Quality STDs (1)	Water	Water	Water	Water	Water
Sample Date		07/26/96	07/26/96	07/26/96	07/26/96	07/26/96
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
ASP Semivolatiles						
4-Chloro-3-methylphenol	1 (2)	10 U	**3 J**	**5 J**	10 U	10 U
Bis(2-ethylhexyl)phthalate	50	10 U	10 UJ	10 UJ	10 U	10 UJ
Diethylphthalate	50 (G)	3 J	10 U	10 U	10 U	10 U
Inorganics						
Aluminum	100	**32,100**	**43,500**	**48,700**	**151 J**	133 U
Arsenic	25	13.4 J	9.1 J	12.1	5.2 UJ	5.2 U
Barium	1,000	537	615	633	153 J	31.4 J
Beryllium	3 (G)	1.8 J	2.3 J	2.4 J	0.2 U	0.2 U
Cadmium	10	0.5 U	0.8 J	0.87 J	0.5 U	0.5 U
Calcium		300,000	138,000	144,000	17,800	43,600
Chromium	50	38.3 J	**53.3**	**57.9**	8.3 U	8.3 UJ
Cobalt		32.5 J	41.4 J	44.8 J	2.1 U	2.1 U
Copper	200	60.3	87.6	92.9	78.4	5.4 U
Iron	300	**68,800**	**88,400**	**97,200**	**23,800**	54.2 U
Lead	25	14.3	**36**	**36**	**28.7**	4.8 J
Magnesium	35,000	**125,000**	**75,000**	**80,200**	13,600	25,400
Manganese	300	**8,420**	**10,100**	**10,300**	229	6.8 J
Mercury	2	0.48	0.42	0.48	0.2 U	0.36
Nickel		71	94.6	102	5.3 J	4.2 U
Potassium		33,600	8,130	8,980	788 J	2,180 J
Sodium	20,000	4,390 J	5,410	5,650	4,270 J	12,600
Thallium	4 (G)	7.8 UJ	7.8 U	7.8 UJ	7.8 U	**9.4 J**
Vanadium		54.5	69.2	76.3	2.3 U	2.3 U
Zinc	300	185 U	228 U	243	267	48.8 U

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for total chlorinated phenols.
(G) Guidance value.

TABLE 5-10
MONITORING AND RESIDENTIAL WELL GROUNDWATER SVOC AND INORGANIC ANALYTICAL RESULTS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Sample ID	NYSDEC	RT2E00	RT3E00	M07B00
Location	Groundwater	TMB-02	TMB-03	Field Blank
Sample Type	Quality STDs [1]	Water	Water	Water
Sample Date		07/26/96	07/26/96	07/26/96
Units	ug/L	ug/L	ug/L	ug/L
ASP Semivolatiles				
4-Chloro-3-methylphenol	1 (2)	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	50	10 UJ	10 UJ	2 J
Diethylphthalate	50 (G)	10 U	1 J	10 U
Inorganics				
Aluminum	100	133 U	**133 J**	133 U
Arsenic	25	5.2 U	5.2 U	5.2 U
Barium	1,000	24.9 J	32.4 J	13 U
Beryllium	3 (G)	0.2 U	0.2 U	0.2 U
Cadmium	10	0.5 U	0.5 U	0.5 U
Calcium		11,400	20,000	230 U
Chromium	50	8.3 UJ	8.3 UJ	8.3 UJ
Cobalt		2.1 U	2.1 U	2.1 U
Copper	200	5.4 U	5.4 U	5.4 U
Iron	300	131	**1,770**	59.8 J
Lead	25	2.2 UJ	2.2 UJ	2.2 UJ
Magnesium	35,000	2,290 J	1,770 J	354 U
Manganese	300	265	**2,520**	4.9 J
Mercury	2	0.22	0.2 U	0.2 U
Nickel		4.2 U	4.2 U	4.2 U
Potassium		1,230 J	976 J	426 U
Sodium	20,000	7,880	2,500 J	890 U
Thallium	4 (G)	7.8 UJ	**7.8 J**	7.8 UJ
Vanadium		2.3 U	2.3 U	2.3 U
Zinc	300	43.9 U	47 U	46.2

NOTES: Compounds only listed if detected in at least one sample.
Bold indicates concentration exceeds NYSDEC Groundwater Quality Standard.
U - Non-detected at presented quantitation limit (QL).
J - Estimated concentration. The result has been detected below the QL or has been qualified as estimated due to outlying QC result(s).
UJ - Non-detected at presented QL. The quantitation limit has been qualified as estimated due to outlying QC result(s).
(1) NYS Groundwater Quality Standards as published by NYSDEC, October 22, 1993
(2) Standard is for total chlorinated phenols.
(G) Guidance value.



LEGEND

G-1 △	GEOPROBE SOIL GAS SAMPLE
ND	NONE DETECTED
1,1-DCA	1,1-DICHLOROETHANE
1,1-DCE	1,1-DICHLOROETHENE
1,1,1-TCA	1,1,1-TRICHLOROETHANE
cis-1,2-DCE	cis-1,2-DICHLOROETHENE
trans-1,2-DCE	trans-1,2-DICHLOROETHENE
ETH	ETHYLBENZENE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
XYL	TOTAL XYLENES
VC	VINYL CHLORIDE

NOTE

ALL CONCENTRATIONS IN PARTS PER MILLION (PPM).

N

0 15 30 60

APPROXIMATE SCALE IN FEET

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Solon, Ohio 44139

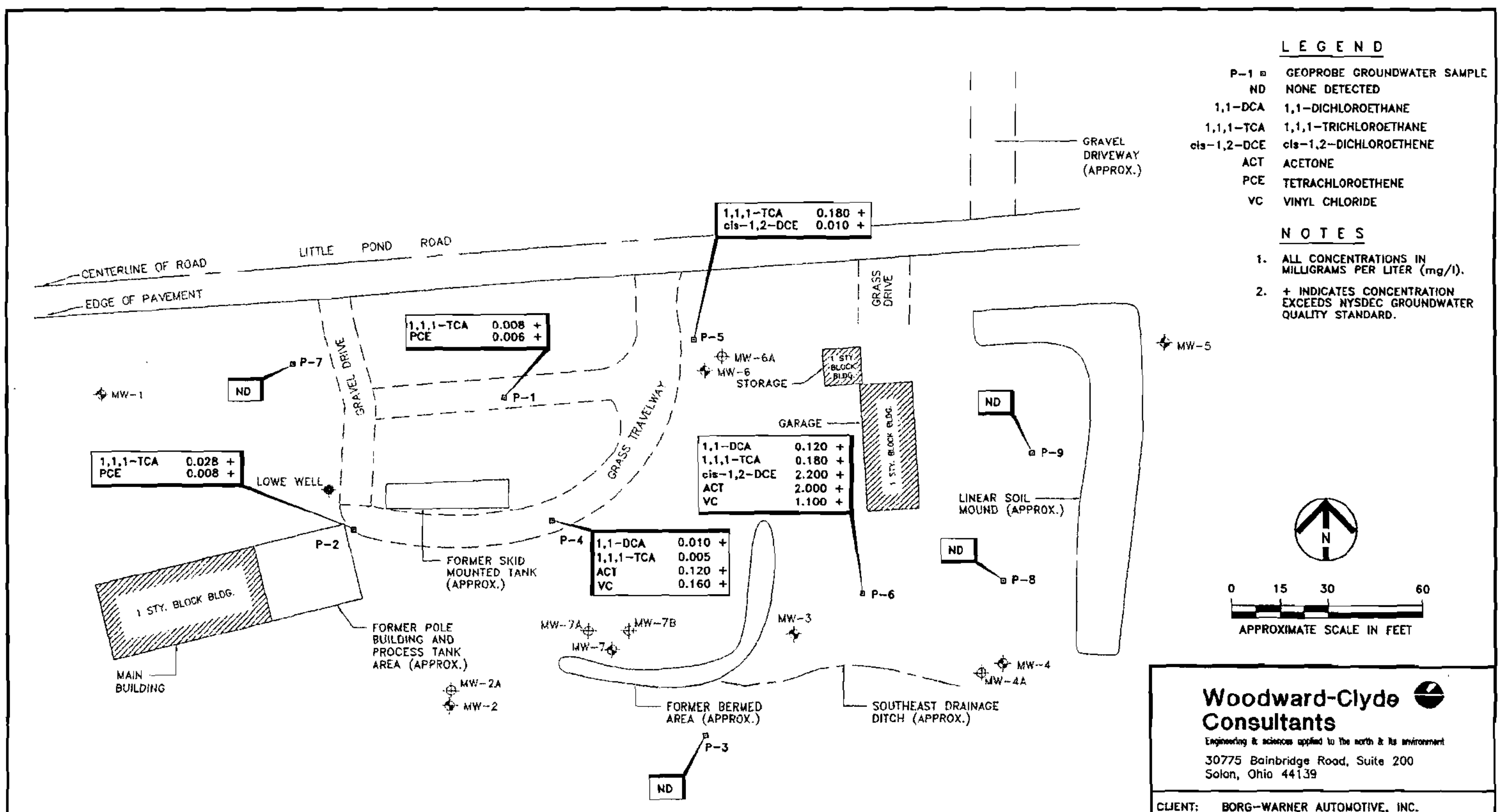
CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN GEOPROBE SOIL GAS SAMPLES - JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-29-97	5-1

U:\5E15509\PROBEGAS



LEGEND

P-1 ▫	GEOPROBE GROUNDWATER SAMPLE
ND	NONE DETECTED
1,1-DCA	1,1-DICHLOROETHANE
1,1,1-TCA	1,1,1-TRICHLOROETHANE
cis-1,2-DCE	cis-1,2-DICHLOROETHENE
ACT	ACETONE
PCE	TETRACHLOROETHENE
VC	VINYL CHLORIDE

NOTES

1. ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/l).
2. + INDICATES CONCENTRATION EXCEEDS NYSDEC GROUNDWATER QUALITY STANDARD.

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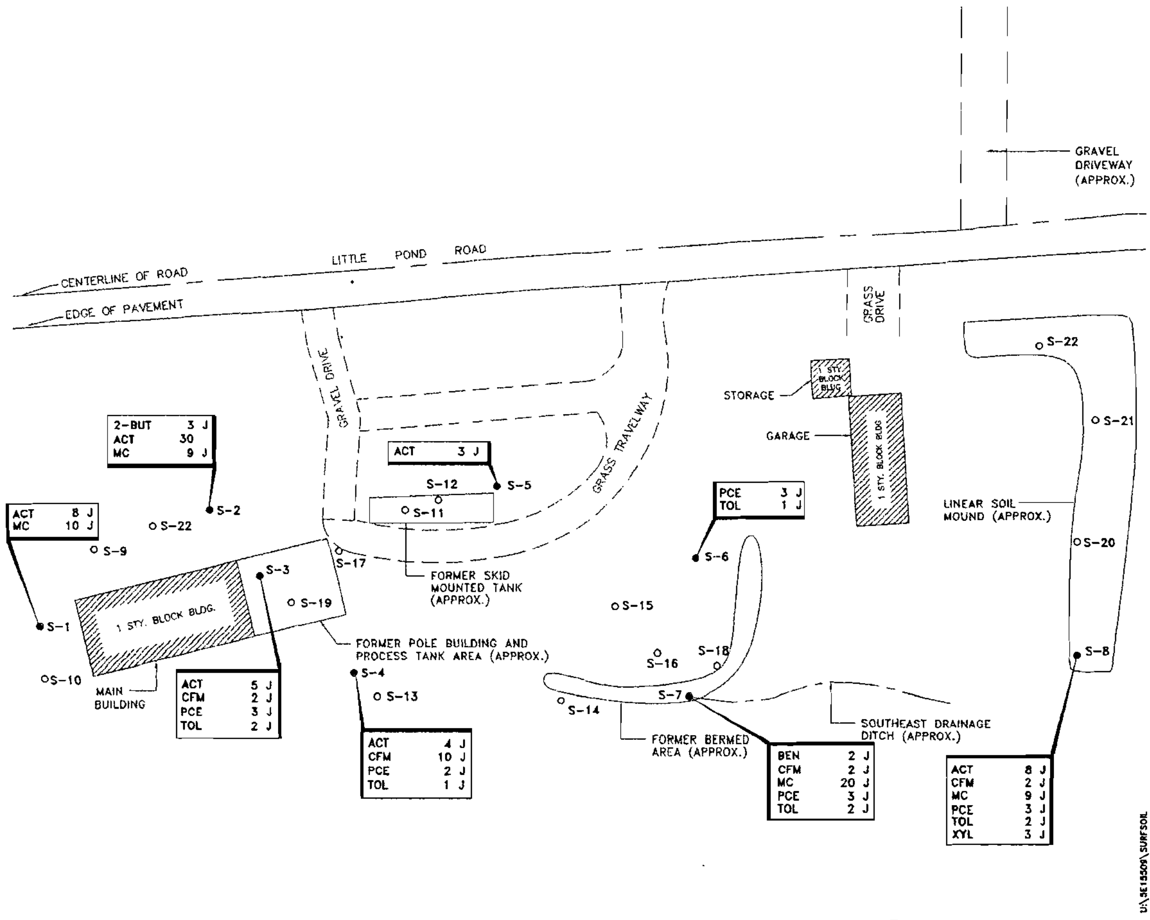
VOCs IN GEOPROBE GROUNDWATER SAMPLES JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	5-2

U:\5E15509\PROBEGW



LEGEND

S-1 ●	SURFACE SOIL SAMPLE (SUBMITTED FOR ANALYSIS)
S-1 ○	SURFACE SOIL SAMPLE (FIELD SCREENING ONLY, NOT SUBMITTED FOR ANALYSIS)
ND	NONE DETECTED
2-BUT	2-BUTANONE
ACT	ACETONE
BEN	BENZENE
CFM	CHLOROFORM
MC	METHYLENE CHLORIDE
PCE	TETRACHLORIDE
TOL	TOLUENE
XYL	TOTAL XYLENES

NOTES

1. RESULTS PRESENTED IN MICROGRAMS PER KILOGRAM (ug/kg).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULTS HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. DETECTED RESULTS DO NOT EXCEED NYSDEC SOIL CLEANUP OBJECTIVE.

N

0 15 30 60

APPROXIMATE SCALE IN FEET

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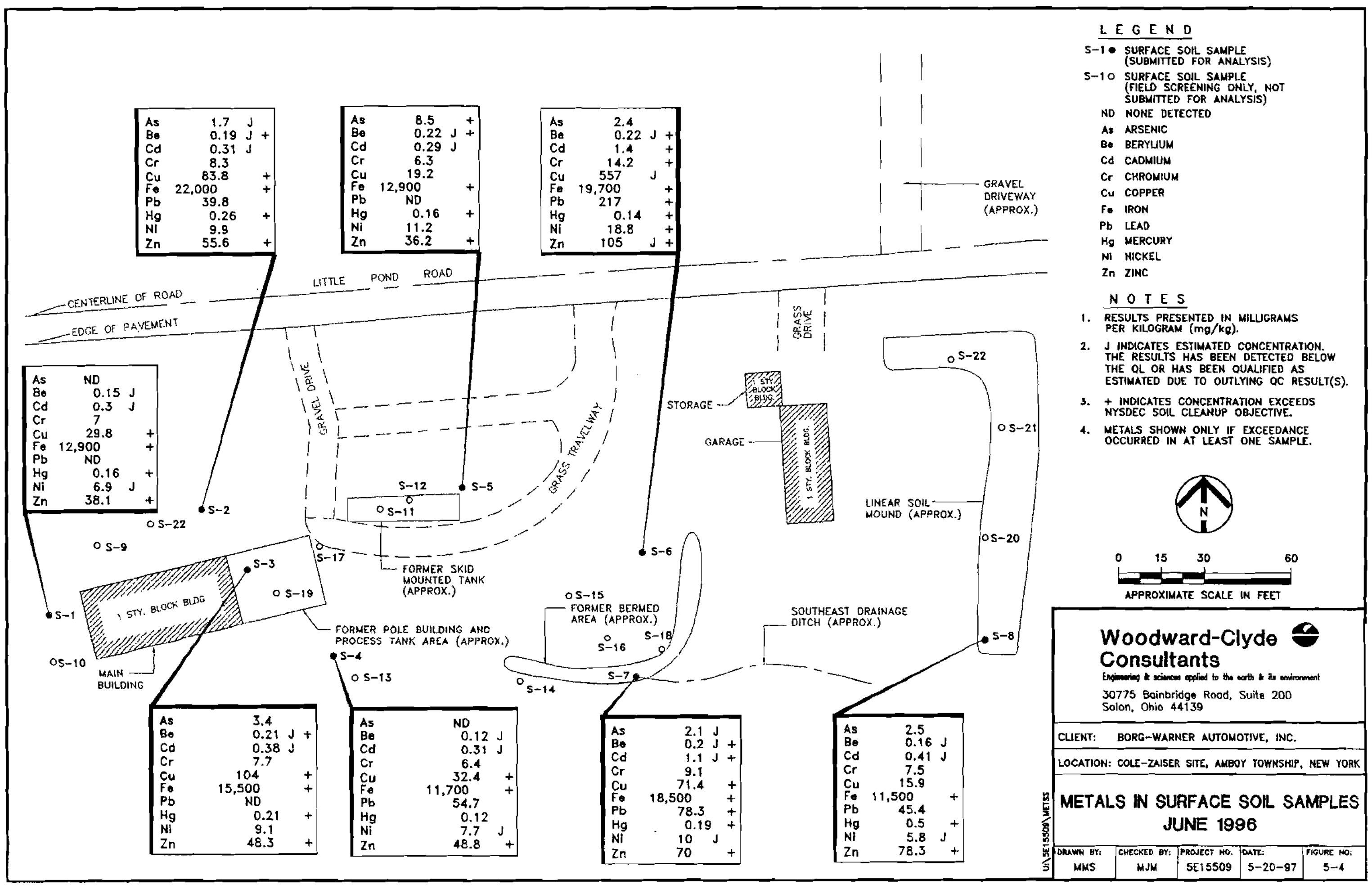
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN SURFACE SOIL SAMPLES JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	5-20-97	5-3

U:\5E15509\SURFSOIL



LEGEND

S-1● SURFACE SOIL SAMPLE (SUBMITTED FOR ANALYSIS)
S-1○ SURFACE SOIL SAMPLE (FIELD SCREENING ONLY, NOT SUBMITTED FOR ANALYSIS)
ND NONE DETECTED
As ARSENIC
Be BERYLIUM
Cd CADMIUM
Cr CHROMIUM
Cu COPPER
Fe IRON
Pb LEAD
Hg MERCURY
Ni NICKEL
Zn ZINC

NOTES

1. RESULTS PRESENTED IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULTS HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC SOIL CLEANUP OBJECTIVE.
4. METALS SHOWN ONLY IF EXCEEDANCE OCCURRED IN AT LEAST ONE SAMPLE.

