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# REMEDIAL INVESTIGATION ALTERNATIVES ANALYSIS REPORT

## For

## 90 HOPKINS STREET SITE

## NYSDEC Site E915181
## 90 Hopkins Street
## Buffalo, New York

**Prepared for:**

**City of Buffalo**
**Office of Strategic Planning**
**65 Niagara Square**
**Buffalo, New York 14202**

**Prepared by:**

**Panamerican Environmental, Inc.**
**2390 Clinton Street**
**Buffalo, New York 14227**

**JULY 2014**

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# CERTIFICATIONS

I, John B. Berry, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Report [Remedial Investigation, Alternatives Analysis Report] was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

STATE OF NEW YORK
JOHN B. BERRY
No. 046600
LICENSED PROFESSIONAL ENGINEER

John B. Berry, PE

# EXECUTIVE SUMMARY

## Introduction

This document presents details of a Remedial Investigation/Alternatives Analysis Report (RI/AAR) at the 90 Hopkins Street Site (NYSDEC Site # E915181) located in the City of Buffalo, New York **(**refer to Figure 1). The work is being completed by the City of Buffalo under the New York State Department of Environmental Conservation (NYSDEC) Environmental Restoration Program (ERP). To complete the work, the City contracted with Panamerican Environmental, Inc. (PEI). This report documents the findings of the RI and presents remedial alternatives analysis with a recommended remedy for the site. RI data was used to develop and screen alternatives.

In 2009, the original 2006 SI/RAR work plan was revised/updated to reflect changes in project approach and scope (*Work Plan for Site Investigation/Remedial Alternatives Report, for the 90 Hopkins Street Site Number E915181, prepared for: City of Buffalo, prepared by: PEI, Revised December 2009*). The revised work plan included the following new scope of work:

- Complete a more thorough history to include completing a Phase 1 Environmental Site Assessment
- Develop data that will determine a more accurate estimation of carbide lime volume
- Assess soil conditions/collect samples on the property and below the lime material.
- Determine if the property has been impacted by adjacent land uses (i.e., junk yard/rail- perimeter sampling/assessment.
- Assess groundwater quality (esp. the pH of the groundwater).
- Determine the quality of the carbide lime and potential for beneficial use – develop creative re-use potential. This will include confirming the chemistry and developing a list of potential uses.

## Remedial Investigation

The remedial investigation described in this work plan, and the basis of this report, was completed in April 2010.

The primary purpose/goals of the RI were to:

- Assess/verify the extent of the lime material below grade;
- Assess, as necessary, the chemical characteristics of lime material for beneficial reuse;
- Visually inspect and describe lime and soil/fill conditions across the site;
- Characterize site fill/soils for contaminants of concern; and,
- Install monitoring wells to assess groundwater quality and flow information.

A combination of borings, test trenches and monitoring wells (refer to Figure 3) were used to meet these goals. All work was performed in accordance with the project approved work-plan. Prior to preparing the RI, a Phase I Environmental Site Assessment was conducted and is provided in Appendix A.

The 90 Hopkins Street Site (site) is owned by the City of Buffalo and consists of an approximately 8-acre parcel located in a heavily industrial area of Hopkins Street. To the north, the site is bounded by a common access way/rail spur and the Alltift Landfill/Ramco Pond remedial action areas (DEC Site No's 915054 and 915046B). To the northeast is commercial and private property including the Niagara Cold Drawn Corp. (former Ramco Steel/Bliss & Laughlin – Niagara LaSalle facility). The site is further bounded by an industrial facility (Mardan Technologies Inc.) along the northern part of the eastern property boundary, a large automobile scrap yard (LKQ Corp.) to the east and southeast, and the LTV Marilla St. Landfill (formerly Republic Steel) site (DEC Site No. 915047) to the south- southwest. A railroad right-of-way is located immediately along the west/southwestern side of the site.

The site is currently a vacant parcel and there are no structures. Several former structures were demolished sometime during 2002. The structures, part of the original acetylene manufacturing facility, included a gas holder, transformer house, oil house, generator building, and a purifying/compressor building. Two carbide lime material piles (byproduct from the carbide lime acetylene manufacturing process), measuring approximately 118,000 cubic yards in total, occupy most of the property. The rest of the site contains concrete pads/floors of former buildings and weed covered vacant areas. These areas are covered with soil comingled with pieces of brick, concrete and stone; remains from the recent use as a construction and demolition (C&D) recycling operation and from the former structures. A large pile of wood debris and a large weed-covered soil pile exist along the central eastern border. A recently installed fence separates the property from the auto junk yard to the east. The junk yard has evolved over the recent 3-5 years. Currently, the junk yard operation is very professionally managed in a very neat and extremely organized manner. Prior to the new management, some auto junk materials were piled on the eastern border and some on the eastern side of the lime pile and the junk yard in general was very haphazard and unkempt.

Historical information identifies that the Union Carbide Company (or various named units of this company) operated the site at 90 Hopkins Street as an acetylene gas manufacturing facility from the 1930's until about 1964. From 1964 to 1968 the site appeared to be owned and operated by Sloan Auto Parts (Iroquois Gas Corp. and National Fuel obtained utility easements around 1974). The City of Buffalo obtained the parcel in 1987 through the tax foreclosure process, now owns the site.

Several environmental assessments were previously conducted at the site and include:

- Characterization of "Lime Piles". Malcolm Pirnie, Inc. For the City of Buffalo Law Department- February 2, 1998);
- Technical Assistance for the Sloan Auto/90 Hopkins Street Site, Buffalo, New York. Brown fields Technology Support Center. Completed by USEPA contractor Tetra Tech EM Inc. March 1999;
- Soil Sampling, Sloan Auto, Buffalo, New York. Completed by Weston for

USEPA ERTC. October 29, 1998;

- Petition For Determination of Beneficial Use For Calcium Carbonate Product Located At Hopkins Street, South Buffalo. Prepared by Malcolm, Inc. for BERC. January 2000; and,
- Lime Pile Investigation & Limited Groundwater Quality Evaluation, 90 Hopkins Street, City of Buffalo, New York, prepared by Clough Harbour & Associates, LLP, for Honeywell Corp., July 2006.

## RI Summary

The waste lime/soil assessment consisted of advancing a total of 10 test trenches from the toe of the lime piles and across open areas of the site and installing 5 borings through the lime piles (3 in the north pile and 2 in the south pile). The test trenches revealed that the carbide lime material extends below existing grade from the south pile toe all the way to the eastern property fence line where the trenches stopped The carbide lime material appears to extend further to the east beyond this property line. Trenches extended to the west from the western toe of slopes of the north and south lime piles reveal the carbide lime material extends below existing grade to the end of the brush line east of the railroad tracks, but west of the property line. The borings through the piles indicated that the south carbide lime pile material extended approximately one foot deeper than earlier estimates or approximately 10 feet below existing grade. The borings through the north pile confirmed the earlier extent of the carbide lime material below grade of approximately 7 feet. The extent of the carbide lime based on the RI data is depicted on Figure 3. The volume of additional carbide lime material identified by the test trenches and borings beyond the limits assumed in the 2006 assessment was calculated to be approximately 3,850 cubic yards. The total carbide lime material on site is currently estimated to be approximately 121,850 cubic yards.

Analytical results of waste lime samples indicated that the carbide lime material chemistry was similar to what was found in previous programs. Analytical results from soil/fill samples collected below the carbide lime piles, in trenches from the edge of the carbide lime pile slopes and in open areas of the site indicated the presence of low concentrations of a number of SVOC, metals and a few VOC compounds (see Figure 4). In almost all cases, concentrations were below Part 375 commercial soil cleanup requirements. One PCB compound was detected with a concentration slightly above Part 375 commercial soil cleanup requirements. This occurred in a sample from a test trench (TP-03) located adjacent the westerly property line near the off-site junk yard. The potential source of these compounds detected in the fill/soils is either from the historic industrial operations at the site or from past practices of the junk yard.

The top several feet of material beneath and adjacent the carbide lime piles is composed of soil fill and C & D material (concrete, metal debris, wood, etc.) The C & D material is most likely from the demolition of the various historic buildings and structures that housed previous industrial operations. Also, as noted previously, an auto junk yard has operated to the east of the site for a number of years and until recently a portion of these operations spilled over onto the 90 Hopkins's property along the east perimeter. Also an active railroad operates along the west property perimeter. Environmental contamination associated with these facilities is known to include elevated levels of metals and PAH compounds in the associated soils.

Three groundwater monitoring wells were installed across the site as follows: MW-01 along the south west perimeter; MW-02 along the north perimeter and MW-03 at the northwest corner of the site (see Figure 3). Groundwater beneath the site is relatively shallow (1.5 to 4.5 feet below ground surface).This was identified in previous investigations and confirmed by water level measurements in the RI monitoring wells. Groundwater appears to flow from the southeast to the northwest towards the wetlands north of the site and Lake Erie.

Groundwater samples indicated the presence of a number of metal compounds in all of the wells at low concentrations with only iron and sodium exceeding NYSDEC TOGs (see Figure 3). Several SVOC were detected at low concentrations below TOGs in MW-02 and MW-03. Several petroleum VOCs were detected at concentrations that exceeded TOGs in MW-01. The elevated petroleum compounds detected in MW-01 appear to be localized at present since none of these compounds was detected in the down gradient wells (MW-02 and MW-03). The potential source of the petroleum compounds most likely relates to the historic industrial use of the site and the junkyard operations immediately to the east of the well. The pH level in all samples was elevated (12 +/-) which is indicative of the influence of the large quantity of carbide lime on site.

Fate and transport, and qualitative exposure evaluations suggest that public exposure to site contaminants is minimal due to no active operations on site and the lack of public access to the site. An increased potential exposure to workers and adjacent public to carbide lime dust and other soil contaminants could occur during site remediation activities. These can be managed using proper engineering and administrative controls.

Runoff from the carbide lime piles as well as fugitive dust blowing off site during dry seasons to adjacent properties particularly the wetlands to the north is an ecological exposure concern. High pH groundwater flowing offsite and recharge to surface wetland areas is also a possible ecological concern. Currently, elevated petroleum compounds detected in MW- 01 appear to be localized to the southeastern portion of the site based on the limited data and may be reflective of past activities on the site or adjacent property.

The final remedial measures to be developed during the Alternative Analysis (AA)Report phase of the RI/AAR for the Site must satisfy Remedial Action Objectives (RAOs). RAOs are site-specific statements that convey the goals for minimizing or eliminating substantial risks to public health and the environment. Appropriate RAOs for the 90 Hopkins Street Site are:

- Through creative re-use (Beneficial Use Determination) and/or through off-site disposal, remove the on-site carbide lime material piles and below grade carbide lime material to prevent future off-site release of carbide lime and elevated pH to allow for future site development;
- Prevent ingestion or direct contact with carbide lime/soil/fill that contains

contaminants of concern above Part 375 Commercial Use SCOs; and,

- Prevent ingestion or direct contact with groundwater containing concentrations of contaminants of concern above TOGs groundwater standards.

## Remedial Alternatives Evaluation and Selected Alternative

Remedial goals and RAOs were developed for the site based on the investigation findings provide in the RI and the future use of the property. RAOs are site-specific statements that convey the goals for minimizing or eliminating substantial risks to public health and the environment.

The following RAOs were developed for the 90 Hopkins Street Site:

- Removal of the on-site carbide lime material for beneficial reuse and/or dispose of the material at an off-site landfill. The purpose is to prevent future off-site release of lime material, normalize the elevated pH of surface and groundwater by removing this source, and allow for future site re-development.
- Remediate the site to prevent the ingestion or direct contact with carbide lime and soil/fill that contains contaminants of concern above Part 375 Commercial Use SCOs; and,
- Prevent ingestion of or direct contact with groundwater containing concentrations of contaminants of concern above TOGs groundwater standards.

Based on the RAOs, a number of remedial alternatives were reviewed. These included standard alternatives and those associated with beneficial reuse of the carbide lime material. The following is a list of remedial alternatives that were evaluated:

Alternative 1 – No action;

Alternative 2 – Restoration to Pre-Disposal or Unrestricted Conditions;

Alternative 3 – Carbide Lime/Fill Material Excavation for Off-site Disposal at an Operating Landfill;

Alternative 4 –Carbide Lime/Fill Material Excavation for Off-site Disposal at the Marilla St. Landfill; and,

Alternative 5 – Carbide Lime Material Excavation for Off-site Beneficial Reuse and Impacted Soil/Fill Excavation/Off-site Disposal at an Operating Landfill.

Based on the Remedial Alternatives Analysis evaluation, Alternative 5 is the recommended final remedial alternative for the 90 Hopkins Street. This alternative was selected based on cost and that it allows for beneficial use of the lime material which supports DER-32 “Green Remediation” objectives. This selected remedy fully satisfies the remedial alternative objectives for commercial re-use and is protective of human health and the environment.