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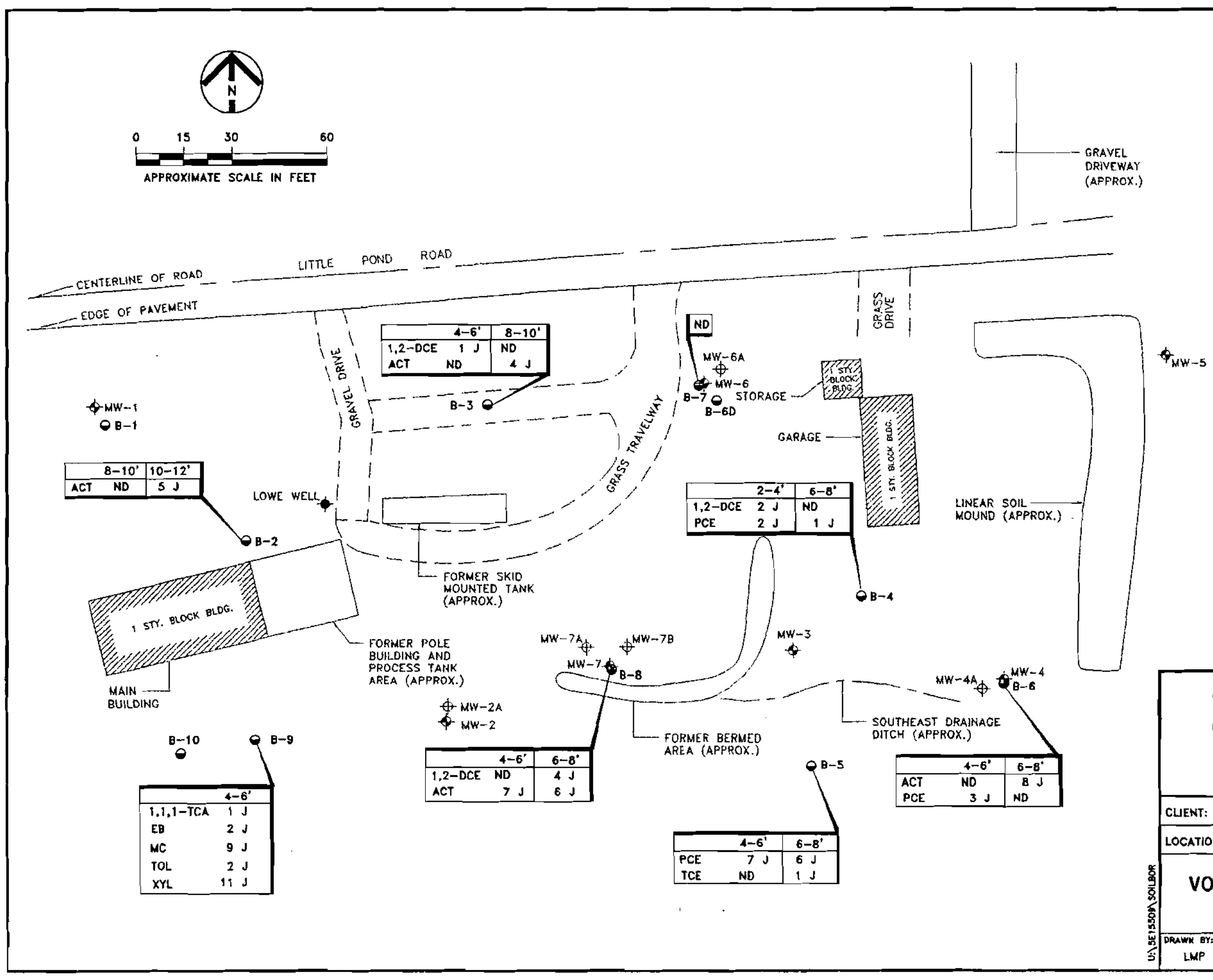
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

METALS IN SURFACE SOIL SAMPLES JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO.	DATE:	FIGURE NO:
MMS	MJM	5E15509	5-20-97	5-4



	4-6'	8-10'
1,2-DCE	1 J	ND
ACT	ND	4 J

	8-10'	10-12'
ACT	ND	5 J

	2-4'	6-8'
1,2-DCE	2 J	ND
PCE	2 J	1 J

	4-6'
1,1,1-TCA	1 J
EB	2 J
MC	9 J
TOL	2 J
XYL	11 J

	4-6'	6-8'
1,2-DCE	ND	4 J
ACT	7 J	6 J

	4-6'	6-8'
PCE	7 J	6 J
TCE	ND	1 J

	4-6'	6-8'
ACT	ND	8 J
PCE	3 J	ND

LEGEND

B-1 ⊖	SOIL BORING
ND	NONE DETECTED
1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,2-DCE	1,2-DICHLOROETHENE
ACT	ACETONE
EB	ETHYLBENZENE
MC	METHYLENE CHLORIDE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
XYL	TOTAL XYLENES
VC	VINYL CHLORIDE

NOTES

1. ALL RESULTS PRESENTED IN MICROGRAMS PER KILOGRAM (ug/kg).
2. J INDICATES AN ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. DETECTED RESULTS DO NOT EXCEED NYSDEC SOIL CLEANUP OBJECTIVE.

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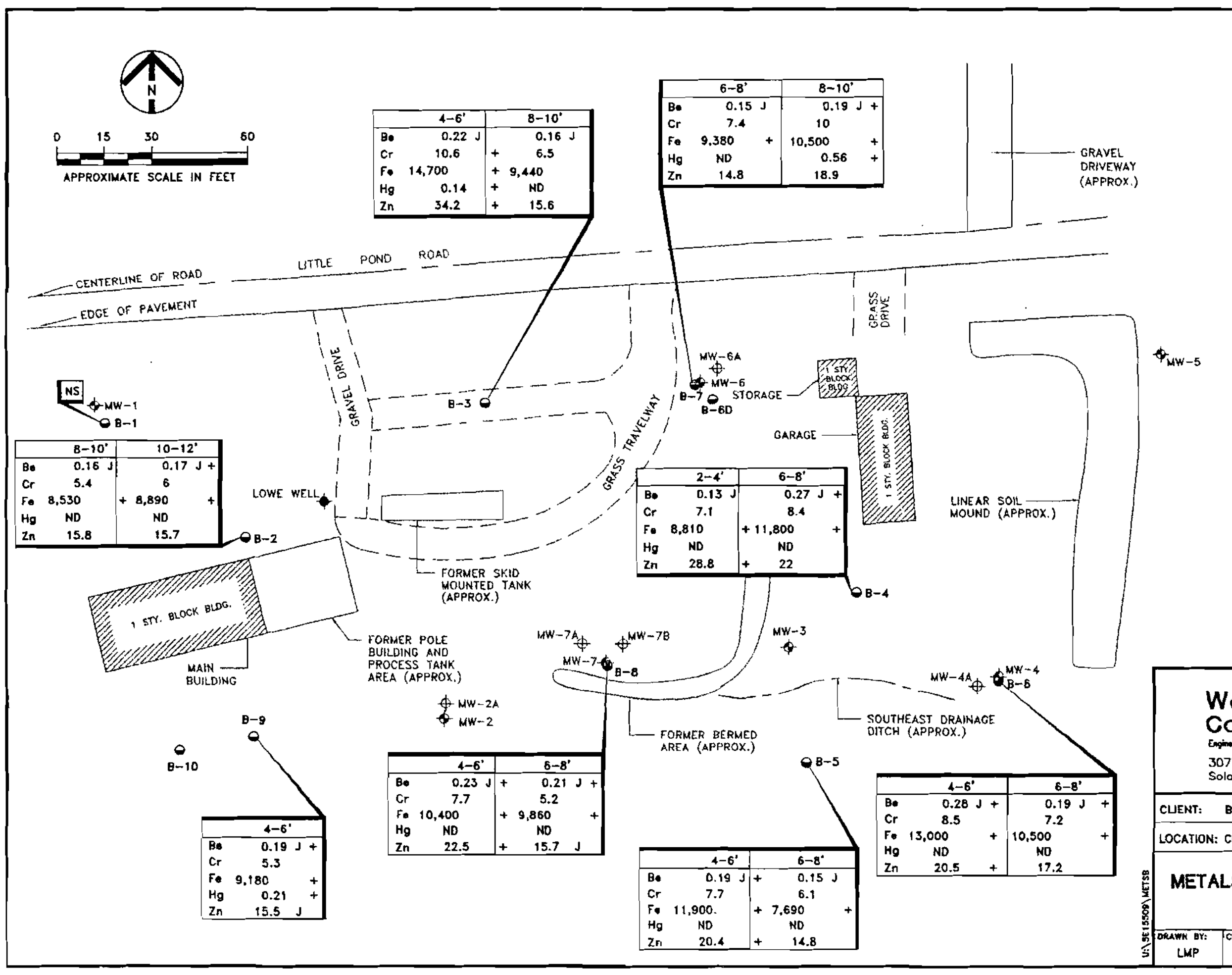
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN SOIL BORING SAMPLES JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	06-17-97	5-5

U:\5E15509\SOILBOR



	4-6'	8-10'
Be	0.22 J	0.16 J
Cr	10.6	+ 6.5
Fe	14,700	+ 9,440
Hg	0.14	+ ND
Zn	34.2	+ 15.6

	6-8'	8-10'
Be	0.15 J	0.19 J +
Cr	7.4	10
Fe	9,380 +	10,500 +
Hg	ND	0.56 +
Zn	14.8	18.9

	8-10'	10-12'
Be	0.16 J	0.17 J +
Cr	5.4	6
Fe	8,530	+ 8,890 +
Hg	ND	ND
Zn	15.8	15.7

	2-4'	6-8'
Be	0.13 J	0.27 J +
Cr	7.1	8.4
Fe	8,810	+ 11,800 +
Hg	ND	ND
Zn	28.8	+ 22

	4-6'	6-8'
Be	0.23 J	+ 0.21 J +
Cr	7.7	5.2
Fe	10,400	+ 9,860 +
Hg	ND	ND
Zn	22.5	+ 15.7 J

	4-6'
Be	0.19 J +
Cr	5.3
Fe	9,180 +
Hg	0.21 +
Zn	15.5 J

	4-6'	6-8'
Be	0.19 J	+ 0.15 J
Cr	7.7	6.1
Fe	11,900.	+ 7,690 +
Hg	ND	ND
Zn	20.4	+ 14.8

	4-6'	6-8'
Be	0.28 J +	0.19 J +
Cr	8.5	7.2
Fe	13,000 +	10,500 +
Hg	ND	ND
Zn	20.5 +	17.2

LEGEND

B-1 ◒	SOIL BORING
ND	NONE DETECTED
NS	NOT SAMPLED
Be	BERYLLIUM
Cr	CHROMIUM
Fe	IRON
Hg	MERCURY
Zn	ZINC

NOTES

1. ALL RESULTS PRESENTED IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. J INDICATES AN ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC SOIL CLEANUP OBJECTIVE.
4. METALS SHOWN ONLY IF EXCEEDANCE OCCURRED IN AT LEAST ONE SAMPLE.

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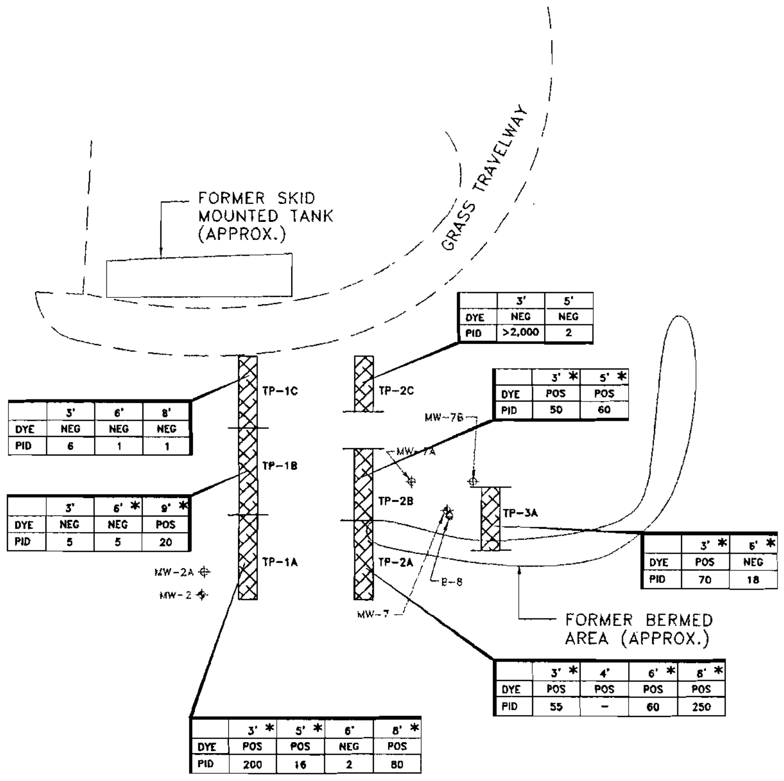
METALS IN SOIL BORING SAMPLES
JUNE 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	06-17-97	5-6

U:\5E15509\METSB



L E G E N D

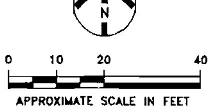
▨ TEST PIT (APPROXIMATE)

POS POSITIVE DYE TEST RESULT

NEG NEGATIVE DYE TEST RESULT

NOTES:

1. PID READINGS ARE IN ppm.
2. DYE TESTING WAS PERFORMED USING SUDAN IV.
3. * INDICATES SAMPLE WAS SUBMITTED FOR LABORATORY ANALYSIS.



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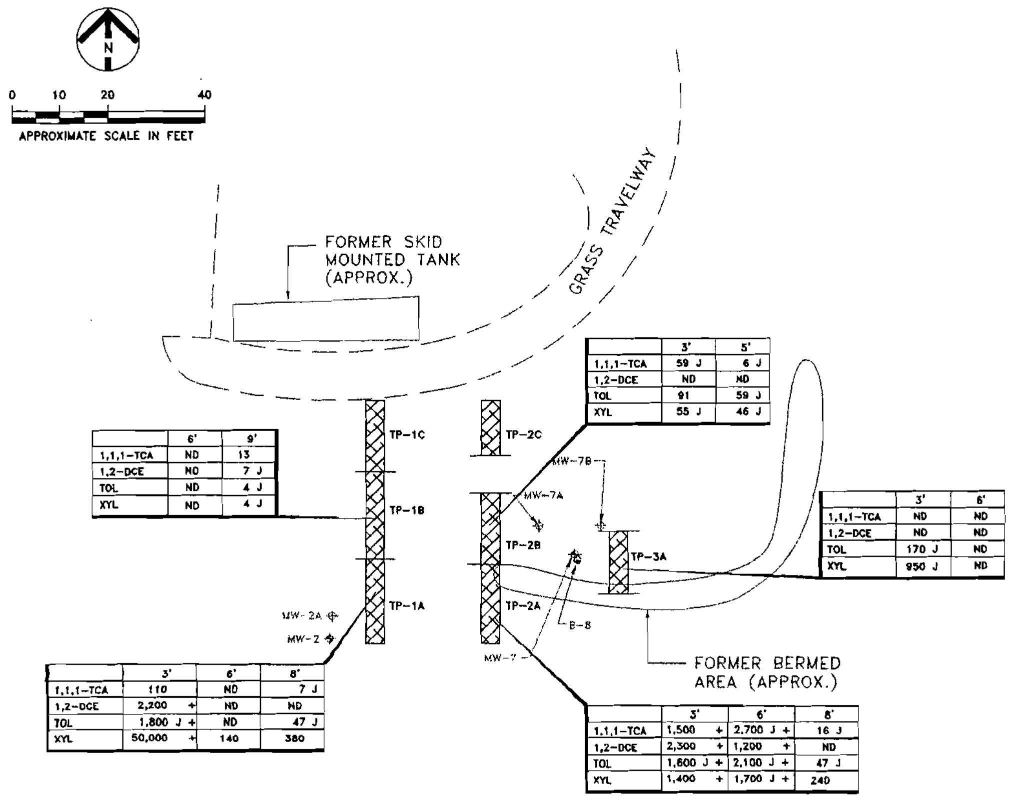
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

FIELD SCREENING RESULTS FOR TEST PIT SOIL SAMPLES OCTOBER 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
MMS	MJM	5E15509	02-25-98	5-7

U:\5E15509\TPFIELD



	6'	9'
1,1,1-TCA	ND	13
1,2-DCE	ND	7 J
TOL	ND	4 J
XYL	ND	4 J

	3'	6'	8'
1,1,1-TCA	110	ND	7 J
1,2-DCE	2,200 +	ND	ND
TOL	1,800 J +	ND	47 J
XYL	50,000 +	140	380

	3'	5'
1,1,1-TCA	59 J	6 J
1,2-DCE	ND	ND
TOL	91	59 J
XYL	55 J	46 J

	3'	6'
1,1,1-TCA	ND	ND
1,2-DCE	ND	ND
TOL	170 J	ND
XYL	950 J	ND

	3'	6'	8'
1,1,1-TCA	1,500 +	2,700 J +	16 J
1,2-DCE	2,300 +	1,200 +	ND
TOL	1,600 J +	2,100 J +	47 J
XYL	1,400 +	1,700 J +	240

LEGEND

▨	TEST PIT (APPROXIMATE)
1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,2-DCE	1,2-DICHLOROETHANE
TOL	TOLUENE
XYL	XYLENE

NOTES:

1. RESULTS PRESENTED IN MICROGRAMS PER KILOGRAM (ug/kg).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULTS.
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC STANDARDS.
4. COMPOUNDS SHOWN ONLY IF EXCEEDANCE OCCURRED IN AT LEAST ONE SAMPLE.

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

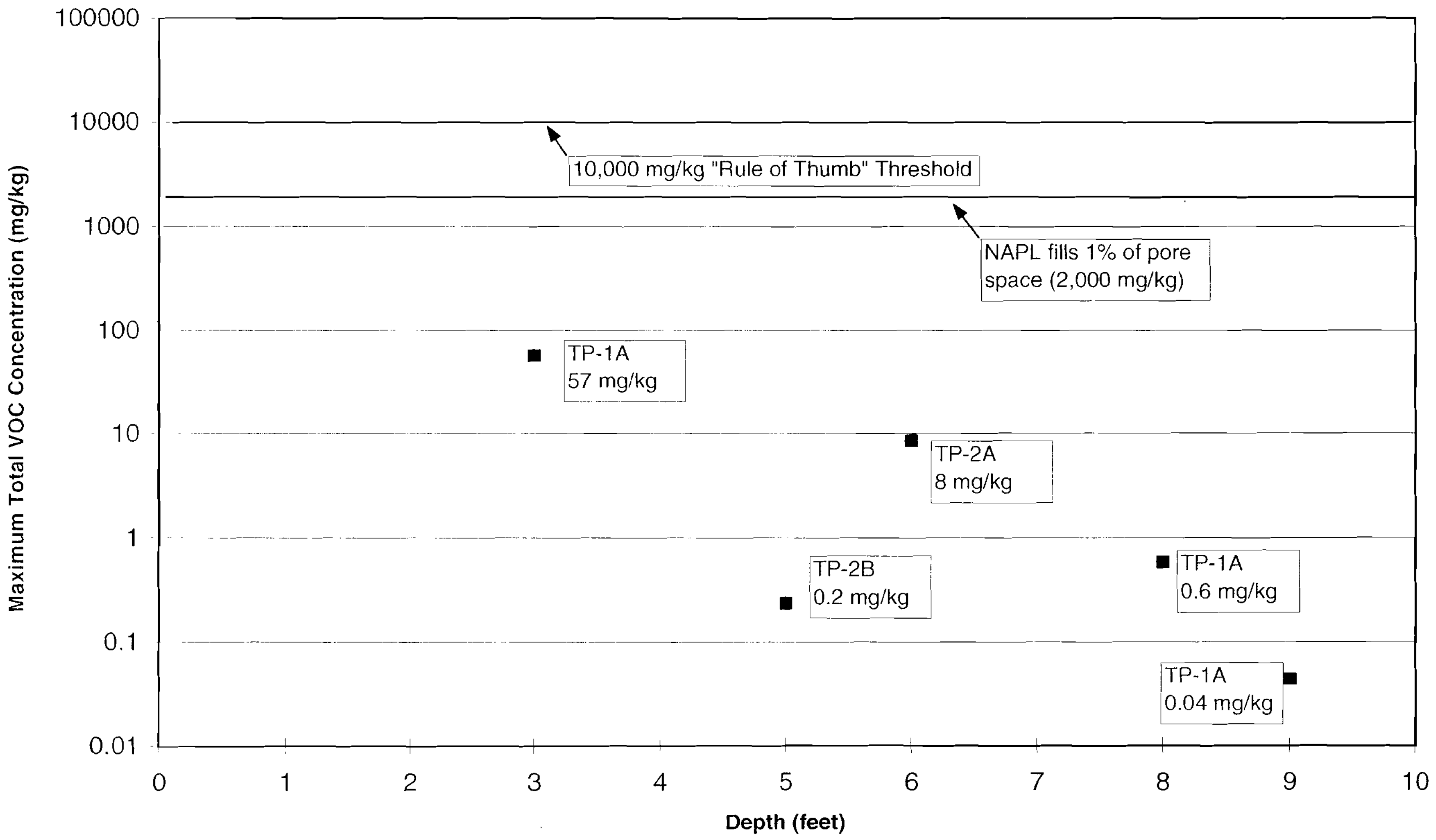
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