# 1.0 INTRODUCTION AND BACKGROUND

## 1.1 Introduction

The City of Buffalo has contracted Panamerican Environmental, Inc. (PEI) to complete an Remedial Investigation/Alternatives Analysis Report (RI/AAR) for the 90 Hopkins Street Site (NYSDEC Site # E91 5181) located in the City of Buffalo, New York **(**refer to Figures 1 and 2). In 2006 an SI/RAR work plan was prepared (*Work Plan for Site Investigation/Remedial Alternatives Report, for the 90 Hopkins Street Site Number 31570006, prepared for: City of Buffalo, prepared by: PEI/URS, July 2006*) and a IRM work plan (*Work Plan for Interim Remedial Measure (IRM), Environmental Restoration Program Project for the 90 Hopkins Street Site Number E915181, prepared for: City of Buffalo, prepared by: PEI/URS, May 2006*) along with preparation of construction drawings and specifications for an IRM to excavate and remove the waste lime piles from the 90 Hopkins Street Site. At the end of 2006, construction bids were received to implement the IRM. However, as a result of an increased cost estimate based on new volume estimates and funding limitations, the IRM and the project were put on hold.

In 2009, the original 2006 SI/RAR work plan was revised/updated to reflect changes in project approach and scope (*Work Plan for Site Investigation/Remedial Alternatives Report, for the 90 Hopkins Street Site Number E915181, prepared for: City of Buffalo, prepared by: PEI, Revised December 2009*).The revised work plan included the following new scope of work:

- Complete a more thorough history review to include completing a Phase 1 Environmental Site Assessment;
- Develop data that will determine a more accurate estimation of carbide lime volume;
- Assess soil conditions/collect samples on the property and below the lime material;
- Determine if the property has been impacted by adjacent land uses (i.e., junk yard/rail- perimeter sampling/assessment);
- Assess groundwater quality (especially for pH); and
- Determine the quality of the carbide lime and potential for beneficial use – develop creative re-use potential. This will include confirming the chemistry and developing a list of potential uses (provided in the AAR portion of this document).

The remedial investigation described in this work plan was completed in April 2010. As part of the AAR portion of this RI/AAR program, an assessment was conducted into Beneficial Uses for the carbide lime as a remedial alternative.

As part of Task 1 of the work plan, a Phase I Environmental Site Assessment (ESA) was completed to assist in compiling a site history. This was also used to identify other potential environmental concerns at the site (other than the lime piles) to be evaluated during the RI/AAR. The text portion of the Phase I ESA is presented in Appendix A – the complete Phase I is referenced as a separate stand-alone project document.

The goal of this project is to complete an RI/AAR as part of the New York State Department of Environmental Conservation (DEC) Environmental Restoration Program (ERP) under the1996 Clean Water/Clean Air Bond Act ECL Article 56 - 6NYCRR 375-4. The purpose of the RI is to determine the potential nature and extent of contamination and impacts at the site both from the carbide lime piles and other sources and assessment of impacts to the site soil, groundwater and adjacent wetlands. The RI/AAR has been developed using NYSDEC DER- 10 Technical Guidance for Site Investigation and Remediation, May 2010.

## 1.2 Background

The 90 Hopkins Street Site is owned by the City of Buffalo and consists of an approximately 8-acre parcel located in a heavily industrial area of Hopkins Street. To the north, the site is bounded by a common access way/rail spur and the Alltift Landfill/Ramco Pond remedial action areas (DEC Site No's 915054 and 915046B). To the northeast is commercial and private property including Niagara Cold Drawn Corp (former Ramco Steel/Bliss & Laughlin– Niagara LaSalle facility). The site is further bounded by an industrial facility (Mardan Technologies Inc.) along the northern part of the eastern property boundary, a large automobile scrap yard (LKQ Corp.) to the east and southeast, and the LTV Marilla St. Landfill (formerly Republic Steel) site (DEC Site No. 915047) to the south- southwest. A railroad right-of-way is located immediately along the west/southwestern side of the site.

The site is currently a vacant parcel and there are no structures present, but foundations and floor slabs from former structures exist at the site. Several former structures were demolished sometime during 2002. These structures were part of the original acetylene manufacturing facility included a gas holder, transformer house, oil house, generator building, and a purifying/compressor building. Two carbide lime material piles (by-product from the carbide lime acetylene manufacturing process), previously measuring approximately 118,000 cubic yards in total, occupy most of the site. The rest of the site contains concrete pads/floors of former buildings and weed covered vacant areas. These areas are covered with soil comingled with pieces of brick, concrete and stone; remains from the recent use as a C&D recycling operation and from the former structures. A large pile of wood debris and a large weed-covered soil pile exist along the central eastern border. A recently installed fence separates the site from the auto junk yard to the east. The junk yard has evolved over the recent 3-5 years. Currently, the junk yard operation is very professionally managed in a very neat and extremely organized manner. Prior to the new management, some auto junk materials were piled on the eastern border and some on the eastern side of the lime pile and the junk yard in general was very haphazard and unkempt.

Historical information identifies that the Union Carbide Company (or various named units of this company) operated the site at 90 Hopkins Street as an acetylene gas manufacturing facility from the 1930's until about 1964. From 1964 to 1968, the site appeared to be owned and operated by Sloan Auto Parts (Iroquois Gas Corp. and National Fuel obtained utility easements around 1974). The City of Buffalo, who obtained the site parcel in 1987 through the tax foreclosure process, now owns the site.

Several environmental assessments previously conducted at the site include:

- *Characterization of "Lime Piles"*. Malcolm Pirnie, Inc. For the City of Buffalo Law Department- (February 2, 1998);
- *Technical Assistance for the Sloan Auto/90 Hopkins Street Site, Buffalo, New York. Brown fields Technology Support Center.* Completed by USEPA contractor Tetra Tech EM Inc. March 1999;
- *Soil Sampling, Sloan Auto, Buffalo, New York*. Completed by Weston for USEPA ERTC. October 29, 1998;
- *Petition For Determination of Beneficial Use For Calcium Carbonate Product Located At Hopkins Street, South Buffalo*. Prepared by Malcolm, Inc. for BERC. January 2000; and,
- *Lime Pile Investigation & Limited Groundwater Quality Evaluation, 90 Hopkins Street, City of Buffalo, New York, prepared by Clough Harbour & Associates, LLP, for Honeywell Corp*., *July 2006.*

The limited soils investigations completed by Weston in 1998 only evaluated soil/carbide lime to a depth of 3 feet. Visual observations/site use history indicate that overburden fill includes varying amounts of wood and brick fragments, metallic scrap, concrete and asphalt fragments, glass, and other miscellaneous material. The Weston report also indicated that groundwater was encountered at 3 feet at some locations.