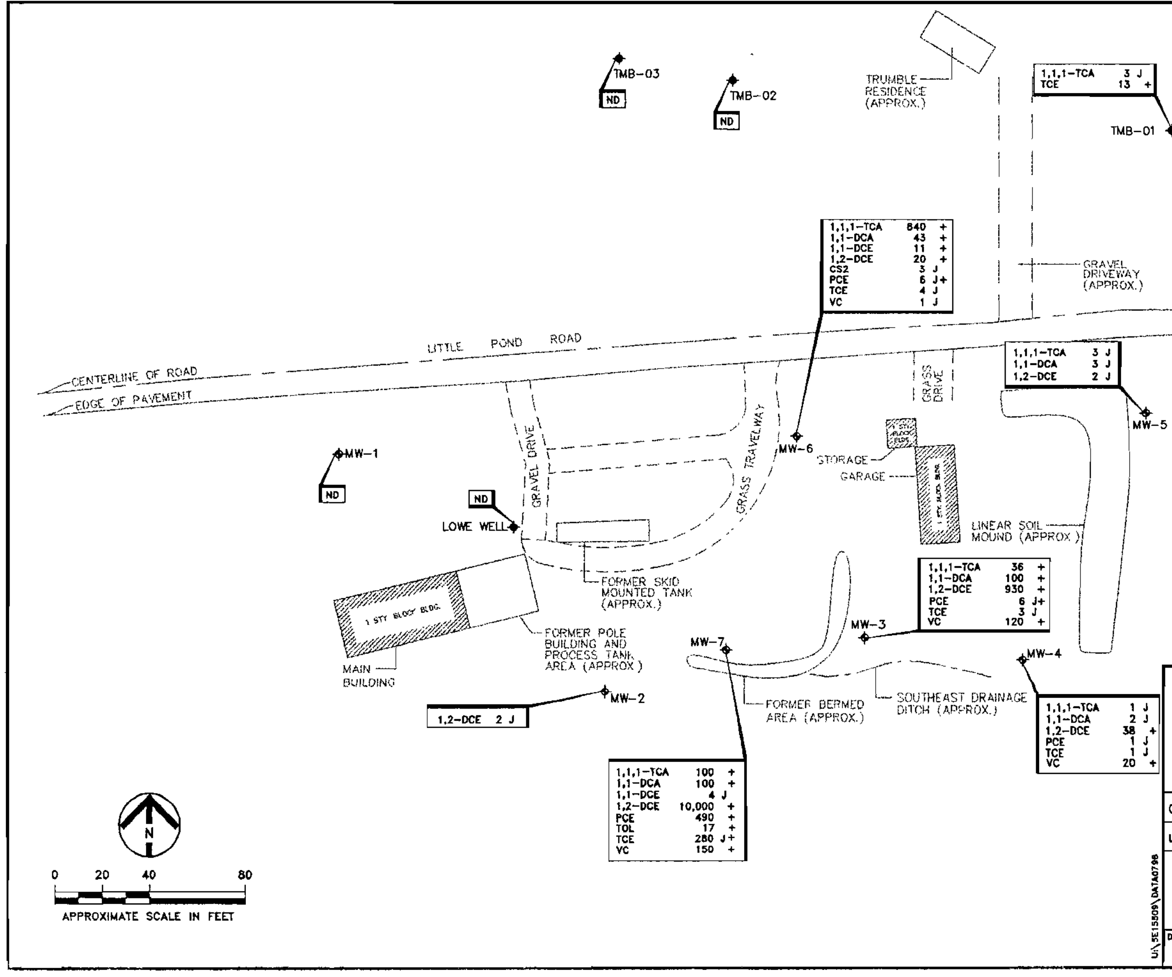
VOCs IN TEST PIT SOIL SAMPLES
OCTOBER 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	02-12-98	5-8

U:\5E15509\TPSOIL

Figure 5-9
Maximum Total VOC Concentration vs. Depth





LEGEND

MW-1 ⌖	MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
ND	NONE DETECTED
1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,1-DCA	1,1-DICHLOROETHANE
1,1-DCE	1,1-DICHLOROETHENE
1,2-DCE	1,2-DICHLOROETHENE
CS2	CARBON DISULFIDE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

NOTES:

1. RESULTS PRESENTED IN MICROGRAMS PER LITER (ug/l).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC GROUNDWATER QUALITY STANDARD.

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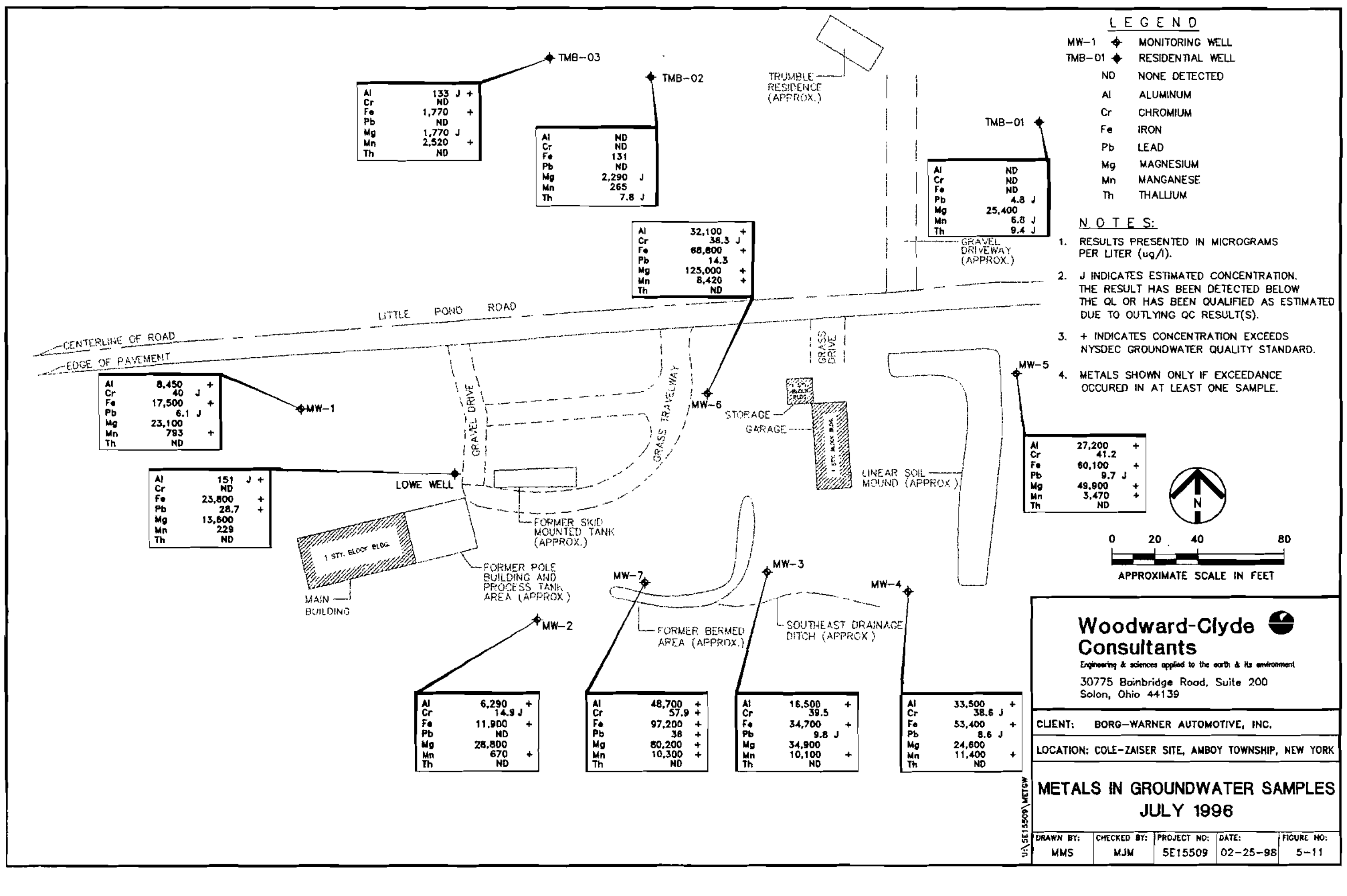
LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN GROUNDWATER SAMPLES
JULY 1996

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	02-25-98	5-10

U:\5E15509\DATA0798



TMB-03

Al	133 J	+
Cr	ND	
Fe	1,770	+
Pb	ND	
Mg	1,770 J	
Mn	2,520	+
Th	ND	

TMB-02

Al	ND	
Cr	ND	
Fe	131	
Pb	ND	
Mg	2,290	J
Mn	265	
Th	7.8	J

TMB-01

Al	ND	
Cr	ND	
Fe	ND	
Pb	4.8	J
Mg	25,400	
Mn	6.8	J
Th	9.4	J

MW-6

Al	32,100	+
Cr	38.3 J	
Fe	68,800	+
Pb	14.3	
Mg	125,000	+
Mn	8,420	+
Th	ND	

MW-1

Al	8,450	+
Cr	40 J	
Fe	17,500	+
Pb	6.1 J	
Mg	23,100	
Mn	793	+
Th	ND	

LOWE WELL

Al	151 J	+
Cr	ND	
Fe	23,800	+
Pb	28.7	+
Mg	13,600	
Mn	229	
Th	ND	

MW-5

Al	27,200	+
Cr	41.2	
Fe	60,100	+
Pb	9.7 J	
Mg	49,900	+
Mn	3,470	+
Th	ND	

MW-2

Al	6,290	+
Cr	14.9 J	
Fe	11,900	+
Pb	ND	
Mg	28,800	
Mn	670	+
Th	ND	

MW-7

Al	48,700	+
Cr	57.9	+
Fe	97,200	+
Pb	38	+
Mg	80,200	+
Mn	10,300	+
Th	ND	

MW-3

Al	16,500	+
Cr	39.5	
Fe	34,700	+
Pb	9.8 J	
Mg	34,900	
Mn	10,100	+
Th	ND	

MW-4

Al	33,500	+
Cr	38.6 J	
Fe	53,400	+
Pb	8.6 J	
Mg	24,600	
Mn	11,400	+
Th	ND	

LEGEND

MW-1 ⌖	MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
ND	NONE DETECTED
Al	ALUMINUM
Cr	CHROMIUM
Fe	IRON
Pb	LEAD
Mg	MAGNESIUM
Mn	MANGANESE
Th	THALLIUM

NOTES:

1. RESULTS PRESENTED IN MICROGRAMS PER LITER (ug/l).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC GROUNDWATER QUALITY STANDARD.
4. METALS SHOWN ONLY IF EXCEEDANCE OCCURED IN AT LEAST ONE SAMPLE.

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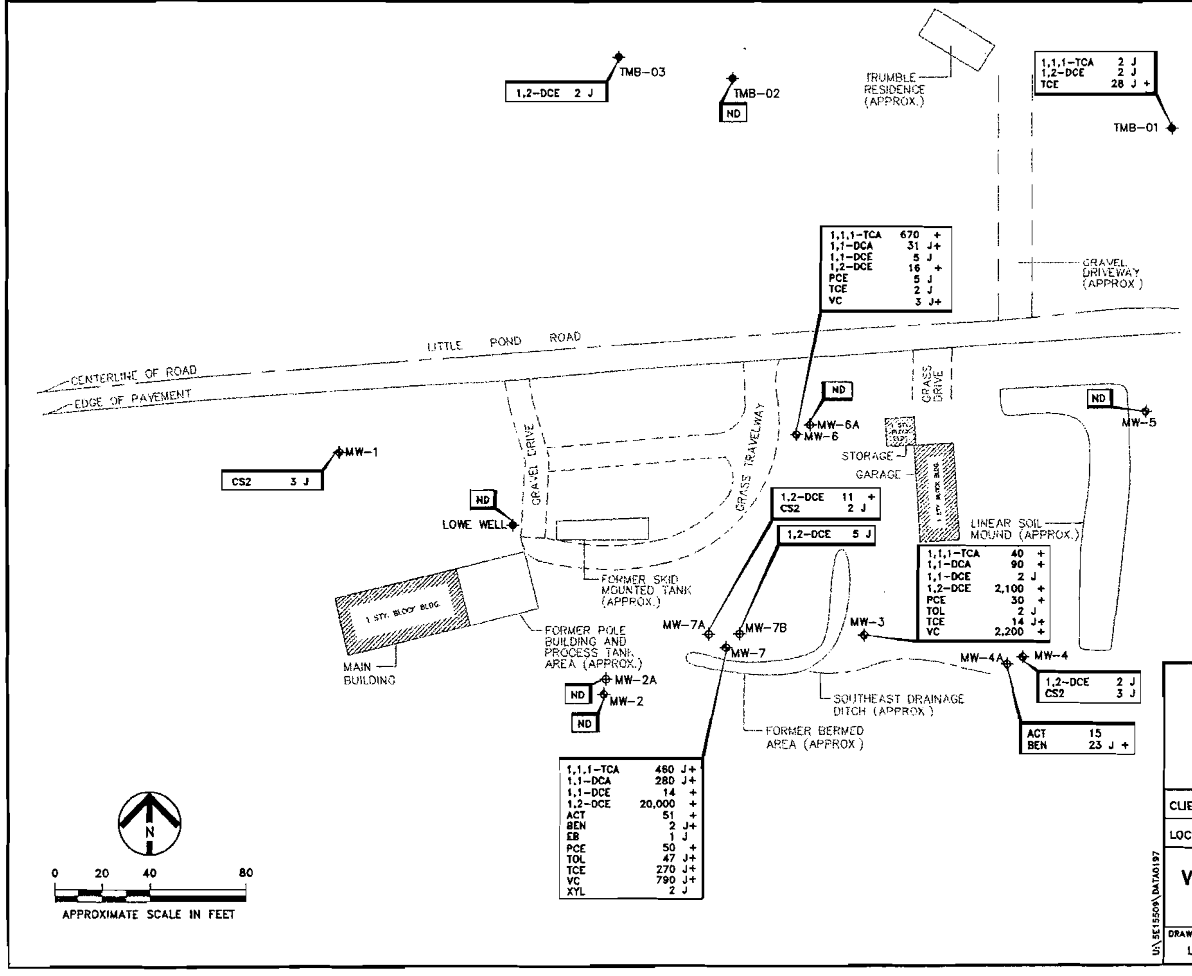
CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

METALS IN GROUNDWATER SAMPLES JULY 1996

U:\5E15509\METGW

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
MMS	MJM	5E15509	02-25-98	5-11



LEGEND

MW-1 ⌖	MONITORING WELL
MW-2A ⌖	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
ND	NONE DETECTED
1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,1-DCA	1,1-DICHLOROETHANE
1,1-DCE	1,1-DICHLOROETHENE
1,2-DCE	1,2-DICHLOROETHENE
ACT	ACETONE
BEN	BENZENE
CS2	CARBON DISULFIDE
EB	ETHYLBENZENE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE
XYL	XYLENE

NOTES

1. RESULTS PRESENTED IN MICROGRAMS PER LITER (ug/l).
2. J INDICATES ESTIMATED CONCENTRATION. THE RESULT HAS BEEN DETECTED BELOW THE QL OR HAS BEEN QUALIFIED AS ESTIMATED DUE TO OUTLYING QC RESULT(S).
3. + INDICATES CONCENTRATION EXCEEDS NYSDEC GROUNDWATER QUALITY STANDARD.

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment
30775 Bainbridge Road, Suite 200
Solon, Ohio 44139

CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN GROUNDWATER SAMPLES JANUARY 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	02-25-98	5-12

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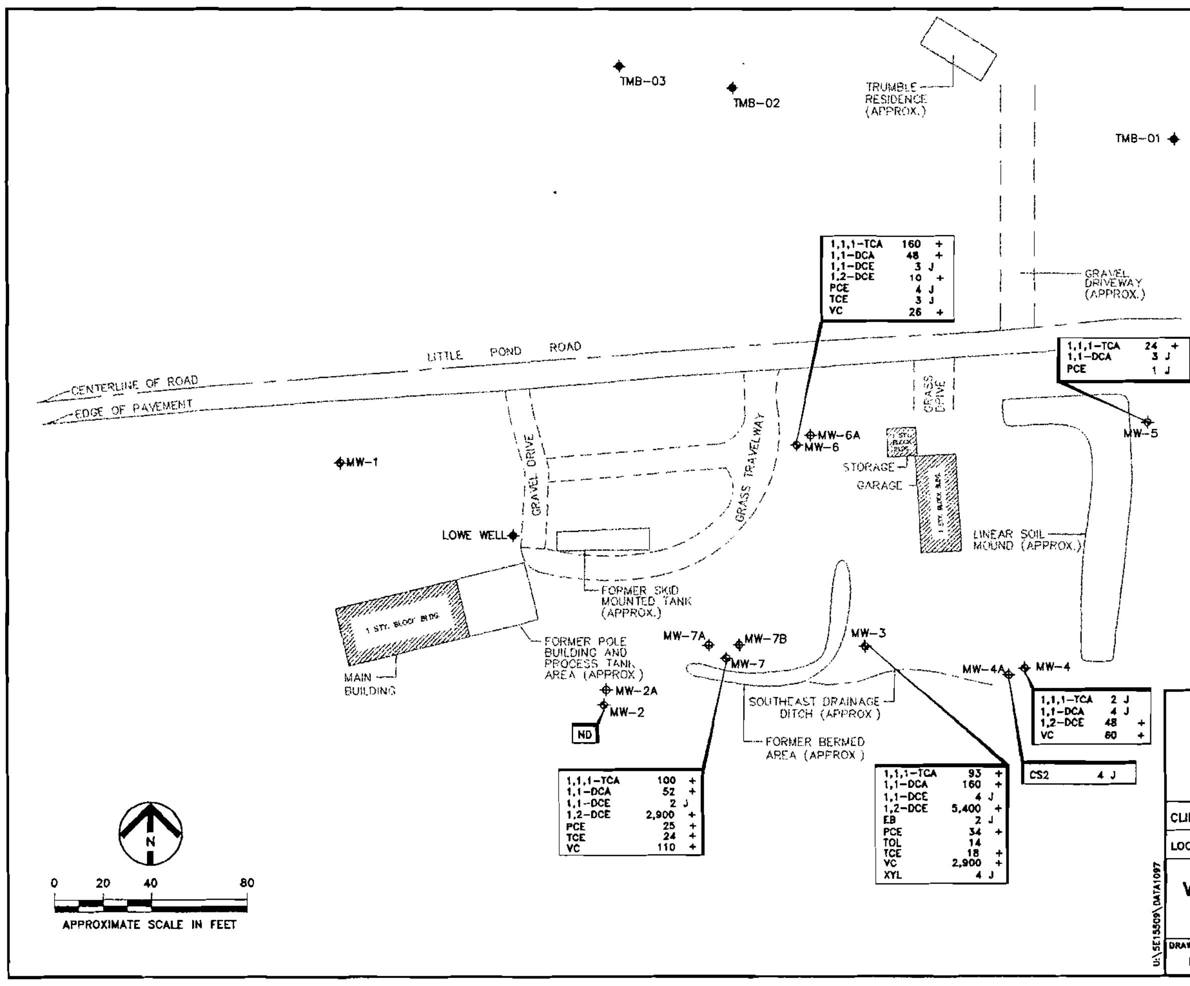

LEGEND

MW-1 ◆	MONITORING WELL
MW-2A ⊕	INTERMEDIATE/DEEP MONITORING WELL
TMB-01 ◆	RESIDENTIAL WELL
ND	NONE DETECTED
1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,1-DCA	1,1-DICHLOROETHANE
1,1-DCE	1,1-DICHLOROETHENE
1,2-DCE	1,2-DICHLOROETHENE
CS2	CARBON DISULFIDE
EB	ETHYLBENZENE
PCE	TETRACHLOROETHENE
TOL	TOLUENE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE
XYL	XYLENE

NOTES

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CLIENT: BORG-WARNER AUTOMOTIVE, INC.

LOCATION: COLE-ZAISER SITE, AMBOY TOWNSHIP, NEW YORK

VOCs IN GROUNDWATER SAMPLES OCTOBER 1997

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LMP	MJM	5E15509	02-25-98	5-13

The potential receptors and exposure pathways for the soil and groundwater media are identified in the Site Conceptual Exposure Model (SCEM) (**Figure 6-1**). The SCEM integrates information on sources, release mechanisms, exposure media, potential receptors and routes of uptake to determine the completeness and significance of the potential pathways of exposure (USEPA, 1989). The SCEM depicts the pathways and media by which exposure to chemicals of concern (COCs) may occur at the Cole-Zaiser site to potential human receptors. The exposure pathway analysis is dependent on various site-specific factors which are discussed in detail in the following sections.