Information in DEC site files indicates that the United States Environmental Protection Agency (USEPA) completed a remediation of PCBs in 1998 related to the demolition of the transformer and oil house structures. Because of the limited information available regarding surface/subsurface soils and groundwater, the focus of the RI was on these media to determine the likelihood and level of contamination and to determine the remedial measures necessary to allow site re-use.

A more detailed description and history of the site is described in Section 2.1 and the Phase I ESA provided in Appendix A.

# 2.0 REMEDIAL INVESTIGATION

## 2.1 Site History Assessment

Environmental concerns at the site may be attributed to both past site uses and adjacent property uses. A summary of the subject site and adjacent properties history from an environmental perspective is provided below and also presented in attached Table 1. Additional information is provided in the Phase I ESA.

Subject Property

The 90 Hopkins Street site is approximately eight acres in size, is currently a vacant parcel and no structures are present. Several former structures were demolished sometime during 2002. These structures, part of the original acetylene manufacturing facility, included a gas holder, transformer house, oil house, generator building, and a purifying/compressor building. Two carbide lime material piles (by-product from the carbide lime acetylene manufacturing process) measuring approximately 118,000 cubic yards in total occupy most of the site. The rest of the site contains concrete pads/floors of former buildings and weed covered vacant areas. These areas are covered with soil comingled with pieces of brick, concrete and stone.

The site was most recently leased by the City of Buffalo from approximately 2002 to 2005 to a contractor to re-cycle/crush construction materials including brick, concrete and stone. When active, these materials were stored in large piles adjacent to the carbide lime piles. These materials were removed when the lease was terminated by the City of Buffalo. It is probable that much of the materials currently observed across the site surface are materials from this recycling operation. Some may be remains from the former on-site buildings. A large pile of wood debris and a large weed-covered soil pile exist along the central eastern border.

The Union Carbide Company (or various named units of this company) operated the site at 90 Hopkins Street as an acetylene gas manufacturing facility from the 1930's until about 1964 (or for approximately 30 years). Commercial use of the site by Union Carbide affiliated companies appears to have begun in the mid 1930's. During 1916-1917 Union Carbide & Carbon Corporation incorporated and acquired Linde Air Products Co., National Carbon Co., Inc., Prest-O-Lite Co., Inc. and Union Carbide Company. Records show that in 1930 the International Oxygen Company sold the subject site to the Linde Air Products Company and by 1935, a Prest-O-Lite plant was established on the site. Historic Sanborn Maps during that time show numerous buildings including Charging Building, Generator Building, Purifying and Compressing rooms and a Gas Holder.

The site appeared to be owned from 1964 to 1986 by Sloan Auto Parts (Iroquois Gas Corp. and National Fuel obtained utility easements around 1974). The City of Buffalo obtained the site in 1987 through the in-rem tax foreclosure process.

The carbide lime piles have been examined as part of the past assessments listed above and have been shown to exhibit a high pH. According to DEC records, the site was subject to a USEPA removal action to remove drums of waste, some PCB soil removal and building demolition.

In 1997, the carbide lime material was sampled and analyzed to determine its characteristics for potential beneficial use (Malcolm Pirnie report). The results indicated that the material is calcium carbonate. Sample analysis also included Target Compound List (TCL) volatile organic Compounds (VOCs), TCL semi-volatile compounds (SVOCs), Target Analyte List (TAL) metals, total cyanide, and pH. Also samples were collected for Toxicity Characteristic Leaching Procedure (TCLP). The TCLP analysis indicated that, with the exception of an elevated pH, the material would not be considered a RCRA Characteristic Hazardous Waste. However, the high pH (12.5 range) of the material poses a risk, through runoff and seepage, to the newly constructed wetlands north of the site. Low concentrations of metals were detected and calcium (as expected) was found at elevated concentrations. No other significant levels of contaminants were detected associated with the previous samples collected at the lime piles. Previous samples collected from surface and subsurface soils and debris, not associated with the carbide lime piles, indicated elevated concentrations of benzene and xylene compounds (petroleum), polycyclic aromatic hydrocarbons (PAHs), PCBs, and metals. A limited investigation of the soils completed by Weston (USEPA Subcontractor) to a depth of 3 feet indicated that overburden fill included varying amounts of wood and brick fragments, metallic scrap, concrete and asphalt fragments, glass, and other material. Water was encountered at 3 feet at some locations.

The USEPA also assisted the City in identifying potential beneficial uses for the carbide lime stockpiled at the site and provided information on remedial technologies for the treatment and cleanup of shallow soils at the site. The associated report discussed eight industries and chemical processes where the carbide lime could be used beneficially. Names of potential users in proximity to the site were also identified. The report also discussed five technologies for treating shallow soils and the potential advantages and limitations for each. At this time, some of the carbide lime material was taken and used by the USEPA for acid pit neutralization at the nearby Bethlehem Steel property in Lackawanna, N.Y. Further analysis of alternatives will be provided in the AAR report.

Adjacent Property Use

Adjacent properties, north, east and west of the site have various environmental issues. As described in the Phase I ESA, the adjacent former and current property uses include landfilling, commercial uses and junk yard operations.

The junk yard located along the eastern side of the site has changed considerably in recent years. The most recent owner, LKQ Corp, an automobile wrecking operation, set up operations in the spring of 2009. The new owners cleaned up the junk yard considerably, removed junk yard debris from the subject property on and along the lime pile and installed a new fence which separates the site from the auto junk yard. In recent years (as recently as 2005-2006), prior to the current owners, some auto junk materials were piled on the eastern border and some on the eastern side of the carbide lime pile. However, although the area is substantially cleaner in terms of junk storage, some remnant automobile junk materials and parts were observed intermingled with the soil along the lime pile and fence running along the eastern border of the site.

The adjacent property to the north is 110 Hopkins which historically was occupied by the Bliss & Laughlin Company as early as 1928. After Bliss & Laughlin, the owner was Ramco Steel and currently is Niagara Cold Drawn. The 110 Hopkins parcel contains a single, approximately 129,600-squarefoot, building surrounded by approximately 161,460 square feet of grounds. Used for finishing steel products, the facility, in September and October of 1952, machined and straightened uranium rods under subcontract to National Lead of Ohio (NLO), who operated the Fernald Site in Ohio under contract to the U.S. Atomic Energy Commission (AEC). These activities at the 110 Hopkins facility generated 53 drums of uranium waste cuttings, which AEC shipped to the Lake Ontario Ordnance Works in Lewiston, New York, for disposal or recycling. At the completion of the uranium machining operations, NLO conducted radiological surveys of the facility and identified contamination on the machining equipment. These machines were subsequently replaced. Because no records could be located indicating the radiological condition of the site following uranium machining, the U.S. Department of Energy (DOE) Office of Environmental Restoration and Waste Management recommended that current radiological conditions be determined. A 1992 preliminary survey of the building interior and exterior indicated residual radioactive material on the floor of the Special Finishing Area, a 3,230-square-foot section of the facility where the machining operations were performed. Samples confirmed that the contaminant was processed uranium metal. As a result of the 1992 survey, DOE designated the 110 Hopkins' facility for inclusion into the Formerly Utilized Sites Remedial Action Program (FUSRAP) in that year. A subsequent site characterization revealed elevated levels of radioactivity on the surfaces of the trusses and the floor of the former Special Finishing Area and on the concrete poured over a trench located west of this area. In addition, contamination in a second trench in the former Special Finishing Area was identified during the remediation process. Remediation of the 110 Hopkins facility began in December 1998 and continued through March 1999. Trusses were remediated by scraping, wiping, and then removing the residual dust with a high-efficiency vacuum. Scabbling (a process that grinds and removes the surface of concrete) and jackhammers were used to remove surface contamination from the floor and from the concrete over the trench west of the Special Finishing Area. The second trench and a pit area contained metal shavings and debris, which were removed manually. The concrete pad covering this trench was jack hammered, and the trench walls and floors were scabbled, jack hammered, and sand-blasted. Approximately 60 cubic yards of construction debris was generated during the decontamination of the trusses, floors, and trenches. This debris was handled as radiological contaminated waste and shipped to a licensed facility in Clive, Utah, for disposal.

Additionally, the NYSDEC spills database for 110 Hopkins' facility has records of petroleum spills at this facility (1992 -Spill #9214110 and 1998- Spill # 9875127). Oil was found inside and outside of the plant and was associated with uncovered drums full of oil and sloppy housekeeping. These spills were remediated and closed. The 1998-1999 Record of Decision and disposal of waste at a licensed facility included remedial actions including removal of soil and re-establishment of a pond and wetlands which was completed in 2005. Currently, Niagara Cold Drawn's products include cold-drawn bars used in machining applications, automotive and appliance shafts, screw-machine parts, and machinery guides; turned, ground, and polished bars used in precision shafting; and drawn, ground, and polished bars used in chrome-plated hydraulic cylinder shafts. The company is listed as a technological leader in the development of specialized cold-drawn steel products.

The Pravia Manufacturing Property located at 88 Hopkins Street (adjacent northeast property) was listed on the leaking tank and spills databases associated with a fuel oil tank removal and soil contamination (in 1999) and in 2001 for remediation of tar in a concrete vault. Both spills were administratively closed by the DEC.

To the west and northwest of the subject site are recent landfill restoration projects. The following summary is from the South Buffalo Brownfield Opportunity Area nomination documentation. "The Alltift Landfill (NYSDEC Site 915054) is comprised of approximately 25 acres and is a former active landfill that was previously used for the disposal of domestic and industrial wastes (see Figure 2). Environmental studies documented surface and groundwater contamination. According to Phase II Investigation documentation, Allied Corp. (National Aniline Division) disposed miscellaneous organic chemicals, chrome sludge, copper sulfate, nitrobenzene, monochlorobenzene, and naphthalene on a monthly basis in the landfill. A smaller landfill containing automobile shredder wastes, demolition debris, fly-ash and sand wastes was situated on top of the older chemical waste landfill. A Record of Decision was signed on March 27, 1995 requiring installation of a multilayer cap with a suitable sub-base, a composite gas venting system, a geomembrane barrier layer, a composite drainage layer, two feet of cover soil to protect the barrier layer, and a 6-inch topsoil layer to support vegetation. The project also included waste consolidation, wetlands restoration, and groundwater collection. Remedial action was completed in 2005. It included consolidation of waste material from Alltift and the adjacent Ramco Steel site (NYSDEC Site 915046B) as well as four offsite areas including the J.D. Cousins site (677 Tifft Street), Lehigh Valley Railroad Site (adjacent to Tifft Nature Preserve), the Tifft and Hopkins Site and the Buffalo Outer Harbor/Radio Tower Area Site. An Operation, Maintenance and Monitoring Plan was put in place in 2006." The restored wetlands are located adjacent to the north of the subject site.

The Marilla Street Landfill (NYSDEC Site 915047) is comprised of approximately 92 acres and was built in a former wetland (see Figure 2). Waste materials on the site include slag, precipitator dust, clarifier sludge, checker bricks, pickle liquor, tool scale, blast furnace dust, basic oxygen furnace dust and brick generated by the Republic Steel Plant. The waste-mound averages about 30 feet above the undisturbed grade. The Record of Decision was issued in 1997 which required the excavation of sediments containing elevated levels of metals, covering low contaminated sediments with soil, restoration of remediated wetlands, upland enhancement, and long term monitoring of the wetlands and landfill. Remediation of 16 acres of wetlands which consisted of excavation of sediments from ponds and ditches and covering with clean soil, wetland restoration, and upland enhancement started in 1998 and was completed in 1999. The site is being monitored under a long-term Operation and Maintenance Plan.

## 2.2 Carbide Lime/Soil Assessment

The primary purpose of the assessment was to:

- Assess/verify the extent and volume of the carbide lime piles;
- Visually inspect and describe carbide lime and soil/fill conditions across the site and/or in suspected areas of concern;
- Characterize the carbide lime material (soil interface) for contaminants of concern; and
- Assess, as necessary, the chemical characteristics of carbide lime material for beneficial reuse.

This was accomplished using a combination of borings and test trenches (refer to Figure 3). All work was performed in accordance with the NYSDEC approved work plan.

**Test Trenches**

A total of sixteen (16) test trenches were advanced at various locations across the site during the period of April 13, 2010 and April 14, 2010 using a trackhoe operated by SJB Services, Inc. under subcontract to PEI. These were located as follows (refer to Figure 3):

- Ten (10) test trenches were excavated perpendicular from the toe of the two carbide lime piles to assess the depth of the carbide lime beyond the toe of slope below grade surface (bgs). These included test trenches TP-01through 03, 09 and 11 through 16;
- Two (2) test trenches were advanced through the debris pile located along the east side of the site (TP-04 and 05); and,
- Four (4) additional test trenches were advanced in other areas outside the carbide lime piles (TP-06 through 08 and 10).

All test trench locations are indicated on Figure 3. Test trenches varied in length and location depending on conditions in the field during installation. As an example, trenches excavated perpendicular to the carbide lime piles were extended as far as necessary to determine the extent and depth of the carbide lime away from the piles. However, trenches perpendicular to the piles along the west and east perimeter were terminated at approximately the site property line. Soil from each test trench was visually examined, logged by a geologist, and screened using an organic vapor detector (Photoionization Detector-PID). Stratification of material in the trenches including depth to groundwater, where encountered, and observations of soil staining, were noted on the trench logs (refer to Appendix B). Photographs of the RI are contained in Appendix D.