6.1 FACILITY LAND-USE

Historical site use includes waste oil reclamation operations from August 1973 through March 1977. The former facility office was later used as a summer residence by the current owners for some time~~ before they moved~~. The site is currently vacant and not in use. The surrounding land-use in the vicinity of the site is residential and agricultural. The northern site boundary is marked by Little Pond Road. Residential property (Trumble residence) and woods are located north of this road. Vacant land is located south and southeast of the site. Grass fields are located to the west and east. Based on location of the site in a rural residential area, we have assumed that a future residential land-use would be likely ~~is appropriate~~ for the site unless land-use restrictions are implemented.

6.2 POTENTIAL CONTAMINANT SOURCE AREAS

An electromagnetic survey and extensive laboratory analysis of soil and groundwater were completed during the RI to identify potential source areas. While the electromagnetic survey did not identify potential source areas, historical operations and analytical results suggest that the primary sources of chemicals in the soil and groundwater are likely to be the former process area and the former bermed area. According to available data, subsurface landfilling of waste oil residues or chlorinated solvents did not occur at the site. However, spills of waste liquids containing oils and solvents are known to have occurred and waste may have been placed in a lagoon which was later backfilled. The chemicals observed in the site groundwater are primarily related to chlorinated solvents rather than petroleum components.

6.3 GROUNDWATER OCCURRENCE AND USE

Groundwater occurs in both glacial deposits and bedrock in this area. The first water-bearing zone at the Cole-Zaiser site is encountered at a depth of approximately 5 to 15 feet and the second water-bearing zone is comprised of the bedrock underlying the site. Records from on-site drilling indicate that bedrock is located at a depth greater than 85 feet.

Wells used for potable purposes are located on the Trumble property (three wells at depths less than 15 feet) and at the Cole-Zaiser site (Lowe Well with a measured depth of 76.5 feet.). Although a report prepared for the NYSDEC indicates that the Lowe Well was installed in bedrock at a depth of 100 feet, measurements collected during the RI indicate a well depth of 76.5 feet. Comparison of the measured depth of the Lowe Well to the estimated bedrock depth of greater than 85 feet indicates that the Lowe Well was likely installed in the unconsolidated material located above bedrock.

The surrounding~~remaining~~ population within a 4-mile radius of the site also obtain potable water from private wells. Based on the above, the groundwater media and associated pathways are of concern for the human health evaluation as related to the Cole-Zaiser site.

6.4 GROUNDWATER CONTAMINANT TRANSPORT

Groundwater elevations measured in the on-site monitoring wells indicate a groundwater flow direction in the upper 50 feet of glacial deposits to the east-northeast. The Trumble property is located across from Little Pond Road to the northeast of the site. Vacant land is located east of the site on the south side of Little Pond Road.

As discussed in **Section 4.6~~.3~~**, the average hydraulic gradient for the groundwater levels measured in shallow monitoring wells is 0.04 feet per foot. Although the hydraulic gradient and groundwater flow pattern indicate a potential for off-site migration, geochemical processes, such as adsorption of the contaminants to soil particles and ion exchange, could serve to slow or retard migration. In addition, biogeochemical reactions, such as dehalogenation and cometabolism, could lead to the degradation of chlorinated compounds in groundwater prior to migrating off-site (Nyer and Duffin, 1997). Finally, localized recharge areas (e.g., drainage swales along Little Pond Road) or times of increased precipitation could dilute the contaminant concentrations prior to off-site migration.

The Trumbles' drinking well TMB-01 is located downgradient of the site. As discussed previously, groundwater samples have been collected from this well since 1993. Even though PCE concentrations have decreased over time (1993 to 1996) in groundwater from the Trumbles' well, levels of TCE have remained fairly consistent over this period. TCE concentrations, assuming a single source such as the former waste oil reclamation operations, should also have declined somewhat over this period of time due to natural attenuation processes and biodegradation. Groundwater samples obtained from monitoring wells located between the site and the TMB-01 show concentrations of degradation products at much higher concentrations than the few degradation products observed in the groundwater from TMB-01. Degradation is occurring on-site based on the type and concentrations of well-defined degradation products of PCE and TCE. However, groundwater sample results from TMB-01 do not exhibit the same degradation pattern. The data from the groundwater samples collected from the TMB-01 may not be entirely consistent with the concept of a single source, such as the former waste oil reclamation operations at the Cole-Zaiser site. However, no other potential sources have been identified to date.

6.5 POTENTIAL HUMAN RECEPTORS AND EXPOSURE PATHWAYS

Based on the location of the site and surrounding land-use, the potential receptors of concern include a current off-site resident and a future on-site resident. Exposures to off-site residents should occur primarily through transport of COCs in groundwater off-site and impacting potable water wells (the nearest wells being the Trumbles' residential wells). Exposures to a trespasser or a visitor to the site should be relatively insignificant when compared to a resident and are not considered in the site evaluation.

6.5.1 Exposure Pathway Analysis for an Off-Site Resident

Potential exposure pathways that were identified for an off-site resident are shown in **Figure 6-1**. **Figure 6-1** also addresses other insignificant or incomplete pathways that have been evaluated.

6.5.1.1 Soil Pathways

Surface and subsurface soil samples were collected during the RI in the vicinity of potential source areas. Although the analytical results indicate the presence of a subsurface source in the vicinity of the former lagoon/bermed area, ~~There is no evidence of~~ off-site soil contamination is not anticipated based on topography, surface water flow patterns, and geologic conditions. ~~due to previous site related activities~~. Therefore, direct contact exposures to an off-site resident from the impacted soil media would not take place unless a resident trespasses the Cole-Zaiser site. These events, if they do occur, are expected to be infrequent and should not result in significant exposures. Inhalation of volatiles and particulates emanating from the site and dispersing to off-site locations is also expected to be insignificant due to the low levels of VOCs in the ~~site~~surficial soils, the presence of vegetated areas, and the low probability of soil disturbance. Based on the above, soil exposure pathways are insignificant for an off-site resident receptor.

6.5.1.2 Groundwater Pathways

The impacted shallow groundwater at the site is a potential drinking water source and therefore could result in exposures to an off-site resident. The nearest off-site downgradient residential well is located on the Trumble property based on the observed~~apparent~~ groundwater flow direction to the east-northeast. Historical sampling of the Trumbles' drinking water well (TMB-01) has shown the presence of chlorinated organic compounds, most notably PCE and TCE.

A remedial measure for treatment of the Trumbles' well water was implemented in 1993 and involves a granular activated carbon system. Post-treatment groundwater samples from TMB-01 did not contain any chemical compounds during any of the sampling events.

In lieu of any remedial measures, the groundwater pathways that are identified as being potentially complete for an off-site resident consist of:

- Ingestion of groundwater
- Dermal contact with groundwater during showering or household uses
- Inhalation of volatiles in groundwater during showering

In addition to these pathways, a complete pathway was also identified for inhalation of volatiles emanating from groundwater and subsequent transport into the atmosphere. However, the indoor inhalation pathway should be insignificant relative to use of groundwater as a potable water supply and would not be a major contributor to the potential health risk of an off-site resident.

6.5.2 Exposure Pathways to Future On-Site Resident

Potential exposure pathways that were identified for an on-site resident who may reside at the Cole-Zaiser site in the future are shown in **Figure 6-1**. The following considerations justify the pathways of concern for a resident and address other insignificant or incomplete pathways that have been evaluated.

6.5.2.1 Soil Pathways

Due to the current residential nature of the site, it is assumed that an adult or child resident could potentially spend part or all of their day outdoors. This could result in inadvertent ingestion and dermal contact with surficial soils through activities such as gardening and landscaping. There is no direct pathway (ingestion or dermal contact) for exposure to residents from COCs in subsurface soil on a routine basis. It is assumed that subsurface soil at the site could be brought to the surface and mixed with surficial soil during construction or other maintenance activities. Therefore, direct contact exposures are assumed to occur with both surface and subsurface soil.

Inhalation of volatiles and particulates is considered to be a minor contributor to cumulative risk in a residential scenario due to the low concentrations of VOCs in surficial soils, the presence of vegetated areas, and the low probability of soil disturbance. If the site was used for industrial or agricultural purposes, there would be more likelihood of using heavy equipment and related traffic around the soils. This could result in greater potential for the soils to be disturbed and produce more particulate emissions than residential land use.~~ Thus, inhalation exposure is retained as a complete pathway for the qualitative evaluation.~~

Transport of volatiles from subsurface soil into the indoor atmosphere of the main building is not considered to be a significant pathway since the building is a concrete slab-on-grade structure and does not include a basement. However, migration of VOCs from subsurface soil into the indoor atmosphere may be considered a significant exposure pathway if a basement were to be constructed at the site in the future.~~Inhalation exposures from subsurface sources should be a minor contributor to risk when compared to direct contact pathways due to the relatively low levels of VOCs detected in the site soil.~~

6.5.2.2 Groundwater Pathways

The impacted shallow groundwater at the site is a potential drinking water source. The following groundwater pathways are identified as being potentially complete for a future on-site resident:

- Ingestion of groundwater
- Dermal contact with groundwater during showering and household uses
- Inhalation of volatiles during showering

A complete pathway was also identified for inhalation of volatiles emanating from groundwater and subsequent transport into the indoor atmosphere. However, transport of volatiles from groundwater into the main building is not considered to be a significant pathway since the building is a concrete slab-on-grade structure and does not include a basement. Migration of VOCs from groundwater into the indoor atmosphere may be considered a significant exposure pathway if a basement were to be constructed at the site in the future.~~ Indoor inhalation exposures due to migration of vapors from groundwater to indoor air should be a minor contributor to cumulative risk when compared to the use of groundwater as a potable water supply. Based on the above, the indoor inhalation pathway should be relatively insignificant when compared to potable water exposure pathways.~~

6.6 QUALITATIVE HUMAN HEALTH EVALUATION

The surface and subsurface soil analytical results for chemicals detected at least once or more in a site sample are summarized in **Table 6-1**. The groundwater analytical results for chemicals detected once or more in a site sample are summarized in **Table 6-2**. A qualitative evaluation of the potential human health risks from COCs in soil and groundwater is presented below.

6.6.1 Chemicals Detected in Soil Media

The NYSDEC SCOs discussed briefly in **Section 5.0** were used as a screening criteria for the qualitative risk assessment. These criteria are based on a cancer risk goal of 10^{-6} for Class A and B carcinogens, and 10^{-5} for Class C carcinogens. A Hazard Index goal of 1.0 was used for systemic toxicants. The NYSDEC SCO for all detected compounds are listed in **Table 6-1** along with the maximum concentrations and frequency of exceedance. Specific results that exceed the NYSDEC SCOs are highlighted in bold in **Tables 5-3 through 5-8~~7~~**. A qualitative evaluation of human health risks is presented below:

- All the detected VOC, SVOC and pesticide/PCB concentrations in soil boring samples were below the NYSDEC SCOs. Four VOCs were detected in test pit soil samples at concentrations exceeding the NYSDEC SCOs. Based on this screening evaluation, the identified VOC concentrations could present potential health risks to human receptors that may come in contact with certain areas of the test pit soils.~~it is concluded that significant threats to human health will not occur from these chemicals.~~ The specific VOCs detected in the subsurface soil and their potential significance is discussed further in the **Section 6.6.1.1** below.
- Nine metals (arsenic, beryllium, cadmium, chromium, copper, iron, mercury, nickel and zinc) exceeded the corresponding NYSDEC SCOs. However, additional observations and data provided by Shacklette and Boerngen (1984) for inorganics in soils of the eastern United States (US) indicate that significant threats to human health will not occur from these metals. The potential significance of these metals is discussed further in the ~~following~~ subsections below.

6.6.1.1 VOC Exceedances

Four of the detected VOCs exceeded the NYSDEC SCOs in at least one sample. The concentrations of these VOCs in subsurface test pit samples are listed next to the corresponding well locations in **Figure 5-8**. The VOCs and their maximum concentrations (in µg/kg) are as follows:

- 1,1,1-TCA (2,700)
- 1,2-DCE (2,300)
- Tetrachloroethene (2,100)

- Total Xylenes (50,000)

Based on the screening evaluation, the VOCs listed above may present potential health risks to human receptors that come into contact with subsurface soil. The SCOs were only exceeded in subsurface soil samples collected from depths of 3 feet and 6 feet in the southern sections of Test Pits 1 and 2 (TP-1A and TP-2A).

6.6.1.2 Essential Human Nutrients

Three of the nine metals that exceeded the NYSDEC SCOs are essential human nutrients. These three metals are copper, iron, and zinc. Estimated~~The calculated~~ intakes of these metals were compared to their~~are lower than the~~ Recommended Dietary Allowances (RDAs) to evaluate the magnitude of the identified concentrations~~for both adult and child~~. RDAs are defined as levels of intake of essential nutrients that are adequate to meet the known nutrient needs of most healthy persons. The daily intakes were estimated using NYSDEC default exposure assumptions. For all three metals, the daily intakes were lower than the RDAs for both adult and child. ~~Therefore, the current levels of copper, iron and zinc should not pose significant threats to human receptors.~~

6.6.1.3 Infrequent Exceedances

Observation of the individual results indicates that four of the nine metals exceeded the NYSDEC SCOs in only one or two samples. The four metals with infrequent exceedances are as follows:

- Arsenic (8.5 mg/kg at S-5 compared to NYSDEC SCO of 7.5 mg/kg)
- Cadmium (1.4 mg/kg at S-6 and 1.1 mg/kg at S-7 compared to NYSDEC SCO of 1.0 mg/kg)
- Chromium (14.2 mg/kg at S-6 and 10.6 mg/kg in B-3 (4 to 6 feet) compared to NYSDEC SCO of 10 mg/kg)
- Nickel (18.8 mg/kg at S-6 compared to NYSDEC SCO of 13 mg/kg

Although the above-referenced concentrations slightly exceed the NYSDEC SCOs, the average concentrations are less than the SCOs. USEPA guidance indicates that an average soil concentration is most representative of the concentration that would be contacted over time. This is based on the fact that a receptor would be expected to spend time equally in all areas of the site over the duration of exposure and not just in the area of the "hot spot" or "maximum detected concentration". In addition, the distributions~~concentrations~~ of these metals concentrations appear to be indicate that they are~~may be indicative of naturally occurring background levels and~~ not related to historical site operations. Based on the above, the concentrations of arsenic, cadmium, chromium and nickel in soil should not present significant threats to human receptors.

6.6.1.4 Comparison to Eastern US Background Concentrations

The remaining two metals that exceed the NYSDEC SCOs are beryllium and mercury. Specific observations regarding the occurrence of beryllium and mercury are provided as follows:

- Beryllium exceeded the NYSDEC SCO of 0.16 mg/kg at 15 of the 23 surface and subsurface soil sample locations. The concentrations of beryllium in all soil samples were present at relatively consistent levels ranging from 0.12 mg/kg to 0.28 mg/kg. Elevated concentrations were not detected within or downgradient of the former operations areas, where high concentrations of VOCs were observed in the groundwater. As such, the beryllium concentrations are likely indicative of naturally occurring background levels and not related to site activities. Published background concentrations for metals in eastern US soils (Shacklette and Boerngen, 1984) are included in **Table 6-1**. The values provided for beryllium indicate that background would be expected to range from less than 1 to 7 mg/kg, with an average of 0.85 mg/kg.
- Mercury exceeded the NYSDEC SCO of 0.1 mg/kg at 11 of the 23 surface and subsurface soil sample locations. The concentrations of mercury ranged from below detection limit to 0.56 mg/kg. Elevated concentrations were not detected within or downgradient of the former operations area, where high concentrations of VOCs were observed in the groundwater. As such, the mercury concentrations are likely to indicative of naturally occurring background levels and not related to site activities. Published background values for mercury, as provided in **Table 6-1**, range from 0.01 to 3.4 mg/kg, with an average of 0.12 mg/kg.

6.6.2 Chemicals Detected in Groundwater Media

The NYSDEC GWQSs discussed briefly in **Section 5.0** were used as a screening criteria for the qualitative risk assessment. The NYSDEC GWQSs have been developed for specific classes of fresh and saline surface waters and fresh groundwaters. The groundwater concentrations were compared to the NYSDEC GWQSs developed for protection of sources of drinking water. The NYSDEC GWQSs for all detected compounds are listed in **Table 6-2** along with the maximum concentrations and frequency of exceedance. Specific results that exceed the NYSDEC GWQSs are highlighted in bold in **Table 5-8**. The ~~most recent~~ analytical results for shallow groundwater samples are included in this evaluation and consist of the VOC data from July 1996, January-February 1997, and October 1997 and the SVOC, pesticide/PCB, and metals data from July 1996. A qualitative evaluation of human health risks is presented in the subsections below:

6.6.2.1 VOC Exceedances

Nine of the detected VOCs exceeded the NYSDEC GWQSs in shallow groundwater samples. No exceedances occurred in groundwater samples from the Lowes' bedrock well. Concentrations of the~~se~~ nine exceedance VOCs are listed next to the corresponding well locations in **Figures 5-9, 5-11, and 5-12**. The VOCs, the range of their concentrations, and their maximum concentrations for locations at which they were detected are provided below:

1. 1,1,1-TCA - Concentrations of 1,1,1,-TCA ranged from below detection limit to a maximum detected concentration of 840~~670~~ µg/l (MW-6). The maximum concentrations of ~~On-site~~ groundwater samples from monitoring wells MW-3 (93~~40~~ µg/l), MW-5 (24 µg/l), MW-6 (840~~670~~ µg/l) and MW-7 (460 µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
2. 1,1-DCA - Concentrations of 1,1-DCA ranged from below detection limit to a maximum detected concentration of 280 µg/l (MW-7). The maximum concentrations of ~~On-site~~ groundwater samples from monitoring wells MW-3 (160~~90~~ µg/l), MW-6 (48~~31~~ µg/l) and MW-7 (280 µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
3. 1,1-DCE - Concentrations of 1,1-DCE ranged from below detection limit to a maximum detected concentration of 14 µg/l (MW-7). The maximum concentrations of ~~on-site~~ groundwater samples from monitoring wells MW-6 (11 µg/l) and MW-7 (14 µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
4. 1,2-DCE (total) - Concentrations of 1,2-DCE ranged from below detection limit to a maximum detected concentration of 20,000 µg/l (MW-7). The maximum concentrations of ~~On-site~~ groundwater samples from monitoring wells MW-3 (5,400~~2,100~~ µg/l), MW-4 (48 µg/l), MW-6 (20~~16~~ µg/l), ~~and~~ MW-7 (20,000 µg/l), and MW-7A (11 µg/l) exceeded the NYSDEC GWQS of 5 µg/l. The NYSDEC GWQS is 5 µg/l for the cis- or trans- isomers of 1,2-DCE.
5. Benzene - Concentrations of benzene ranged from below detection limit to a maximum detected concentration of 23 µg/l (MW-4A). The maximum concentrations of ~~On-site~~ groundwater samples from monitoring wells MW-7 (2 µg/l) and MW-4A (23 µg/l) exceeded the NYSDEC GWQS of 0.7 µg/l.
6. PCE - Concentrations of PCE ranged from below detection limit to a maximum detected concentration of 490~~50~~ µg/l (MW-7). The maximum concentrations of ~~On-site~~ groundwater samples from monitoring wells MW-3 (34~~30~~ µg/l), MW-6 (6 µg/l), and MW-7 (490~~50~~ µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
7. Toluene - Concentrations of toluene ranged from below detection limit to a maximum detected concentration of 47 µg/l (MW-7). The maximum concentrations of ~~on-site~~ groundwater samples from monitoring wells MW-3 (14 µg/l) and MW-7 (47 µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
8. TCE - Concentrations of TCE ranged from below detection limit to a maximum detected concentration of 28~~7~~0 µg/l (MW-7). The maximum concentrations of ~~Two on-site and one off-site groundwater well~~ samples from wells MW-3 (18~~14~~ µg/l), MW-7 (280~~270~~ µg/l), and TMB-01 (28 µg/l) exceeded the NYSDEC GWQS of 5 µg/l.
9. Vinyl Chloride - Concentrations of vinyl chloride ranged from below detection limit to a maximum detected concentration of 2,9~~2~~00 µg/l (MW-3). The maximum concentrations

of ~~On-site~~ groundwater samples from monitoring wells MW-3 (2,900~~2,200~~ µg/l), MW-4 (60 µg/l), MW-6 (3 µg/l), and MW-7 (790 µg/l) exceeded the NYSDEC GWQS of 2 µg/l.