Test trenches ranged in depth from 4 feet deep to 10.5 feet deep with an average depth of approximately 6.5 feet. The average trench width ranged from 3 to 4 feet wide and the length of test trenches ranged from 10 feet to 50 feet in length (refer to trench logs in Appendix B). Trenches were excavated to refusal or when native soils were encountered. Groundwater was encountered in almost all trenches at between 2 and 6 feet bgs which in many cases hampered excavation and specific identification of the depth of the carbide lime layer.

The depth of carbide lime material and its extent along the trenches were recorded in the trench logs and compared to the extent of carbide lime recorded from previous. These trench depths were compared to previous information on subsurface carbide lime depth. Figure 3 presents the lateral extent of carbide lime identified by this program in comparison to the extent of carbide lime estimated for the 2006 IRM carbide lime pile removal design. As shown, based on this new information, carbide lime depth subsurface extends outward from the piles further than previously thought in the locations shown on Figure 3. The trench excavations indicated the following:

**South Lime Pile**

- Carbide lime extends for some distance beyond the southern carbide lime pile's eastern side to and possibly beyond the property line and current fence. The lime beyond the elevated pile is covered by two to six feet of fill/debris and is about one to six feet thick.
- Carbide lime extends to at least 15 feet in some locations north of the southern carbide lime pile and is covered by about two feet of soil/fill.
- Carbide lime extends beyond the southern lime pile along the northwestern side to at least the property line and most likely to the end of the brush line as shown on Figure 3. The carbide lime is approximately 3 feet in depth and is covered by about four feet of fill/soil.
- Carbide lime extends beyond the southwestern side of the southern carbide lime pile to at least the property line and most likely to the end of the brush line as shown on Figure 3. The carbide lime is approximately 3 feet thick and is covered by about four feet of fill/soil.

Two test trenches were advanced to the east of the southern carbide lime pile (TP-01 & TP02) where no previous data was available. These indicated that the carbide lime pile extends from the carbide lime pile toe to the east to the property line fence and probably beyond. These trenches indicate that approximate six (6) feet of fill/debris covers approximate six (6) feet of carbide lime that extends from the carbide lime pile and the property line (refer to Figure 4).Test trench TP-03 advanced from the toe at the northeast corner of the south carbide lime pile indicated a thinner layer of carbide lime (1 +/- feet) extending outward from the toe at a depth of about 2 feet bgs. Carbide lime material was also found when drilling monitoring well MW-01 (refer to monitoring well drill logs) installed approximated 15 feet to the northeast of the toe of the south carbide lime pile. This indicates that the carbide lime material 1 to 2 feet in depth, extends at least 15 feet to the north of the carbide lime pile toe, and is covered by 2 +/- feet of overburden/debris (refer to Figure 4). Test trench TP-16, advanced to the southwest at the northwest corner of south carbide lime pile, confirmed previous investigations that a 3 +/- feet thick layer of carbide lime extends beyond the carbide lime pile. This is covered by approximately 4 feet of overburden/debris and extends to the westerly brush line where the trench was terminated.

**North Lime Pile**

- Waste carbide lime extends beyond the northern carbide lime pile to the west/southwest to beyond the southwest property line. The carbide lime is about 6 feet thick and covered by a half foot of overburden fill. The carbide lime layer thinned and was not detected at the end of each trench at approximately the brush line indicated on Figure 3.

- Waste carbide lime extends beyond the northern lime pile to the north to approximately the property line. The carbide lime is approximately 3 feet thick and is approximately one foot bgs. Groundwater was encountered at 2 to 3 feet bgs.

Test trenches advanced to the west/southwest from the toe of the north carbide lime pile (TP-1 1 & TP-12) indicated a carbide lime material layer 6+/- feet thick at the toe, covered by a half foot of overburden fill. The carbide lime layer thinned as the trench was advanced away from the toe and was not detected at the end of each trench, near the brush line indicated on Figure 3. These test trenches indicate that the carbide lime material extends further to the west/southwest than earlier indicated and extends beyond the southwest property line. Test trenches advanced to the north of the north carbide lime pile (TP-1 3 & TP-1 4) confirmed the presents of a carbide lime material layer 3+/- feet thick approximately one foot bgs, extending, at least, to the limits shown on Figure 3. Because of the heavy influx of groundwater at 2 to 3 feet bgs the trenches could not be advanced further to the north than indicated. All test trenches were terminated at a depth where native soil was reached or the inflow of groundwater hampered soil/strata identification.

**<u>Center of the Property</u>**

Four test trenches were installed across the center of the site, between the carbide lime piles, from south to north (TP-06, TP-07, TP-08 and TP-10).These trenches were advanced in the areas of the former gas holder, transformer and oil house structures, and processing buildings. In each of these trenches the top four to six feet consisted of overburden and C & D debris with some minor traces of carbide lime material. Groundwater entered each of these trenches at approximately four (4) feet bgs. Below the overburden/debris, native soil was encountered consisting of brown and green silty clay. Other than the C&D debris material, no evidence of contamination was observed in any of the trenches. None of the trench soils exhibited elevated PID readings, soil discoloration or odors.

Test trenches TP-04 and TP-05 were advanced through the debris pile located along the east side of the site (refer to Figure 3). Both test trenches encountered approximately 4 to 4.5 feet of C & D debris including metal rebar, piping, brick, concrete and wood. TP-04 reached refusal at 4 feet bgs due to encountering a concrete slab or foundation. Native material (brown and green silty clay) was encounter in TP-05 at 4.5 feet bgs. Other than C&D debris, no contaminated material was observed in either test trench.

A total of nine (9) discrete surface and sub-surface soil samples were collected from the test trenches as follows:

- Four (4) surface samples were collected from the top 2 inches (in non-lime areas); and,
- Five (5) subsurface samples were collected at depths below lime layer and/or based on observable in-field non-native conditions.

Since no obvious areas of impact were identified by visual or olfactory/screening, both surface and subsurface samples were selected from random test trenches across the site. In addition, one carbide lime sample was collected from carbide lime material near the carbide lime soil interface to determine if the carbide lime material below the existing grade may have become mixed and or contaminated with soils resulting in changed physical/chemical characteristics. Samples were sent to an approved laboratory and analyzed as follows:

- Surface soil samples – TCL SVOCs, PCBs and TAL metals;
- Subsurface soil samples – TCL VOCs, TCL SVOCs, PCBs and TAL metals; and,
- Subsurface/lime interface sample -TCL VOCs, TCL SVOCs, PCBs and TAL metals.

Analytical results are discussed in Section 4.0

**Soil Borings**

A total of five (5) borings were advanced during the two day period of April 19, 2010 and April 20, 2010. Borings were advanced using a hollow stem auger track drill rig operated by SJB Services, Inc. under subcontract to PEI. Borings were installed in accordance with Section C2.1.2 of the approved work plan.

The objective was to advance borings through the two separate carbide lime piles and to install monitoring wells in borings at the property borders. Two borings were drilled through the top of each of the two carbide lime piles to below the carbide lime and an additional boring was advanced to the depth of carbide lime in the northern carbide lime pile. The information was necessary to augment previous limited data on the depth and size of the carbide lime piles. Further objectives were to:

- Profile the carbide lime piles;
- Assess depth of carbide lime piles; and,
- Collect appropriate samples from the lime/soil interface material and the soils beneath the carbide lime piles.

The additional boring was advanced in the northern pile (PEI-BH-5) to add to the assessment of the depth of carbide lime fill only. The depth and physical characteristics of the carbide lime were recorded in each boring log (refer to Appendix B). Photographs of the RI are contained in Appendix D.

Previous to this RI, two borings were advanced through the north carbide lime pile (CHA 2006 program) and no borings had been advanced through the south carbide lime pile;

however, test trenches were excavated in both piles during Malcolm Pirnie's 1998 investigation. Utilizing this data, estimates of the depth to the bottom of the carbide lime piles were previously made and an IRM to remove the carbide lime was designed in 2006. The following is an assessment of each carbide lime pile based on the RI data.

South Carbide Lime Pile

The 2006 design, using MP 1998 test pit data, estimated that the lime depth in the carbide lime pile was approximately 22 feet deep (top elev. 601.5 +/- feet & bottom of carbide lime elev. 579.5 +/- feet).

The borings completed for this RI provides more information. The south carbide lime pile borings (BH-03 and BH-04 – refer to Figure 3) installed during the RI indicated that the carbide lime depth in both borings was approximately 23.5 feet deep (top elev. 601.5 +/- feet & bottom elev. 578.0 +/- feet). This would indicate that the bottom of the carbide lime is approximately 1.5 feet deeper than previously estimated. The borings also indicate that the carbide lime extends approximate 10 feet below the existing surface grade adjacent the pile which correlates with the depth of carbide lime indicated in the test trenches advanced from the pile toe (TP-01 and TP-02). The bottom of the carbide lime was found to be between 9 and 10 feet below the surfaces of the trenches.

North Carbide Lime Pile

The 2006 design, utilizing boring data from the CHA 2006 program, estimated the carbide lime depth in the pile to be, on average, 20.5 feet deep (top elev. 599.5 +/- feet & bottom of carbide lime 579.0+/- feet).

The north carbide lime pile borings (BH-01, BH-02 and BH-05 – refer to Figure 3) installed during the RI indicated that the waste lime depth in these borings was approximately the same on average (20.5 feet deep) as used in the 2006 design. The borings also indicate that the carbide lime extends approximate 7 feet below the existing surface grade adjacent to the pile.

Samples were collected from the carbide lime; lime/soil interface and the soil beneath the carbide lime in borings BH-01 through BH-04 (refer to Section 4.0). The samples from each boring were analyzed for the set of parameters identified in the work plan. Eight soil/lime samples were analyzed for TAL metals, PCBs, TCL VOCs and TCL SVOCs. A ninth sample – the carbide lime sample from BH-01A - was placed on hold for potential future lime characterization; if deemed necessary.

Continuous sampling was conducted below the carbide lime soil interface to refusal using standard split spoon sampling devices. The depth of soil below the carbide lime interface to refusal ranged from two (2) feet in BH-01 to eight (8) feet in BH-03. A total of four discrete soil samples were collected (one from each boring) from the soil beneath the carbide lime that indicated the highest potential for contamination, based on visual, olfactory, and screening information. A PEI field geologist logged all samples and performed visual and field screening of all core samples for volatile organic compound (VOC) concentrations using a PID. Observations are contained on the boring logs in Appendix B. No elevated PID readings or obvious signs of contamination were observed. The soils below the carbide lime consisted of medium to fine sandy loam directly below the lime at depths ranging from two (2) feet in BH-01 to five (5) feet in BH-3. Beneath the loam layer there is a layer of tight silty clay, ranging in depth from one (1) foot in BH-02 to five (5) feet in BH-4. Borings reached refusal in bedrock beneath the silty clay layer.

Analytical results are discussed in Section 4.0.

**Additional Lime Material assessment**

Based upon the data from the test trenches and borings an evaluation was made of the additional carbide lime material that was detected at depth beyond the toe of slope of both carbide lime piles, extending to the property boundary. The extended areas of the carbide lime below grade, beyond what were the assumed limits from the 2006 assessment, are shown as cross hatch areas on Figure 3. The estimated volume of carbide lime within the cross hatched area on the Figure 3 is approximately 2500 cubic yards. The boring program also indicated that the depth of carbide lime beneath the south carbide lime pile is approximately one foot deeper than previously estimated, which amounts to an approximate additional 1400 cubic yards of carbide lime.

The original extent, both laterally and vertically, of the carbide lime material was estimated as part of the 2006 IRM design using the data from previous investigations, including support data from the limited 2006 CHA lime assessment. The previous lateral extent of the waste lime is indicated by a dashed line on Figure 3. Based on those limits and depth assessments from boring and test trench data from earlier investigations the volume of carbide lime was calculated in 2006 to be approximately 118,000 cubic yards. Adding the additional volumes from this assessment the total volume of carbide lime is now estimated to be 121,900 cubic yards. Between 2011 and 2013, approximately 9,000 cubic yards were removed from the site. The current estimate of lime at the site as of 2013 is approximately 113,000 cubic yards.

## 2.3 Groundwater Investigation

Three groundwater wells were installed on April 16, 2010 to confirm groundwater flow direction and assess groundwater quality (refer to Figure3). The wells were installed using the same track drill rig that was used for the borings and operated by SJB services under subcontract to PEI.