Based on the screening evaluation, the VOCs listed above may present potential health risks to human receptors that use the shallow groundwater aquifer as a drinking water source. It should be noted that the groundwater standards were exceeded in ~~very few monitoring well~~ locations~~, primarily~~ near potential on-site source areas. ~~Since the levels of chemicals were below groundwater standards or detection limits in a majority of the monitoring wells, the average chemical concentrations in the plume are likely to be much lower than the concentration near the source areas.~~

6.6.2.2 SVOC Exceedances

One SVOC (4-chloro-3-methylphenol) exceeded the NYSDEC groundwater standards in shallow groundwater. The concentrations ranged from below detection limit of 10 µg/l to a maximum detected concentration of 5 µg/l (MW-7). Two~~One on-site~~ groundwater samples from monitoring well MW-7 (3 and 5 µg/l) exceeded the NYSDEC groundwater standard of 1 µg/l. The NYSDEC groundwater standard is 1 µg/l for chlorinated phenols. No exceedances occurred in the groundwater sample collected from the Lowes' bedrock well.

Since the groundwater samples from a single monitoring well exceeded the NYSDEC GWQSs and the levels of chemicals were below detection limits in a majority of the monitoring wells, the average chemical concentration in the plume is likely to be below the NYSDEC groundwater criteria. Based on the above, the current levels of 4-chloro-3-methylphenol are~~is~~ not likely to cause unacceptable human health risks.

6.6.2.3 Metal Exceedances

Five of the 23 TAL metals were identified at concentrations that exceeded the NYSDEC GWQSs in shallow groundwater. Three of these five metals were detected at concentrations that exceeded the GWQSs in the Lowes' bedrock well. The concentrations of these five metals are listed next to each well location in **Figure 5-10~~8~~**. The five metals, the range of their concentrations, and their maximum concentrations for the locations at which they were detected are listed below:

1. Aluminum - Concentrations of aluminum ranged from below detection limit to a maximum detected concentration of 48,700 µg/l (MW-7). ~~A majority of the on-site~~The maximum concentrations of shallow groundwater samples from wells MW-1 (8,450 µg/l), MW-2 (6,290 µg/l), MW-3 (16,500 µg/l), MW-4 (33,500 µg/l), MW-5 (27,200 µg/l), MW-6 (32,100~~000~~ µg/l), and MW-7 (48,700 µg/l)~~, and the Lowe Well (151 µg/l)~~

exceeded the NYSDEC GWQS of 100 µg/l. The concentration in the Lowes' bedrock well (151 µg/l) exceeded the NYSDEC GWQS for aluminum.

2. Chromium - Concentration of chromium ranged from below detection limit to a maximum detected concentration of 57.9 µg/l (MW-7). The maximum concentrations of shallow groundwater samples from monitoring well MW-7 (53.3 and 57.9 µg/l) exceeded the NYSDEC GWQS.
3. Iron - Concentrations of iron ranged from below detection limit to a maximum detected concentration of 97,200 µg/l (MW-7). ~~A majority of the on-site~~ The maximum concentrations of shallow groundwater samples from wells MW-1 (17,500 µg/l), MW-2 (11,900 µg/l), MW-3 (34,700 µg/l), MW-4 (53,400 µg/l), MW-5 (60,100), MW-6 (68,800 µg/l), MW-7 (97,200 µg/l), ~~Lowe well (23,800 µg/l)~~ and TMB-03 (1,770 µg/l) exceeded the NYSDEC GWQS of 300 µg/l. The concentration in the Lowes' bedrock well (23,800 µg/l) exceeded the NYSDEC GWQS for iron.
4. Lead - Concentrations of lead ranged from below detection limit to a maximum detected concentration of 36 µg/l (MW-7). ~~On site~~ The maximum concentrations of shallow groundwater samples from monitoring well MW-7 (36 µg/l) ~~and Lowe Well (28.7 µg/l)~~ slightly exceeded the NYSDEC GWQS of 25 µg/l. The concentration in the Lowes' bedrock well (28.7 µg/l) also slightly exceeded the NYSDEC GWQS for lead.
5. Magnesium - Concentrations of magnesium ranged from 1,770 µg/l to a maximum detected concentration of 125,000 µg/l (MW-6). ~~On site~~ The maximum concentrations of shallow groundwater samples from wells MW-5 (49,900 µg/l), MW-6 (125,000 µg/l) and MW-7 (80,200~~000~~ µg/l) exceeded the NYSDEC GWQS of 35,000 µg/l.
6. Manganese - Concentrations of manganese ranged from 6.8 µg/l to a maximum detected concentration of 11,400 (MW-4)~~10,300 µg/l (MW-7)~~. ~~A majority of the on-site~~ The maximum concentrations of shallow groundwater samples from wells MW-1 (793 µg/l), MW-2 (670 µg/l), MW-3 (10,100 µg/l), MW-4 (11,400 µg/l), MW-5 (3,470~~00~~ µg/l), MW-6 (8,420 µg/l), MW-7 (10,300 µg/l), and TMB-03 (2,520 µg/l) exceeded the NYSDEC GWQS of 300 µg/l.
7. Thallium - Concentrations of thallium ranged from below detection limit to a maximum detected concentration of 9.4 µg/l (TMB-01). The maximum concentrations of shallow groundwater samples from TMB-01 (9.5 µg/l) andTMB-03 (7.8 µg/l) exceed the NYSDEC GWQS of 4 µg/l.

The site-wide distribution of metals in groundwater (see **Figure 5-10~~8~~**) indicates consistently high concentrations of aluminum, iron, magnesium, and manganese in the shallow monitoring wells (MW-1 through MW-7). The consistent results appear to suggest naturally high concentrations of these metals. The absence of high concentrations of these metals in groundwater collected from the Trumbles' well may be attributed to the lower turbidity of the groundwater samples from these wells. Although the~~se~~ high concentrations at the site may impact the aesthetic quality of the shallow groundwater, they are not exclusively located in the source areas associated with former site operations. In addition, the slight exceedances of lead that were identified in MW-7 and the Lowe Well and of chromium that were identified in MW-7 appear quite localized. ~~The average lead concentration in the plume is likely to be below the NYSDEC GWQS and, as such, is not expected to cause unacceptable health.~~ The thallium concentrations that were identified at or slightly above the NYSDEC GWQS in two samples from the Trumbles' wells appear to quite localized and are not expected to be related to the Cole-Zaiser site operations.

TABLE 6-1
HUMAN HEALTH IMPACT SCREENING-LEVEL ANALYSIS FOR SURFACE AND SUBSURFACE SOILS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Constituent of Interest	Maximum Soil Concentration	NYSDEC Soil Cleanup Objective[1]	Range and Mean in Eastern US Soils[2]	NYSDEC Criterion Exceeded?	Frequency of Exceedance
Volatile Organics (ug/kg)					
1,1,1-Trichloroethane	2,700	800	N/A	Yes	2/36
1,2-Dichloroethene (total)	2,300	300	N/A	Yes	3/36
2-Butanone	3	300	N/A	No	0/36
Acetone	30	200	N/A	No	0/36
Benzene	2	60	N/A	No	0/36
Chloroform	2	300	N/A	No	0/36
Ethylbenzene	2	5,500	N/A	No	0/36
Methylene Chloride	20	100	N/A	No	0/36
Tetrachloroethene	2,100	1,400	N/A	Yes	3/36
Toluene	2	1,500	N/A	No	0/36
Trichloroethene	1	700	N/A	No	0/36
Xylenes (total)	50,000	1,200	N/A	Yes	3/36
Semivolatile Organics (ug/kg)					
2-Methylnaphthalene	79	36,400	N/A	No	0/24
4-Chloro-3-Methylphenol	38	240 or QL	N/A	No	0/24
bis(2-Ethylhexyl)phthalate	380	50,000	N/A	No	0/24
Di-n-butylphthalate	450	8,100	N/A	No	0/24
Diethylphthalate	1,100	7,100	N/A	No	0/24
Fluoranthene	140	50,000	N/A	No	0/24
Pentachlorophenol	260	1,000 or QL	N/A	No	0/24
Phenanthrene	92	50,000	N/A	No	0/24
Pyrene	40	50,000	N/A	No	0/24
Pesticides/PCBs (ug/kg)					
alpha-BHC	1.0	110	N/A	No	0/28
Aroclor-1248	3,400	1,000 - 10,000	N/A	No	0/28
Aroclor-1254	590	1,000 - 10,000	N/A	No	0/28
Aroclor-1260	580	1,000 - 10,000	N/A	No	0/28
4-4'-DDE	2.9	2,100	N/A	No	0/28
delta-BHC	2.1	300	N/A	No	0/28
Dieldrin	3.6	44	N/A	No	0/28
Endosulfan I	1.1	900	N/A	No	0/28
Endrin	4.0	100	N/A	No	0/28
Heptachlor	1.5	100	N/A	No	0/28
Heptachlor epoxide	2.2	20	N/A	No	0/28
Inorganics (mg/kg)					
Aluminum (Al)	9,780	SB	0.7->10 (5.7)	N/A	N/A
Arsenic (As)	8.5	7.5 or SB	0.1-73 (7.4)	Yes	1/23
Barium (Ba)	57.5	300 or SB	10-1,500 (420)	No	0/23
Beryllium (Be)	0.28	0.16 or SB	<1-7 (0.85)	Yes	15/23
Cadmium (Cd)	1.4	1 or SB	N/A	Yes	2/23
Calcium (Ca)	1,350	N/A	100-280,000 (6,300)	N/A	N/A

TABLE 6-1
HUMAN HEALTH IMPACT SCREENING-LEVEL ANALYSIS FOR SURFACE AND SUBSURFACE SOILS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

Constituent of Interest	Maximum Soil Concentration	NYSDEC Soil Cleanup Objective[1]	Range and Mean in Eastern US Soils[2]	NYSDEC Criterion Exceeded?	Frequency of Exceedance
Chromium (Cr)	14.2	10 or SB	1-1,000 (52)	Yes	2/23
Cobalt (Co)	6.7	30 or SB	<0.3-70 (9.2)	No	0/23
Copper (Cu)	557	25 or SB	<1-700 (22)	Yes	6/23
Cyanide (CN)	7.4	N/A	N/A	No	0/23
Iron (Fe)	22,000	2,000 or SB	0.01->10 (2.5)	Yes	23/23
Lead (Pb)	217	SB	<10-300 (17)	N/A	N/A
Magnesium (Mg)	2,990	SB	50-50,000 (4,600)	N/A	N/A
Manganese (Mn)	1,370	SB	<2-7,000 (640)	N/A	N/A
Mercury (Hg)	0.56	0.1	0.01-3.4 (0.12)	Yes	11/23
Nickel (Ni)	18.8	13 or SB	<5-700 (18)	Yes	1/23
Potassium (K)	1,570	SB	50-37,000	N/A	N/A
Selenium (Se)	1.6	2 or SB	<0.1-3.9 (0.45)	No	0/23
Thallium (Th)	2.4	SB	N/A	N/A	N/A
Vanadium (V)	16.9	150 or SB	<7-300 (66)	No	0/23
Zinc (Zn)	34.2	20 or SB	<5-2,900 (52)	Yes	14/23

1. NYSDEC (1994a)
2. Shacklette and Boerngen (1984); mean () is estimated arithmetic average.

N/A - Not applicable.
QL - Analytical quantitation limit ("detection limit")
SB - Site background (per procedures established in NYSDEC [1994a]; not obtained for Cole-Zaiser Site)

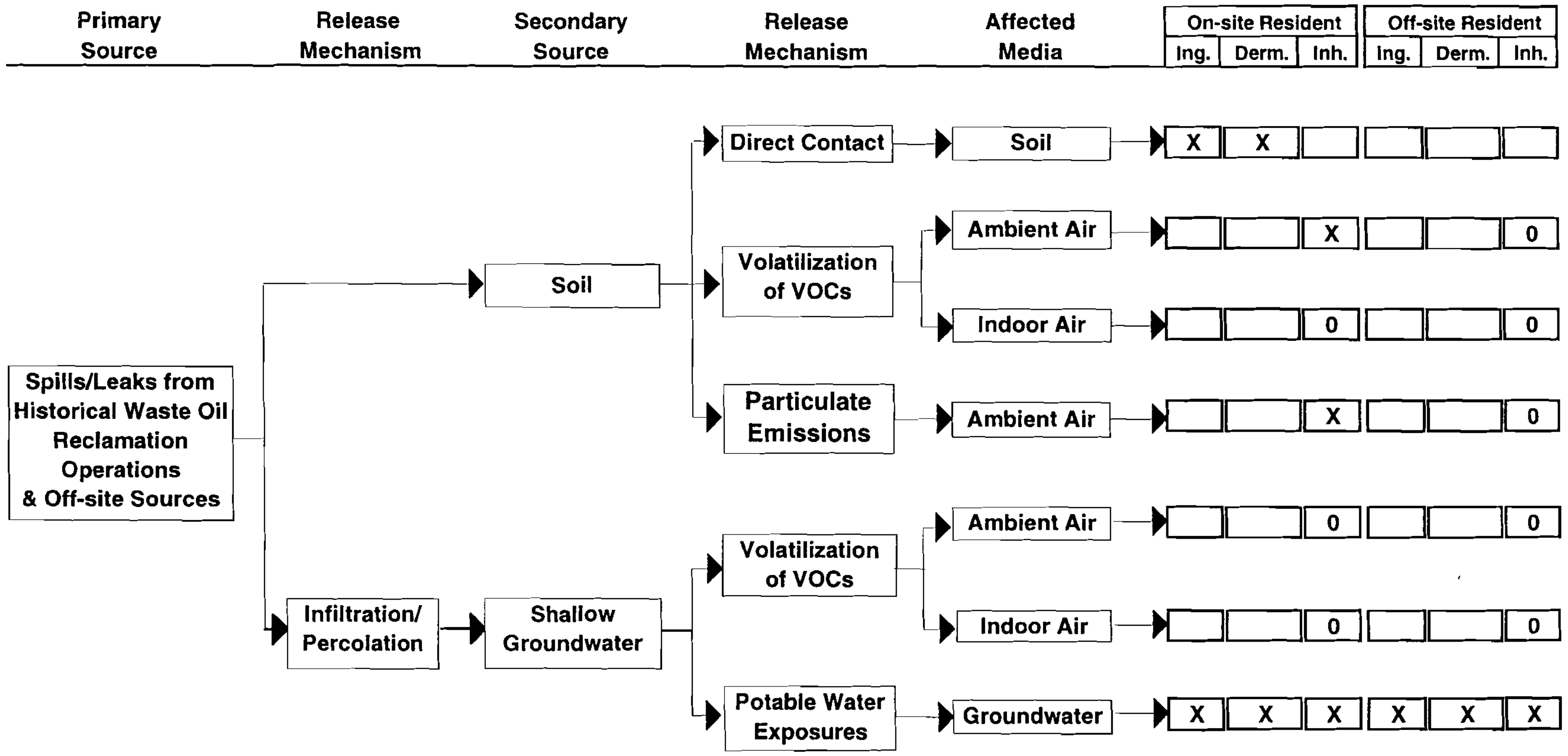
TABLE 6-2
HUMAN HEALTH IMPACT SCREENING-LEVEL ANALYSIS FOR SHALLOW GROUNDWATER
COLE-ZAISER SITE- AMBOY TOWNSHIP, NEW YORK

	Groundwater	**Groundwater**	**Criterion**	**Frequency of Exceedance**		
Constituent of Interest	**Concentration**	**Quality Standards[1]**	**Exceeded?**	**Jul-96**	**Jan/Feb-97**	**Oct-97**
Volatile Organics (ug/l)						
1,1,1-Trichloroethane	840	5	Yes	4/11	4/16	5/8
1,1-Dichloroethane	280	5	Yes	4/11	4/16	5/8
1,1-Dichloroethene	14	5	Yes	1/11	2/16	0/8
1,2-Dichloroethene (total)	20,000	5	Yes	5/11	5/16	5/8
Acetone	51	50	No[2]	0/11	0/16	0/8
Benzene	23	0.7	Yes	0/11	1/16	0/8
Carbon Disulfide	4	50	No	0/11	0/16	0/8
Ethylbenzene	2	5	No	0/11	0/16	0/8
Tetrachloroethene	490	5	Yes	4/11	3/16	3/8
Toluene	47	5	Yes	2/11	2/16	1/8
Trichloroethene	280	5	Yes	3/11	4/16	3/8
Vinyl Chloride	2,900	2	Yes	4/11	4/16	5/8
Xylenes (total)	4	5	No	0/11	0/16	0/8
Semivolatile Organics (ug/l)						
4-Chloro-3-Methylphenol	5	1	Yes	1/11	NS	NS
Diethylphthalate	3	50	No	0/11	NS	NS
Inorganics (ug/l)						
Aluminum (Al)	48,700	100	Yes	9/11	NS	NS
Arsenic (As)	13.4	25	No	0/11	NS	NS
Barium (Ba)	633	1,000	No	0/11	NS	NS
Beryllium (Be)	2.4	3	No	0/11	NS	NS
Cadmium (Cd)	0.87	10	No	0/11	NS	NS
Calcium (Ca)	300,000	N/A	N/A	N/A	NS	NS
Chromium (Cr)	57.9	50	Yes	2/11	NS	NS
Cobalt (Co)	44.8	N/A	N/A	N/A	NS	NS
Copper (Cu)	92.9	200	No	0/11	NS	NS
Iron (Fe)	97,200	300	Yes	9/11	NS	NS
Lead (Pb)	36	25	Yes	2/11	NS	NS
Magnesium (Mg)	125,000	35,000	Yes	4/11	NS	NS
Manganese (Mn)	11,400	300	Yes	9/11	NS	NS
Mercury (Hg)	0.48	2	No	0/11	NS	NS
Nickel (Ni)	102	N/A	N/A	N/A	NS	NS
Potassium (K)	33,600	N/A	N/A	N/A	NS	NS
Sodium (Na)	12,600	20,000	No	0/11	NS	NS
Thallium (Th)	9.4	4	Yes	2/11	NS	NS
Vanadium (V)	76.3	N/A	N/A	N/A	NS	NS
Zinc (Zn)	267	300	No	0/11	NS	NS

1. NYSDEC (1993a)
2. Acetone only detected in two samples. Average concentration is below NYSDEC criterion.

N/A - Not Applicable

NS - Not Sampled for this analysis



Primary Source	Release Mechanism	Secondary Source	Release Mechanism	Affected Media	On-site Resident Ing.	On-site Resident Derm.	On-site Resident Inh.	Off-site Resident Ing.	Off-site Resident Derm.	Off-site Resident Inh.
Spills/Leaks from Historical Waste Oil Reclamation Operations & Off-site Sources		Soil	Direct Contact	Soil	X	X				
			Volatilization of VOCs	Ambient Air			X			0
				Indoor Air			0			0
			Particulate Emissions	Ambient Air			X			0
	Infiltration/ Percolation	Shallow Groundwater	Volatilization of VOCs	Ambient Air			0			0
				Indoor Air			0			0
			Potable Water Exposures	Groundwater	X	X	X	X	X	X

Abbreviations:
Ing. - Ingestion
Derm. - Dermal Contact
Inh. - Inhalation

LEGEND

X	Potentially complete and significant exposure pathway
0	Potentially complete but insignificant exposure pathway
	Incomplete exposure pathway

SITE CONCEPTUAL EXPOSURE MODEL - RESIDENTIAL LAND-USE

COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

DRAWN BY: MR	CHECKED BY: MJM	DATE: 20/05/97	PROJECT NO.: 5E15509	FIGURE NO: 6-1	L:\COLESCEM.XLS

A Fish and Wildlife Impact Analysis (FWIA) was conducted to provide a site description, address existing environmental conditions, and characterize local ecological resources. The analysis follows the requirements outlined as Steps I through IIB of the October 1994 NYSDEC Division of Fish and Wildlife guidance, *Fish and Wildlife Impact Analysis for Inactive Waste Sites* (NYSDEC, 1994b).

Step I is a site description including characterization of topography and physical conditions; land use and vegetative cover; ecological resources; habitat value; and applicable regulatory criteria. These descriptions are provided in the following subsections with the exception of site topography and physical features which were presented in **Section 2.0**. Steps IIA and IIB are the first two elements of a contaminant-specific impact assessment and include a pathway analysis (**Section 7.8**) and criteria-specific analysis (**Section 7.9**).

7.1 VEGETATIVE COVER

Figures 2-2 and 7-1 include information on broad vegetative covertypes in the general vicinity and at the site, respectively. The Cole-Zaiser site is in the Tug Hill Transition Ecozone (Reschke, 1990). Based on the 1980 aerial photograph used in the Soil Conservation Service soil survey document (Rapparlie, 1980), approximately 70 percent of the land within a one-mile radius of the site is forested, with most of the non-forested areas being along Little Pond Road to the east and Foil Road to the south. The open areas are mainly agricultural, with some crops such as corn or other grains but are mostly hayfields or pasture. The non-forested areas that are not in agricultural use are for the most part either unmanaged old fields (such as much of the site itself), landscaped residential plots, or scrub-shrub wetlands in various early successional stages. At the end of the one-mile radius to the southwest (along Foil Road) and to the west-northwest (along Little Pond Road) are some agricultural fields, pastures, and scrub-shrub wetlands. The area out to a two-mile radius from the site is generally similar to that just described, although non-forested sections are more prevalent to the west and southwest.

Most of the forest in the vicinity of the site are either: (1) upland stand on the knolls or ridges and their slopes; or (2) palustrine swamp forests on the lower slopes and in the valleys (the latter including much of the floodplain of South Branch Little Salmon River). Most of these forests are second- or third-growth due to the area having been extensively logged in the two previous centuries (Ellis, 1981). Original forests in the area were a mixture of beech, yellow birch, and sugar maple on higher areas and softwoods (mainly red spruce, balsam fir, hemlock, and tamarack) on lower slopes and edges of floodplains (Stout, 1958). Present forests are mainly pure stands of older sugar maple ("hard maple"), yellow birch, and beech, with younger volunteer hardwoods such as aspen, red maple ("soft maple"), and black cherry in the fringe areas. Conifers such as hemlock, white pines, and tamarack still occur in peripheral portions of some of the palustrine swamp forests. Red spruce and balsam fir are even more restricted.

The Cole-Zaiser site is located in a non-forested pocket that was apparently a cleared area used for cropland and/or pasture prior to 1960. Roughly, the top of the site knoll, another knoll approximately 1,000 feet to the south, the intervening swale, and the upper third of the valley to the east are depicted as non-forested in the 1960 USGS topographic quadrangle map, and the area remains much the same today. The site is still dominated by grasses and weeds and thus best characterized as a successional old field (Reschke, 1990), but an extensive invasion of shrubs (e.g., black cherry) and tree saplings (e.g., aspen, red maple) occurs in many areas. Currently, some clumps of older volunteer hardwoods (red maple, black cherry, aspen) or individuals of the same species are scattered through the unmanaged field on the site. A cornfield was located to the west and south of the site in the late 1980s and early 1990s, and an old field area was to the east. More recently, the agricultural fields have not been cultivated or planted and are almost indistinguishable from the site itself. Beyond these features to the west and south (and beyond Little Pond Road to the north), narrow sections of upland forest grade into palustrine lowland forest. To the southeast, the old field grades into a scrub-shrub wetland (NYSDEC WM-13; see **Section 7.3** below).

7.2 WILDLIFE RESOURCES

Table 7-1 is a list of the terrestrial vertebrates known or expected to occur in the general vicinity of the site, based on information provided~~s~~ by Messrs. Ronald Frodelius and Ray Nolan (NYSDEC Division of Fish and Wildlife, Cortland Office), zoogeographic and other literature, interviews with local residents, 1995-96 small game harvest data for Wildlife Management Unit 27 (which includes Amboy Township), and limited site visits. As noted above, the area within a two-mile radius of the site contains a mixture of uplands and lowlands, includes extensive forests and some open sections, and also has several wetlands, ponds, and streams. This variety of covertypes, together with the fact that the area (especially within the one-mile radius) is relatively undeveloped, provides at least potential habitat for more than 200 species of terrestrial and/or semiaquatic "wildlife".

Although as many as 19 species of amphibians are known or likely to be present in the general vicinity, nearly all of these small, cryptic animals tend to remain near permanent water or wet areas in forests. Only the American toad (*Bufo terrestris*) is likely to be very common on the site itself, but many of the other frogs and some of the salamanders (e.g., Jefferson salamander, *Ambystoma jeffersonianum*) would be expected to be common in the wetland to the east southeast.

At least 14 species of reptiles are known or expected in the area. Representatives of six of these (all snakes) probably reside on, or at least occasionally visit, the site. An eastern garter snake (*Thamnophis sirtalis*) was once observed on the site. The other listed reptiles are likely to remain in or near permanent water and/or forests, although common snapping turtles (*Chelydra serpentina*) may occasionally move up into the drainage swales at the eastern end of the site.

Well over 150 species of birds are likely to occur in the general vicinity of site, but only about a third of these are resident to the area. Moreover, about a third of the species listed in **Table 7-1**, nearly all of which are migrants, seldom, if ever, stray very far from waterbodies or wetlands (except when in flight). Many of the remainder, including both residents and migrants, spend all or much or their time in (or over) wooded areas. When these relationships are taken into account, it appears likely that representatives of only about 40 species reside on the site or visit it frequently. The more common birds observed thus far on or near the site include mourning doves (*Zenaida macroura*), flickers (*Colaptes auratus*), crows (*Corvus brachyrhynchos*), wrens (e.g., *Troglodytes aedon*), mockingbirds (*Mimus polyglottos*), robins (*Turdus migratorius*), red-winged blackbirds (*Agelaius phoeniceus*), cowbirds (*Molothrus ater*), grackles (*Quiscalus quiscula*), meadowlarks (*Sturnella magna*), cardinals (*Cardinalis cardinalis*), goldfinches (*Spinus tristis*), and field sparrows (*Spizella pusilla*). Only two gamebirds are known to occur on the site or its immediate vicinity, wild turkeys (*Meleagris gallopavo*) and pheasants (*Phasianus colchicus*). Ruffed grouse (*Bonas umbellus*) and woodcock (*Philohela minor*) are both very common in lowlands of the general area but are unlikely to visit the site itself.

About 50 species of mammals are known or expected to occur in the vicinity of the site. Of these, representatives of about 12 are probably residents or frequent visitors to the site. These include opossums (*Didelphis virginiana*), least shrews (*Cryptotus parva*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), red fox (*Vulpes fulva*), woodchucks (*Marmota monax*), several small rodents (e.g., *Peromyscus leucopus* and *Microtus pennsylvanicus*), snowshoe hare (*Lepus americanus*), eastern cottontail (*Sylvilagus floridanus*), and whitetail deer (*Odocoileus virginianus*). Other than a few of the small rodents (e.g., white-footed mouse, meadow vole), most of the mammals typically have home ranges that are substantially larger than the Cole-Zaiser site, so very few individuals of any species are likely to spend much time on the property. This is especially true of the game or furbearing species (e.g., opossum, raccoon, fox, rabbits, deer).

The nearest land in the general vicinity of the Cole-Zaiser site that is specifically-designated for wildlife management is the Happy Valley Wildlife Management Area, about 3.2 miles northwest. Although partly within the South Branch Little Salmon River watershed, the wildlife management area is effectively upgradient from the site and therefore considered beyond the site's potential influence.

7.3 WETLANDS

Within a two-mile radius of the site there are two small NYSDEC wetlands (Code Nos. WM-3 and WM-13), as well as substantial portions of PL-2, which is basically the floodplain of South Branch Little Salmon River (**Figure 7-1**). The upper edge of WM-13 is about 550 feet east-southeast of the site and is the only wetland immediately downgradient; thus, it is the only wetland with a potential to be directly affected by the site. WM-3 and limited portions of PL-2 might be indirectly affected in the sense that certain wider-ranging semiaquatic vertebrates from these wetlands (e.g., woodcock, raccoon) may occasionally visit the site to forage.

Based on the National Wetland Inventory (NWI) map (USDI/FWS, 1995) presented as **Figure 7-2**, it appears that WM-13 is a seasonally-flooded, palustrine scrub-shrub wetland in its upper third and grades into a seasonally-flooded palustrine forest. To the south, the latter approaches, but is not contiguous with, similar forest along the South Branch Little Salmon River (i.e., a part of PL-2). As depicted by the NWI map, WM-13 appears to consist of about 15 acres of scrub-shrub vegetation and about 23 acres of forest. However, the aerial photograph upon which this interpretation was based is nearly two decades old and from a distance it appears that WM-13 currently has more extensive early-successional forest. Under the NYSDEC system (6NYCRR, Part 664), WM-13 is a Class II wetland. The vegetation in both portions appears (from a distance) to be dominated by red maple, alders, and aspens. Willows, arrowwood, white pines, and buttonbush were also noted in some areas.

The eastern edge of WM-3 is about 500 feet from the Cole-Zaiser site, but upgradient. This wetland is a seasonally-flooded palustrine forest similar to the lower part of WM-13, but WM-3 has a permanent pond (about 3 acres) in its approximate center which drains via a small stream to South Branch Little Salmon River.

7.4 AQUATIC ENVIRONMENTS

The South Branch Little Salmon River originates as the outflow from a pond in a swamp northeast of Amboy Center (junction of state Highways 69 and 183), about 2.2 stream miles above where the stream passes south of the Cole-Zaiser site. From the vicinity of the site, the South Branch Little Salmon River flows westward about 14 stream miles and joins the North Branch near the town of Parish. The combined flows of the North and South Branches form the

Little Salmon River, which flows northwest about 12 stream miles to enter Lake Ontario near Mexico Point.

The South Branch Little Salmon River is categorized by NYSDEC as a Class D stream ("suitable primarily for fish propagation"), whereas the Little Salmon River is a Class C/C(T) stream, considered suitable for both fish propagation and recreational fishing. The localized sections of the Little Salmon River classified C(T) are trout waters, but major salmon and steelhead runs (such as those for which the main Salmon River is famous) do not occur because of an old mill dam only a few miles upstream from Lake Ontario. **Table 7-2** is a list of 37 fishes known or expected to occur in the Little Salmon River and its tributaries. However, it is unlikely that more than about a third of these species are represented as far upstream as the headwaters in the vicinity of the Cole-Zaiser site. The South Branch Little Salmon River is a very small stream where it meanders through the swampy valley to the south of the site and has a relatively low gradient, with a vertical drop of about 10 feet per stream mile. In the context of this FWIA, it is noteworthy that this stream, although topographically downgradient from the Cole-Zaiser site, it is not directly connected to the site by any permanent, discrete conveyance of surface flows (i.e., tributary stream).

7.5 ENDANGERED SPECIES

A letter received from the New York Natural Heritage Program (Mr. Nicholas B. Conrad to Ms. Lisa M. Pfaff, April 29, 1997; Appendix D) states that review of its files indicates that there are no known occurrences of threatened or endangered species or significant habitats within a two-mile radius of the Cole-Zaiser site[2]. Limited onsite inspections yielded no observations of rare plant or animal species. The disturbed, successional nature of the site habitat, together with its small size and confinement to higher ground with a paved public road along one side, probably preclude its ability to support rare or endangered species. Bald eagles are known to pass through the general area during migration, but they normally forage near large bodies of water. The nearest such features are Coan Pond (about 1.5 miles west-northwest) and Long Pond (about 2 miles northwest).

7.6 HABITAT VALUES TO WILDLIFE

The most significant habitat that could be potentially affected by migration of contaminants associated with the Cole-Zaiser site is the scrub-shrub/forested wetland to the east-southeast

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[2] The absence of data from the Natural Heritage Program files does not necessarily mean that rare species or natural communities do not exist on or near the site.

(NYSDEC Code No. WM-13). Due primarily to its small size, the site itself offers limited habitat for nesting, cover, and/or foraging for all but a few amphibians, reptiles, small birds, small mammals, and invertebrates. The site is too small to provide all of the habitat requirements of medium-sized and larger, wider-ranging mammals and migratory birds, and it contains no habitat for waterfowl, wading birds, or shorebirds. As noted above, the site probably serves as a small component of much wider foraging areas associated with the surrounding lands (particularly the upland forests to the north and the wetlands to the west and east). Therefore, the primary habitat value of the Cole-Zaiser site is mainly in its contributions to the biodiversity of the region.

Functional values of the downgradient scrub-shrub/forested wetland near the site were not investigated as part of this study. Presumably they are significant, but it is also noteworthy that this wetland habitat constitutes a relatively small percentage of that available in the general vicinity.

7.7 HABITAT VALUES TO HUMANS

Due its small size, the site itself offers little potential for either consumptive (hunting) or non-consumptive (e.g., bird-watching) wildlife use. However, the area within a two-mile radius encompasses a variety of terrestrial and wetland habitats, with a relatively low density of people and little intensive agriculture or industry. For example, six residences housing fewer than 20 people were identified within a mile of the site in 1992 (URS, 1992). The area would be expected to offer substantial resources for commercial trapping and hunting, as well as nonconsumptive recreational activities such as hiking and wildlife observation. This was generally confirmed by interviews with local residents. The South Branch Little Salmon River is a small, Class D stream near the site, and has relatively limited access upstream from the village of West Amboy (about 4 stream miles west of the site). Therefore, it has little attraction to anglers, especially considering the proximity of more accessible (and popular) fisheries such as the main Salmon River and Oneida Lake.

7.8 APPLICABLE FISH AND WILDLIFE REGULATORY CRITERIA

Since terrestrial, wetland, and aquatic ecological resources have been identified herein as being potentially impacted by the Cole-Zaiser site, there are several contaminant-specific and site-specific standards, criteria, and guidelines (SCGs) that might ultimately apply. The only contaminant-specific SCGs available for upland terrestrial receptors are Soil Cleanup Objectives and Cleanup Levels (as established in NYSDEC, 1994a). If further evaluation indicates that contaminants have actually migrated off-site into surface waters or sediments of Wetland

WM-13 and the South Branch Little Salmon River, the levels of contaminants in those media will need to be compared to SCGs provided at 6NYCRR, Part 703 (water-quality standards) and sediment-quality guidance (NYSDEC, 1993b). Site-specific SCGs include applicable state and federal regulations promulgated to protect sensitive environments such as wetlands, streams, and navigable waters (6NYCRR, Parts 663-664; NYSDEC 1990, 1991, 1993b; 33CFR320-328). At this time, there is no indication that off-site contaminant migration has occurred, with the exception of groundwater transport of VOCs.

7.9 ECOLOGICAL PATHWAY ANALYSIS

Potential exposure pathways to ecological receptors would be through groundwater, surface water, and soil. Each of these media is discussed in the following subsections.

7.9.1 Groundwater Exposure Pathway

Logs of the on-site soil borings and groundwater monitoring wells indicate that the shallowest water-bearing zones at the site are well below depths at which direct contact with plant roots or burrowing animals would be possible. The flows are to the east-northeast, so near-field interaction between shallow groundwater and surface water is not expected. Therefore, it is concluded that a groundwater exposure pathway to ecological receptors is incomplete.

7.9.2 Surface Water Exposure Pathway

As noted above, surface drainage from the site is intercepted by a wetland (NYSDEC Code No. WM-13) with no discrete discharge conveyance to the South Branch Little Salmon River. Therefore, there is no direct pathway for migration of contaminants from surface soils to the permanent stream and its aquatic inhabitants.

To the extent that site drainage (intermittent storm runoff and snowmelt) may entrain contaminants and contribute to temporary pools or seasonal inundation of portions of the wetland, there is a limited potential exposure pathway. That is, aboveground portions of plants would temporarily be in direct contact with the water, and transient aquatic stages of certain invertebrates (e.g., insects) and larval amphibians (e.g., tadpoles) would be immersed in the water and ingest it. Semiaquatic and terrestrial animals would be exposed to limited dermal contact and most would drink the water. A few of the latter (e.g., adult amphibians, some snakes and turtles, wading birds, raccoons) would also ingest prey whose tissues might have accumulated contaminants. However, based on the information currently available it appears unlikely that significant off-site migration of contaminants has occurred (see discussion of soil concentrations below). At this time the surface-water exposure pathway, although potentially complete in a localized and intermittent sense, is considered insignificant.

7.9.3 Soil Exposure Pathway

Sampling on the site indicates that some of the surficial soils contain elevated concentrations of metals or metalloids that might pose a hazard to ecological receptors (**Table 7-3**). These concentrations may reflect residual contamination from the previously-mentioned spills activities on the site or background conditions. In most cases, the maximum levels found on-site are within the range of those recorded as naturally-occurring in the eastern US (Shacklette and Boerngen, 1984). Unfortunately, there are no data available on background soil concentrations in the immediate vicinity of the Cole-Zaiser site.

The release mechanisms for contaminants from soils include surface runoff; tracking by vehicles, people, and animals; leaching to groundwater; and fugitive dust generation and deposition. Among these, only leaching to groundwater is likely to be significant at the Cole-Zaiser site, due to the low erosion potential, relative isolation and disuse of the property, and the virtually complete and luxuriant vegetative cover.

Direct exposure mechanisms for surface soils include dermal contact by invertebrates (especially burrowing forms such as earthworms), amphibians, reptiles, birds, and mammals; uptake by plants; incidental ingestion by birds and mammals while foraging, dust-bathing, and grooming; and deliberate ingestion by some reptiles and mammals (a behavior known as geophagy; see USEPA, 1993). Consumers of plants or animals thus exposed may in turn be indirectly exposed, to the extent that contaminants have accumulated in forage or prey tissues and can be assimilated through digestion.

Uptake by plants occurs primarily by absorption and assimilation of soluble chemical forms from interstitial soil moisture (pore water) through the roots. A secondary mechanism is absorption through the foliage from settled fugitive dust, other particles, or vapors. However, this applies mainly to organic contaminants, which do not appear to be substantially elevated in site soils. Chemical contaminants are accumulated in different plant tissues, at varying rates, depending upon a large number of factors such as chemical species, plant species, and physicochemical characteristics of the soil (e.g., pH, cation exchange capacity, moisture, temperature). In summary, the surface soils appear to be the only potentially-significant transport and exposure medium for ecological receptors associated with the Cole-Zaiser site.

7.10 CRITERIA-SPECIFIC ANALYSIS

Table 7-3 summarizes the maximum concentrations identified in the surficial soil samples from eight locations on the Cole-Zaiser site. Detailed analytical results for the individual samples are presented in **Tables 5-3 and 5-4**. In **Table 7-3**, maximum reported bulk-soil concentrations for 23 organic and 19 inorganic chemicals are compared to NYSDEC SCOs (NYSDEC, 1994c). The NYSDEC SCOs were developed to "at a minimum, eliminate all significant threats to human health and/or the environment posed by the inactive hazardous waste site." Since site background data were not available, the ranges and estimated arithmetic means for inorganics in soils of the eastern US (Shacklette and Boerngen, 1984) are also included for comparison.

None of the organic chemicals analyzed exceeded the applicable NYSDEC SCOs. Several were not detected (at reporting limits well below the NYSDEC SCOs), and all those quantified, but the PCB Aroclor-1254, were one or more orders of magnitude below the respective NYSDEC SCOs. Aroclor-1254 was not pervasive, as indicated by its detection at only three locations. Therefore, none of the organics are considered chemicals of potential ecological concern (COPECs).

Since they exceeded NYSDEC SCOs, nine of the inorganic chemicals analyzed should tentatively be recognized as COPECs. Three additional inorganic chemicals (aluminum, lead, and manganese) were also recognized as COPECs based on comparison to the arithmetic means for eastern US soils. There is no applicable criterion for cyanide, so its status cannot be definitively resolved, but it was only detected at two locations and seldom is bioavailable in soils (Eisler, 1991). The maximum levels of four of the tentative COPECs (arsenic, beryllium, chromium, and nickel) barely exceeded their respective NYSDEC SCOs and were below or essentially equivalent to their eastern US averages. It is also noteworthy that arsenic, chromium, and nickel only exceeded their NSYDEC Objectives at one location (see **Table 7-3**). Although beryllium exceeded 0.16 mg/kg at five of the eight sampling locations, the site concentrations were all close to the NYSDEC SCO, which is less than a quarter of the estimated eastern US average soil concentration. The relatively low NYSDEC SCO for beryllium is due to concerns for human health, rather than ecological effects[3]. The NYSDEC SCOs for arsenic and chromium are based on the assumption that the reported concentrations represent the more toxic forms (i.e., trivalent arsenic and hexavalent chromium), which is highly improbable (Eisler, 1988; Will and Suter, 1995). For all of the foregoing reasons, it is concluded that cyanide, arsenic, beryllium, chromium, and nickel are unlikely to pose a significant hazard to ecological resources on the Cole-Zaiser site.

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[3] For example, Will and Suter (1994) proposed a soil-screening concentration for beryllium of 10 mg/kg as protective of plants.

Among the remaining eight COPECs, cadmium and manganese were also not pervasive. Cadmium barely exceeded 1 mg/kg at two locations, and the remaining soil levels were less than half the NYSDEC SCO (see **Table 5-4**). The SCO for manganese is site background, for which no local data are available. However, the estimated average concentration of manganese in soils of the eastern US is 640 mg/kg, and this was only exceeded at three locations. These results suggest that there may be a potential for adverse effects on ecological receptors due to direct contact with cadmium and manganese in surface soils at localized areas on the Cole-Zaiser site. Considering that relatively few vertebrates are likely to spend much time on the site, much less localized areas within the site, it appears that primarily soil microbes, soil invertebrates, and plants would be affected. The conservative benchmarks for direct contact with cadmium by microbes (i.e., bacteria and fungi) (20 mg/kg), invertebrates (e.g., earthworms) (20 mg/kg), and rooted plants (3 mg/kg) proposed by Will and Suter (1994, 1995) were not exceeded by even the maximum concentrations on the site. The corresponding benchmarks for manganese and soil microbes (100 mg/kg) and plants (500 mg/kg) were, however, exceeded in several soil samples from the site. Will and Suter (1995) did not propose a benchmark for manganese and soil invertebrates. Based on the information discussed immediately above, it is concluded that localized concentrations of manganese on-site may pose a hazard to certain soil biota and plants.

Lead exceeded the estimated arithmetic mean soil concentration (17 mg/kg) for the eastern US in five locations on the site. However, lead is not particularly toxic at such levels except to certain plants. For example, benchmarks proposed by Will and Suter (1994, 1995) for soil microbes, soil invertebrates, and terrestrial vascular plants are 900, 500, and 50 mg/kg, respectively. As a screening benchmark, 50 mg/kg is conservative, because most of the phytotoxicity data reviewed by Will and Suter (1994) suggested limited or no effects in many species at substantially higher soil concentrations. In the few cases where lead in soil had an effect on plants, it was manifested in reduced growth (as opposed to reproduction or survival). Based on these considerations, it is concluded that there is a slight potential for reduced growth among certain sensitive plants due to localized elevated concentrations of lead in surface soils on the Cole-Zaiser site.

The remaining five COPECs are aluminum, copper, iron, mercury, and zinc, all of which substantially exceeded NYSDEC SCOs and/or estimated average soil concentrations for the eastern US at most or all of the locations sampled. Aluminum, copper, iron, and zinc are all essential micronutrients, but the levels needed to support normal plant and animal requirements are exceeded. Mercury has no known normal metabolic function and its methylated forms are known to biomagnify in food chains (Eisler, 1987), so any exceedance of the relatively low SCO (0.1 mg/kg) or regional average (0.12 mg/kg) suggests a potential problem at least at the screening level. Based on these considerations, the elevated concentrations of aluminum, copper, iron, mercury, and zinc pose at least a potential threat to organisms that may be chronically exposed through direct contact with surface soils at the Cole-Zaiser site. However, it appears unlikely that many nonresident organisms would experience prolonged (i.e., chronic) exposure via direct contact with the soils, due to the small area of the site and its dense vegetative cover. Therefore, the organisms primarily at risk would be soil microbes, invertebrates, rooted plants, and a few resident ground-dwelling and/or fossorial vertebrates (e.g., toads, some snakes, small rodents).

In summary, only seven (aluminum, copper, iron, lead, manganese, mercury, and zinc) of the of the 12 metals and metalloids tentatively identified as COPECs may pose a risk to ecological receptors. Lead and manganese are probably of limited, if any, significance because their exceedances of benchmarks are not pervasive and their effects would be expected to be limited to sensitive forms of soil microbes and/or vascular plants in localized areas. The other metals, based on conservative benchmarks and higher frequencies of exceedances, might be expected to affect a broader assemblage of receptors. Even so, the effects would still be limited mainly to resident organisms that remain in direct contact with the soil for prolonged periods.

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	Scientific Name
Amphibians	
Mudpuppy	*Necturus maculosus*
Red-spotted newt	*Notophthalmus viridescens*
Jefferson's salamander	*Ambystoma jeffersonianum*
Spotted salamander	*Ambystoma maculatum*
Northern dusky salamander	*Desmognathus fuscus*
Mountain salamander	*Desmognathus ochrophaeus*
Red-backed salamander	*Plethodon cinereus*
Slimy salamander	*Plethodon glutinosus*
Spring salamander (purple salamander)	*Gyrinophilus porphyriticus*
Four-toed salamander	*Hemidactylus scutatum*
Northern two-lined salamander	*Eurycea bislineata*
*American toad	*Bufo terrestris*
Spring peeper	*Hyla crucifer*
Gray treefrog	*Hyla versicolor*
Northern leopard frog	*Rana pipiens*
Wood frog	*Rana sylvatica*
Pickerel frog	*Rana palustris*
Green frog	*Rana clamitans*
Bullfrog	*Rana catesbeiana*
Reptiles	
Common snapping turtle	*Chelydra serpentina*
Wood turtle	*Clemmys insculpta*
Spotted turtle	*Clemmys guttata*
Painted turtle	*Chrysemys picta*
Northern red-bellied snake	*Storeria occipitomaculata*
*Northern brown snake	*Storeria dekayi*
Northern water snake	*Nerodia sipedon*
*Eastern garter snake	*Thamnophis sirtalis*
Eastern ribbon snake	*Thamnophis sauritus*
Northern ring-necked snake	*Diadophis punctatus*
*Northern black racer	*Coluber constrictor*
*Smooth green snake	*Opheodrys vernalis*
*Black rat snake	*Elaphe obsoleta*
*Eastern milk snake	*Lampropeltis doliata*
Birds	
Horned grebe (migrant)	*Podiceps auritus*
Pie-billed grebe (migrant)	*Podilymbus podiceps*
Whistling swan (migrant)	*Olor columbianus*
Canada goose (migrant)	*Branta canadensis*
Black duck (resident)	*Anas rubripes*
Gadwall (migrant)	*Anas strepera*
Mallard (resident)	*Anas platyrhynchos*
Common pintail (migrant)	*Anas acuta*
American wigeon (migrant)	*Anas americana*

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	**Scientific Name**
Northern shoveler (migrant)	*Anas clypeata*
Green-winged teal (migrant)	*Anas crecca*
Blue-winged teal (migrant)	*Anas discors*
Wood duck (migrant)	*Aix sponsa*
Oldsquaw (migrant)	*Clangula hyemalis*
Common goldeneye (migrant)	*Bucephala clangula*
Ring-necked duck (migrant)	*Aythya collaris*
Ruddy duck (migrant)	*Oxyura jamaicensis*
Common merganser (migrant)	*Mergus merganser*
Hooded merganser (migrant)	*Lophodytes cucullatus*
American coot (migrant)	*Fulica americana*
Common gallinule (migrant)	*Gallinula chloropus*
Herring gull (migrant)	*Larus argentatus*
Ring-billed gull (migrant)	*Larus delawarensis*
Common tern (migrant)	*Sterna hirundo*
Black tern (migrant)	*Childonias nigra*
Great blue heron (migrant)	*Ardea herodias*
Little blue heron (migrant)	*Florida caerulea*
Green heron (migrant)	*Butorides virescens*
Great egret (migrant)	*Chasmerodius albus*
Black-crowned night heron (migrant)	*Nycticorax nycticorax*
Least bittern (migrant)	*Ixobrychus exilis*
American bittern (migrant)	*Botaurus lentiginosus*
Virginia rail (migrant)	*Rallus limicola*
Sora (migrant)	*Porzana carolina*
Semipalmated plover (migrant)	*Charadrius semipalmatus*
*Killdeer (migrant)	*Charadrius vociferus*
American woodcock (migrant)	*Philohela minor*
Common snipe (migrant)	*Capella gallinago*
Greater yellowlegs (migrant)	*Tringa melanoleuca*
Lesser yellowlegs (migrant)	*Tringa flavipes*
Pectoral sandpiper (migrant)	*Calidris melanotos*
Semipalmated sandpiper (migrant)	*Calidris pusilla*
Spotted sandpiper (migrant)	*Actitis macularia*
Wild turkey (resident)	*Meleagris gallopavo*
Ruffed grouse (resident)	*Bonasa umbellus*
*Ring-necked pheasant (resident)	*Phasianus colchicus*
Sharp-shinned hawk (resident)	*Accipiter striatus*
Cooper's hawk (resident)	*Accipiter cooperii*
Northern goshawk (resident)	*Accipiter gentilis*
Northern harrier (marsh hawk) (resident)	*Circus cyaneus*
*Red-tailed hawk (resident)	*Buteo jamaicensis*
*Rough-legged hawk (migrant)	*Bueto lagopus*
Red-shouldered hawk (migrant)	*Buteo lineatus*
Broad-winged hawk (migrant)	*Buteo platypterus*
Bald eagle (migrant)	*Haliaeetus leucocephalus*
Golden eagle (migrant)	*Aquila chrysaetos*
*Turkey vulture (migrant)	*Cathartes aura*

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	Scientific Name
*American kestrel (sparrow hawk) (resident)	*Falco sparverius*
*Common screech owl (resident)	*Otus asio*
Long-eared owl (resident)	*Asio otus*
Short-eared owl (migrant)	*Asio flammeus*
*Great horned owl (resident)	*Bubo virginianus*
Barred owl (resident)	*Strix varia*
Barn owl (resident)	*Tyto alba*
Saw-whet owl (resident)	*Aegolius acadicus*
*Mourning dove (resident)	*Zenaida macroura*
*Rock dove (pigeon) (resident)	*Columa livia*
Yellow-billed cuckoo (migrant)	*Coccyzus americanus*
Black-billed cuckoo (migrant)	*Coccyzus erythropthalmus*
Common nighthawk (migrant)	*Chordeiles minor*
Whip-poor-will (migrant)	*Caprimulgus vociferus*
Ruby-throated hummingbird (migrant)	*Archilochus colubris*
Belted kingfisher (resident)	*Megaceryle alcyon*
Red-headed woodpecker (resident)	*Melanerpes erythrocephalus*
Pileated woodpecker (resident)	*Drycopus pileatus*
*Common flicker (resident)	*Colaptes auratus*
Yellow-bellied sapsucker (migrant)	*Sphyrapicus varius*
Downy woodpecker (resident)	*Dendrocopos pubescens*
Hairy woodpecker (resident)	*Dendrocopos villosus*
*Eastern kingbird (migrant)	*Tyrannus tyrannus*
Great crested flycatcher (migrant)	*Myiarchus crinitus*
Eastern pewee (migrant)	*Contopus virens*
Eastern phoebe (migrant)	*Sayornis phoebe*
Least flycatcher (migrant)	*Empidonax minimus*
*Willow flycatcher (migrant)	*Empidonax traillii*
Alder flycatcher (migrant)	*Empidonax alnorum*
*Horned lark (resident)	*Erimophila alpestris*
Purple martin (migrant)	*Progne subis*
Cliff swallow (migrant)	*Petrochelidon pyrrhonota*
Tree swallow (migrant)	*Iridoprocne bicolor*
Rough-winged swallow (migrant)	*Stelgidopter ruficollis*
Bank swallow (migrant)	*Riparia riparia*
Chimney swift (migrant)	*Chaetura pelagica*
*American crow (resident)	*Corvus brachyrhynchos*
Blue jay (resident)	*Cyanocitta cristata*
Black-capped chickadee (resident)	*Parus atricapillus*
Tufted titmouse (resident)	*Parus bicolor*
White-breasted nuthatch (resident)	*Sitta carolinensis*
Red-breasted nuthatch (resident)	*Sitta canadensis*
Brown creeper (resident)	*Carthia familiaris*
*House wren (migrant)	*Troglodytes aedon*
Winter wren (migrant)	*Troglodytes troglodytes*
Marsh wren (migrant)	*Telmatodytes palustis*
Sedge wren (migrant)	*Cistothorus platensis*
Golden-crowned kinglet (migrant)	*Regulus satrapa*

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	**Scientific Name**
Ruby-crowned kinglet (migrant)	*Regulus calendula*
Blue-gray gnatcatcher (migrant)	*Polioptera caerulea*
*Brown thrasher (migrant)	*Toxostoma rufa*
Gray catbird (migrant)	*Dumetella carolinensis*
*Northern mockingbird (resident)	*Mimus polyglottos*
Eastern bluebird (migrant)	*Sialia sialis*
*American robin (resident)	*Turdus migratorius*
Veery (migrant)	*Hylocichla fuscescens*
Wood thrush (migrant)	*Hylocichla mustellina*
Hermit thrush (migrant)	*Catharus guttatus*
*Loggerhead shrike (migrant)	*Lanius ludovicianus*
*Cedar waxwing (resident)	*Bombycilla cedrorum*
Red-eyed vireo (migrant)	*Vireo olivaceus*
Warbling vireo (migrant)	*Vireo gilvus*
Yellow-throated vireo (migrant)	*Viero flavifrons*
Solitary vireo (migrant)	*Vireo solitarius*
Northern parula warbler (migrant)	*Parula americana*
Black-and-white warbler (migrant)	*Mniotilta varia*
Black-throated green warbler (migrant)	*Dendroica virens*
Black-throated blue warbler (migrant)	*Dendroica caerulescens*
Caerulean warbler (migrant)	*Dendroica cerulea*
Magnolia warbler (migrant)	*Dendroica magnolia*
Yellow-rumped warbler (migrant)	*Dendroica coronata*
Blackpoll warbler (migrant)	*Dendroica striata*
Chestnut-sided warbler (migrant)	*Dendroica pennsylvanica*
Blackburnian warbler (migrant)	*Dendroica fusca*
Cape May warbler (migrant)	*Dendroica tigrina*
*Yellow warbler (migrant)	*Dendroica petechia*
Prairie warbler (migrant)	*Dendroica discolor*
Canada warbler (migrant)	*Wilsonia canadensis*
Hooded warbler (migrant)	*Wilsonia citrina*
*Golden-winged warbler (migrant)	*Vermivora chrysoptera*
Nashville warbler (migrant)	*Vermivora ruficapilla*
Mourning warbler (migrant)	*Oporornis philadelphia*
*Common yellowthroat (migrant)	*Geothlypis trichas*
*Yellow-breasted chat (migrant)	*Icteria virens*
Northern waterthrush (migrant)	*Seiurus noveboracensis*
Ovenbird (migrant)	*Seiurus aurocapillus*
*Red-winged blackbird (migrant)	*Agelaius phoeniceus*
*Brown-headed cowbird (resident)	*Molothrus ater*
*Common grackle (resident)	*Quiscalus quiscula*
Bobolink (migrant)	*Dolichonyx oryzivorus*
*Eastern meadowlark (resident)	*Sturnella magna*
European starling (resident)	*Sturnus vulgaris*
Orchard oriole (migrant)	*Icterus spurius*
*Baltimore oriole (migrant)	*Icterus galbula*
*Scarlet tanager (migrant)	*Piranga olivacea*
*House sparrow (resident)	*Passer domesticus*

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	**Scientific Name**
Northern junco (resident)	*Junco hyemalis*
Snow bunting (migrant)	*Plectrophenax nivalis*
*Northern cardinal (resident)	*Cardinalis cardinalis*
Red crossbill (migrant)	*Loxia curvirostra*
Purple finch (resident)	*Carpodacus purpureus*
House finch (resident)	*Carpodacus mexicanus*
Evening grosbeak (resident)	*Hesperiphona vespertina*
*American goldfinch (resident)	*Spinus tristis*
Indigo bunting (migrant)	*Passerina cyanea*
Rose-breasted grosbeak (migrant)	*Pheucticus ludovicianus*
*Rufous-side towhee (migrant)	*Pipilo erythrophthalmus*
White-crowned sparrow (migrant)	*Zonotrichia leucophrys*
*White-throated sparrow (resident)	*Zonotrichia albicollis*
Chipping sparrow (migrant)	*Spizella passerina*
*Field sparrow (resident)	*Spizella pusilla*
Tree sparrow (migrant)	*Spizella arborea*
Swamp sparrow (resident)	*Melospiza georgiana*
Song sparrow (resident)	*Melospiza melodia*
Lincoln's sparrow (migrant)	*Melospiza lincolnii*
*Grasshopper sparrow (migrant)	*Ammodramus savannarum*
Henslow's sparrow (migrant)	*Ammodramus henslowii*
*Vesper sparrow (migrant)	*Poecetes gramineus*
*Savannah sparrow (migrant)	*Passerculus sanwichensis*
Mammals	
Virginia opossum	*Didelphis virginiana*
Starnose mole	*Condylura cristata*
Hairytail mole	*Parascalopus breweri*
Smoky shrew	*Sorex fumeus*
Masked shrew	*Sorex cinereus*
Longtail shrew	*Sorex dispar*
Northern water shrew	*Sorex palustris*
Pygmy shrew	*Microsorex hoyi*
*Least shrew	*Cryptotis parva*
Shorttail shrew	*Blarina brevicauda*
Little brown myotis (bat)	*Myotis lucifugus*
Keen myotis (bat)	*Myotis keeni*
Small-footed myotis (bat)	*Myotis subulatus*
Eastern pipistrel (bat)	*Pipistrellus subflavus*
Red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
Silver-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Black bear (occasional transient)	*Ursus americanus*
*Raccoon	*Procyon lotor*
Shorttail weasel	*Mustela erminea*
Longtail weasel	*Mustela frenata*
Mink	*Mustela vison*

TABLE 7-1
TERRESTRIAL VERTEBRATES KNOWN OR EXPECTED TO OCCUR IN THE VICINITY OF THE COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK*

Common Name	**Scientific Name**
*Striped skunk	*Mephitis mephitis*
Gray fox	*Urocyon cinereoargentatus*
*Red fox	*Vulpes fulva*
Coyote	*Canis latrans*
Bobcat	*Lynx rufus*
*Woodchuck	*Marmota monax*
Eastern chipmunk	*Tamias striatus*
Eastern gray squirrel	*Sciurus carolinensis*
Red squirrel	*Tamiasciurus hudsonicus*
Southern flying squirrel	*Glaucomys volans*
Northern flying squirrel	*Glaucomys sabrinus*
Deer mouse	*Peromyscus maniculatus*
*White-footed mouse	*Peromyscus leucopus*
Beaver	*Castor canadensis*
Southern bog lemming	*Synaptomys cooperi*
Boreal redback vole	*Cleithrionomys gapperi*
*Meadow vole	*Microtus pennsylvanicus*
Pine vole	*Pitymys pinetorum*
Muskrat	*Ondatra zibethica*
Norway rat	*Rattus norvegicus*
*House mouse	*Mus musculus*
*Meadow jumping mouse	*Zapus hudsonicus*
*Woodland jumping mouse	*Neozapus insignis*
Porcupine	*Ereyhizon dorsatum*
*Snowshoe hare	*Lepus americanus*
European hare	*Lepus europaeus*
*Eastern cottontail	*Sylvilagus floridanus*
Moose	*Alces americana*
*Whitetail deer	*Odocoileus virginianus*

* Species known or likely to be residents or frequent visitors on the site itself (at least seasonally).

TABLE 7-2
FISHES KNOWN OR EXPECTED TO OCCUR IN THE LITTLE SALMON RIVER OR TRIBUTARIES - OSWEGO COUNTY, NEW YORK

Common Name	**Scientific Name**
American eel	*Anguilla rostrata*
Gizard shad	*Dorosoma cepedianum*
Yellow bullhead	*Ameiurus natalis*
Brown bullhead	*Ameiurus nebulosus*
Stonecat	*Noturus flavus*
Longnose sucker	*Catostomus catostomus*
White sucker	*Catostomus commersoni*
Creek chubsucker	*Erimyzon oblongus*
Northern hog sucker	*Hypentelium nigricans*
Common carp (introduced)	*Cyprinus carpio*
Cutlips minnow	*Exoglossum maxillingua*
Golden shiner	*Notemigonus crysoleucas*
Eastern blacknose dace	*Rhinichthys atratulus*
Longnose dace	*Rhinichthys cataractae*
Creek chub	*Semotilus atromaculatus*
Fallfish	*Semotilus corporalis*
Pearl dace	*Semotilus margarita*
Redside dace	*Clinostomus elongatus*
Rosyface shiner	*Notropis rubellus*
Common shiner	*Notropis cornutus*
Blacknose shiner	*Notropis heterolepis*
Bluntnose minnow	*Pimephales notatus*
Fathead minnow	*Pimephales promelas*
Brown trout (introduced)	*Salmo trutta*
Rainbow trout (introduced)	*Oncorhynchus mykiss*
Brook trout	*Salvelinus fontinalis*
Central mudminnow	*Umbra limi*
Grass pickerel	*Esox americanus*
Chain pickerel	*Esox niger*
Brook stickleback	*Culea inconstans*
Rock bass	*Ambloplites rupestris*
Pumpkinseed	*Lepomis gibbosus*
Iowa darter	*Etheostoma exile*
Fantail darter	*Etheostoma flabellare*
Tessellated darter	*Etheostoma olmstedi*
Logperch	*Percina caprodes*

TABLE 7-3
ECOLOGICAL IMPACT SCREENING-LEVEL ANALYSIS FOR SURFACE SOILS
COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

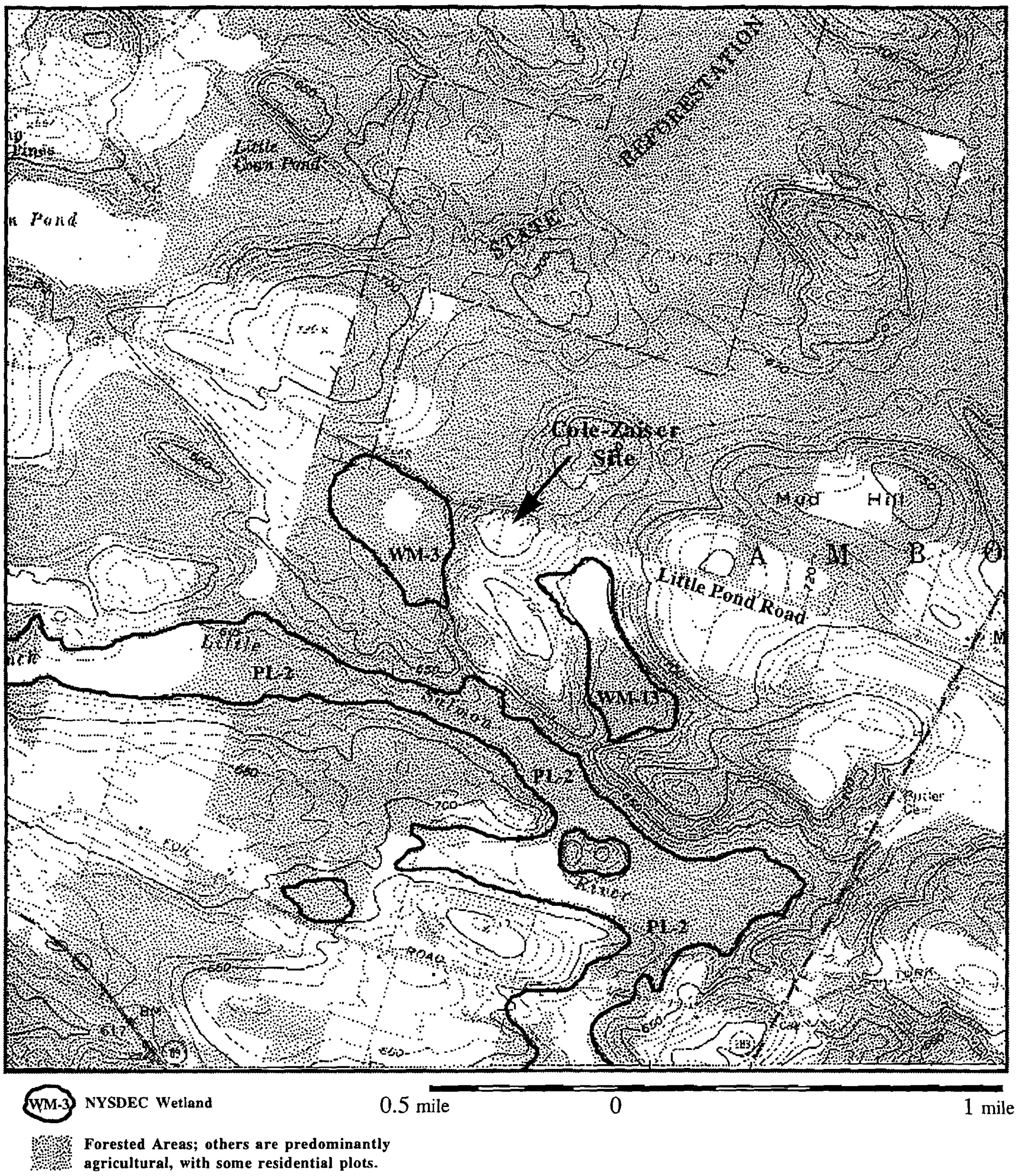
Constituent of Interest	**Maximum Soil Concentration**	**NYSDEC Soil Cleanup Objective[1]**	**Range and Mean in Eastern US Soils[2]**	**NYSDEC Criterion Exceeded?**	**Frequency of Exceedance**
Volatile Organics (ug/kg)					
2-Butanone	3	300	N/A	No	0/8
Acetone	30	200	N/A	No	0/8
Benzene	2	60	N/A	No	0/8
Chloroform	2	300	N/A	No	0/8
Methylene Chloride	20	100	N/A	No	0/8
Tetrachloroethene	7	1,400	N/A	No	0/8
Toluene	2	1,500	N/A	No	0/8
Xylenes (total)	3	1,200	N/A	No	0/8
Semivolatile Organics (ug/kg)					
4-Chloro-3-Methylphenol	38	240 or QL	N/A	No	0/8
bis(2-Ethylhexyl)phthalate	94	50,000	N/A	No	0/8
Di-n-butylphthalate	450	8,100	N/A	No	0/8
Fluoranthene	140	50,000	N/A	No	0/8
Pentachlorophenol	260	1,000 or QL	N/A	No	0/8
Phenanthrene	52	50,000	N/A	No	0/8
Pesticides/PCBs (ug/kg)					
Aroclor-1254	590	1,000	N/A	No	0/8
Aroclor-1260	52	1,000	N/A	No	0/8
4-4'-DDE	1.1	2,100	N/A	No	0/8
Inorganics (mg/kg)					
Aluminum (Al)	9,780	SB	0.7->10 (5.7)	N/A	N/A
Arsenic (As)	8.5	7.5 or SB	0.1-73 (7.4)	Yes	1/8
Barium (Ba)	57.5	300 or SB	10-1,500 (420)	No	0/8
Beryllium (Be)	0.22	0.16 or SB	<1-7 (0.85)	Yes	5/8
Cadmium (Cd)	1.4	1 or SB	N/A	Yes	2/8
Calcium (Ca)	3,210	N/A	100-280,000 (6,300)	N/A	N/A
Chromium (Cr)	14.2	10 or SB	1-1,000 (52)	Yes	1/8
Cobalt (Co)	6.7	30 or SB	<0.3-70 (9.2)	No	0/8
Copper (Cu)	557	25 or SB	<1-700 (22)	Yes	6/8
Cyanide (CN)	7.4	N/A	N/A	N/A	N/A
Iron (Fe)	22,000	2,000 or SB	0.01->10 (2.5)	Yes	8/8
Lead (Pb)	217	SB	<10-300 (17)	N/A	N/A
Magnesium (Mg)	2,990	SB	50-50,000 (4,600)	N/A	N/A
Manganese (Mn)	1,370	SB	<2-7,000 (640)	N/A	N/A
Mercury (Hg)	0.5	0.1	0.01-3.4 (0.12)	Yes	8/8
Nickel (Ni)	18.8	13 or SB	<5-700 (18)	Yes	1/8
Potassium (K)	1,570	SB	50-37,000	N/A	N/A
Selenium (Se)	1.6	2 or SB	<0.1-3.9 (0.45)	No	0/8
Vanadium (V)	16.9	150 or SB	<7-300 (66)	No	0/8
Zinc (Zn)	105	20 or SB	<5-2,900 (52)	Yes	8/8

1. NYSDEC (1994a)
2. Shacklette and Boerngen (1984); mean () is estimated arithmetic average.

N/A - Not Applicable

QL - Analytical quantitation limit ("detection limit")

SB - Site background (per procedures established in NYSDEC [1994a]; not obtained for Cole-Zaiser Site)



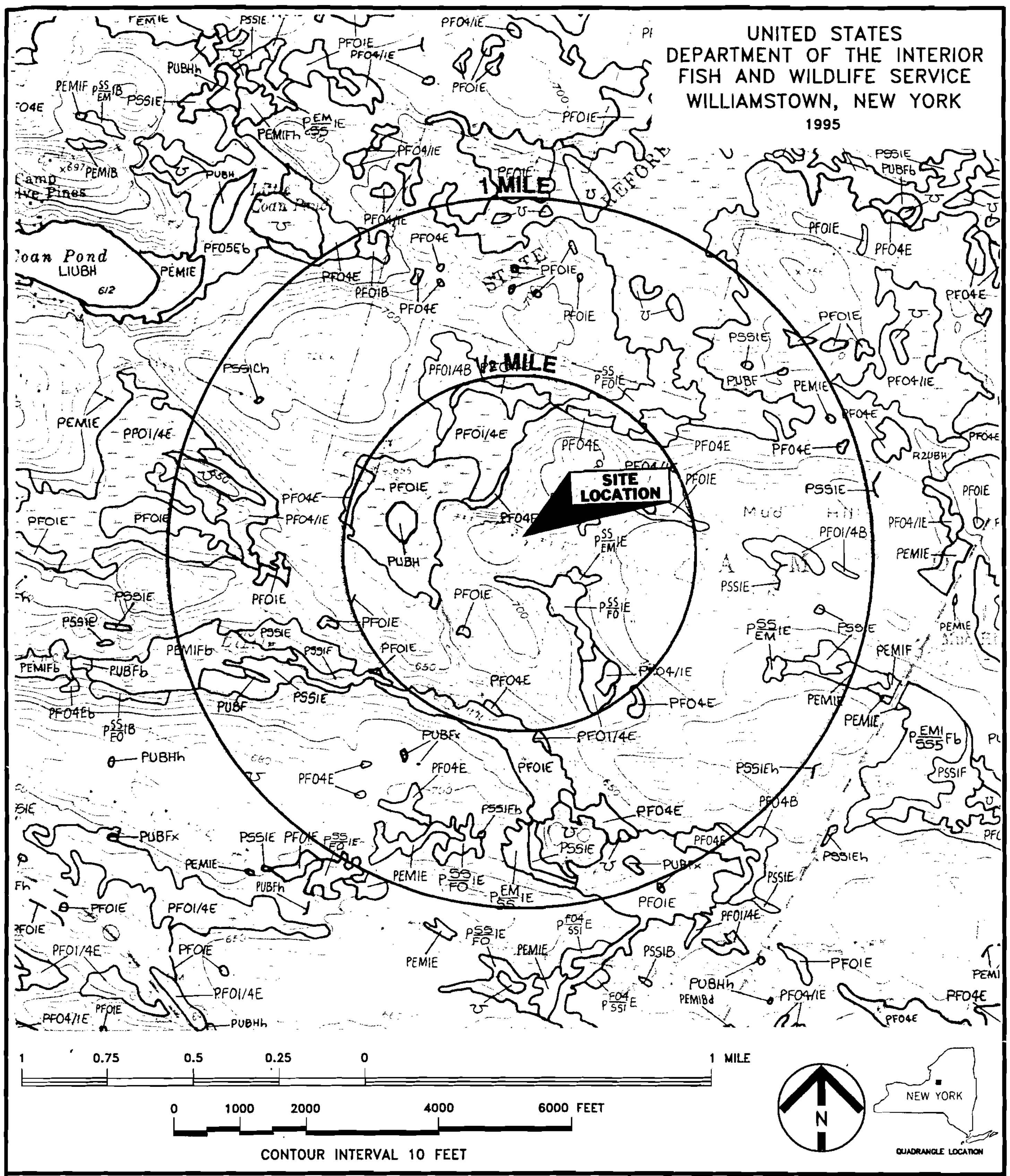
U:\5E15509\FWIA

LOCATION, TOPOGRAPHY, AND VEGETATIVE COVERTYPES

COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

DRAWN BY: LMP
CHECKED BY: MJM
PROJECT NUMBER: 5E15509
DATE: 5-21-97
FIGURE NO: 7-1

Woodward-Clyde Consultants



NATIONAL WETLAND INVENTORY MAP

COLE-ZAISER SITE - AMBOY TOWNSHIP, NEW YORK

DRAWN BY: LMP	CHECKED BY: MJM	PROJECT NUMBER: 5E15509	DATE: 4-24-97	FIGURE NO: 7-2

U:\ .509\NWIMAP

Woodward-Clyde Consultants

The RI for the Cole-Zaiser site generally involved a focused investigation of the occurrence of chemicals in the soil and groundwater underlying the site. Sufficient data were obtained to:

- Adequately characterize the site.
- Identify an on-site source area in the former bermed/lagoon area.
- Verify that the site soil concentrations are lower than those indicative of the presence of NAPL.
- Define the potential for off-site migration.
- Establish qualitatively a potential for human exposure to subsurface soil and shallow groundwater.
- Assess the potential for site impact on fish and wildlife.
- Prepare a focused feasibility study for the development of appropriate remedial alternatives.

~~support a qualitative assessment of human health risks, which considers potential receptors and contaminant transport pathways, and to assess the potential for the site to impact fish and wildlife. Results of the RI are intended to support the development of appropriate remedial alternatives, if necessary.~~

This RI report summarizes the investigation activities that were performed in accordance with the approved February 1996 RI Work Plan and the January and September 1997 Work Plan Addenda~~um~~. Field activities primarily included: a geophysical investigation; Geoprobe® soil gas and groundwater sampling; surface soil sampling; subsurface soil borings; monitoring well installation and sampling; ~~and~~ residential well sampling; and test pit excavation and sampling. Conclusions regarding the potential impacts of the site to human and ecological receptors are provided in this section. Recommended remedial action objectives and potential future work activities are also discussed.

8.1 CONCLUSIONS OF THE HUMAN HEALTH PATHWAY EVALUATION

The qualitative human health evaluation considered potential exposure to soil and groundwater for off-site and/or potential future on-site residents. Evaluation of potential exposure via ~~the~~surface soil media concluded that significant threats to human health will not occur from the detected chemicals. However, potential human health risks may be associated with VOCs that exceeded NYSDEC SCOs in subsurface soil from Test Pits TP-1A and TP-2A. The four VOCs that were found to exceed the SCOs are listed below:

- 1,1,1-TCA
- 1,2-DCE
- Toluene

- Total Xylenes

~~However, r~~Results of the groundwater evaluation indicate that nine VOCs found to exceed the NYSDEC GWQSs may present potential health risks to human receptors when the shallow groundwater is used as a drinking water source. The nine VOCs are:

- 1,1,1-TCA
- 1,1-DCA
- 1,1-DCE
- 1,2-DCE
- Benzene
- PCE
- Toluene
- TCE
- Vinyl Chloride

Results of the RI indicate that the groundwater standards for these VOCs were exceeded at only a few monitoring well locations, primarily near the potential on-site source areas. The data obtained for the deeper monitoring wells demonstrate that significant downward migration of these VOCs is not occurring. The only deep monitoring well with concentrations exceeding a NYSDEC GWQS is monitoring well MW-4A, with 23 µg/l of benzene in January 1997. However, subsequent sampling of MW-4A did not indicate the presence of benzene~~benzene was not identified at shallow monitoring well MW-4 or at upgradient monitoring locations~~. The concentrations of chlorinated VOCs in the on-site wells indicate that natural biodegradation of the more highly chlorinated solvents (i.e., PCE and TCE) has occurred, as evidenced by the presence of significantly higher concentrations of 1,2-DCE and vinyl chloride relative to the parent compounds.

In addition to the VOCs, five of the 23 TAL metals were identified at concentrations exceeding the NYSDEC GWQSs. The concentrations of four of these metals (aluminum, iron, magnesium, and manganese) may impact the aesthetic quality of the shallow groundwater. Elevated concentrations of these metals were also detected at upgradient well locations and at locations away from the on-site source areas, indicating that elevated concentrations may be associated with background groundwater quality. Data for the remaining metal (lead) indicate slight exceedances at MW-7 and the Lowe Well.~~The average lead concentration in the plume is likely to be below the NYSDEC GWQS and, as such, is not expected to cause unacceptable health risks.~~

8.2 CONCLUSIONS OF FWIA

The Cole-Zaiser site itself offers little exploitable habitat value for wildlife and humans, because of its relatively small size, rural vegetative cover, and proximity to a public road. However, the surrounding area provides a variety of relatively undisturbed upland, wetland, and aquatic communities likely to include (or at least seasonally support) representatives of several hundreds of plant and animal species. The primary ecological value of the area lies in its contributions to biodiversity, which in turn provides substantial opportunities for both consumptive and nonconsumptive uses by humans.

The most important habitat that could be potentially impacted by migration of contaminants associated with the site is a Class II wetland (NYSDEC Code No. WM-13) which lies about 550 feet downgradient. However, it appears unlikely that significant transport to the wetland has occurred or is occurring. This is because site soils appear to have relatively low potential for erosion (due to their inherent physical properties and dense vegetative cover), as well as the fact that the COPECs are inorganics that would tend to be tightly bound to the soil matrix. Direct migration to aquatic habitats (i.e., South Branch Little Salmon River) is precluded by the relative isolation of these habitats and the buffering/purifying function of the intervening wetland.

The only exposure pathway which appears significant is direct contact with surface soils on the site by resident organisms such as soil microbes, invertebrates, vascular plants, and a few small vertebrates (e.g., toads, snakes, mice, voles). Indirect exposures are also possible via ingestion of plant and/or animal tissues which may have accumulated COPECs at the site by primary, secondary, and tertiary consumers. However, the secondary and tertiary vertebrate consumers are unlikely to derive a significant proportion of their diet from the site, because such animals tend to have foraging areas substantially larger than the site (see examples in USEPA, 1993 and references cited therein).

The major COPECs at the site are aluminum, copper, iron, mercury, and zinc in surface soils. Of these, the most significant is mercury because of its well-documented tendency to biomagnify through successive trophic levels. But as noted above, larger, longer-lived tertiary consumers (e.g., predatory birds and mammals) would only obtain a small fraction of their diet from the site. For example, assuming the smallest home range reported in the literature (142 acres; DeGraaf and Rudis, 1986; USEPA, 1993), a red fox would be expected to obtain less than 2 percent of its diet from a 2.5-acre site. The other important consideration here is that only a few individuals of such higher-level consumers would be expected to visit the site.

In contrast to human health risk assessment, ecological risk assessment focuses on higher levels of biological organization than individuals -- that is, populations, communities, or even entire ecosystems[4] (USEPA, 1992a; Suter, 1993). Given the small size and limited habitat value of the Cole-Zaiser site itself, it is unlikely that the potential hazards to individual receptors from chronic direct exposures to the COPECs (even if realized) could have a significant impact on populations or communities, much less the local terrestrial ecosystem.

8.3 RECOMMENDED REMEDIAL ACTION OBJECTIVES

Results of the human health and ecological exposure evaluations do not indicate the need to develop remedial objectives for the surface ~~and subsurface~~ soil media. The development of remedial alternatives appears warranted for controlling potential human exposure to a localized area of on-site subsurface soil media and on-site and off-site shallow groundwater with VOC concentrations that exceed the NYSDEC SCOs and GWQSs, respectively. Specific remedial alternatives will be fully developed and evaluated during the analysis of remedial alternatives for this site. The remedial alternatives may include:

- Subsurface source removal
- Institutional controls related to groundwater use restrictions
- Natural attenuation
- Enhanced bioremediation
- Dual-phase (groundwater and soil vapor) extraction
- Groundwater extraction and treatment

The source area appears, based on the RI data, to be limited to the former process area and the former bermed/lagoon area on the site. The groundwater data indicate some ~~limited~~ horizontal migration of VOCs, but a lack of downward vertical migration to underlying deeper zones. The scope of work developed and implemented for the RI was thorough in its investigation of potential on-site source areas and none other than described above were encountered. The limited migration and well-defined source area are likely to focus any future evaluation of potential remedial alternatives on a few, focused strategies for reducing the potential risk to human health and the environment.

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[4] **Except in the case of threatened or endangered species.**

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