Based on historic data, groundwater appears to flow to the north and west toward the wetlands and Lake Erie. To confirm groundwater flow direction, and assess groundwater quality, the three groundwater monitoring were installed. One well was installed up-gradient along the southeast property boundary and the other two wells were installed down- gradient, one along the northern property boundary and one at the northwest corner of the site (refer to Figure 3). The wells were installed in accordance with the work plan. Each well extends to depths of between 11 and 15 feet. Monitoring wells were installed as follows:

- Boreholes were advanced to a maximum depth of 15 feet to the top of bedrock;
- Overburden soils were continuously sampled from ground surface to the bottom depth using split spoon samplers;
- Soil samples were visually inspected, screened with a PID for VOCs, and logged by a PEI geologist;
- Each well consists of a two-inch diameter, schedule 40 PVC casing equipped with a five-foot screen and solid PVC riser pipe extending to the surface;
- Screens were positioned to straddle the groundwater surface to allow monitoring of floating product, if present;
- The annulus around the screen was filled with filter sand to one foot above the top of the screen. A three-foot thick bentonite seal was then installed and the borehole filled to the ground surface with a cement/bentonite mix (refer to monitoring well diagrams in Appendix B); and,
- A steel protective casing with keyed-alike locks was installed to complete each installation.

Following installation, the wells were developed in accordance with standard procedures outlined in the Field Sampling Plan. Development water was discharged directly onto the ground downgradient of the well.

Monitoring wells were installed at the following depths:

- MW-01 – 12 feet to bottom of well – 4.24 feet to standing water (El. 585.79)
- MW-02 – 10 feet to bottom of well –3.18 feet to standing water (El. 582.94)
- MW-03 – 10 feet to bottom of well – 1.38 feet to standing water (El. 582.80)

Water level measurements, as well as basic water quality information, were obtained. Well locations and elevations were surveyed. Based on water level measurements, groundwater appears to be flowing from the southeast toward the northwest. This makes general sense based on topographical information, area wetlands and regional groundwater direction. However, as described, landfills are located west and northwest of the property. These may affect local groundwater patterns.

One groundwater sample was collected from each well on April 22, 2010, in accordance with the procedures outlined in the approved work plan. Groundwater samples were analyzed for TAL metals, PCBs, TCL VOCs and TCL SVOCs. Analytical results are discussed in Section 4.0.

# 3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

## 3.1 Surface Features

Regional Geology/Topography

Natural resources and environmental features immediately adjacent to the site include newly constructed wetlands. In the general area near the site area features include the Buffalo River, the Tifft Nature Preserve, Union Ship Canal, South Park, significant fish and wildlife habitat, federal and state wetlands, and floodplain areas.

*Topography*

The site is located in the Erie-Ontario lake plain province, which has minimal topographic relief, and generally slopes north and west towards the Buffalo River and Lake Erie. The highest elevations are the man-made landfill areas to the west/southwest and northwest.

*Soils*

The predominant soils in the general site area are classified as Urban Land on lowland plains, reflecting previous industrial and urban residential land uses. These urban soils are typically found in areas dominated by nearly level to sloping urbanized areas and areas of well drained to poorly drained soils and disturbed soils. Generally, asphalt, concrete, buildings and other impervious structures cover 80% or more of Urban Land soil surface. Past subsurface investigations conducted in the general area have indicated the presence of fill materials (i.e. construction and demolition debris) and peat which contribute to instability and increase building foundation construction costs. Site specific information based on the recent investigation indicates the presence of considerable construction and demolition debris near the surface. In addition, soil types classified as Dumps (Dp) are located within the Tifft Nature Preserve, the Marilla Street Landfill, and the Alltift Landfill.

*Bedrock and Surficial Geology*

The bedrock underlying the area is composed of three formations roughly dividing the area into three segments north to south; Moorehouse Limestone in the Onondaga Formation, which is approximately 120 feet in depth; the Marcellus Formation, consisting of Oatka Creek Shale, which is approximately 30-55 feet in depth; and Levanna Shale and Stafford Limestone, approximately 60-90 feet in depth. The surface geology of the area consists of one type: Lacustrine silt and clay. The area was a part of several glacial lakes during the last ice age and features lakebed deposits. These consist of generally laminated silt and clay and are generally calcareous.

*Surface Waters and Tributaries*

The general area contains numerous water bodies including the Buffalo River and the

Union Ship Canal as well as small lakes and ponds within the Tifft Nature Preserve to the north- northwest. Lake Erie is located immediately to the west. The NYSDEC establishes water use classification and water quality standards based on considerations for public health and water supplies, recreation, propagation and protection of fish and wildlife. According to the NYSDEC regulations, the Buffalo River is a Class C, Standards C watercourse suitable for fishing, fish propagation and survival, and for primary and secondary contact recreation, although other factors may limit the use for these purposes. The Buffalo River is listed as a Great Lakes Areas of Concern (AOC) in the Great Lakes Water Quality Agreement between the United States and Canada. Great Lakes AOC's are designated geographic areas within the Great Lakes Basin that show severe environmental degradation. Buffalo Niagara Riverkeeper is *currently* coordinating federal and state agency efforts for the assessment and remediation of contaminated sediments in the Buffalo River.

The Union Ship Canal is a man-made water body that formerly served inland industries clustered around the railroad corridor. The area surrounding the Union Ship Canal is now part of the Buffalo Lakeside Commerce Park. According to the NYSDEC regulations, the Union Ship Canal is also classified as a Class C, Standards C watercourse. South Park Lake, located within historic South Park, is a 21-acre manmade lake designed in the 1890's by Frederick Law Olmsted as the key water feature of the park. The lake is fed by surface water runoff and municipal water sources as well as an outfall from Cazenovia Creek, and provides habitat for fish and waterfowl. A large concentration of water bodies is located in Tifft Nature Preserve, including one lake and three ponds: Lake Kirsty, Beth Pond, Lisa Pond, and Berm Pond. Lisa Pond and Berm Pond are connected via wetlands and watercourses. Berm Pond also includes an outfall into Lake Kirsty.

*Groundwater Resources*

According to the USGS Map Potential Yields of Wells in Unconsolidated Aquifers in New York State –Niagara Sheet, the site is not located on an unconfined aquifer. According to NYSDEC and USEPA databases, the site is not located over a primary or sole source aquifer. The Generic Environmental Impact Statement prepared for the Union Ship Canal area indicates that groundwater depth ranges from 2.5 to 9.0 feet. The site and City of Buffalo are served by public water and therefore exposures to contaminated groundwater via drinking water are not expected. Numerous former industrial operations have impacted groundwater in some areas. However, a number sites contaminated by former industrial operations have been remediated, or remediation is ongoing or planned.

*Floodplains*

The City of Buffalo participates in the National Flood Insurance Program, utilizing Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency (Map 3.20 - FEMA Special Hazard Areas). The Flood Insurance Rate Map for the area shows Special Flood Hazard Areas (or 100- year floodplains) associated with the Buffalo River and Lake Erie. The Buffalo River Special Flood Hazard Area is limited in depth and generally confined to the area along the river bank, with the exception of the

Conrail/CSX "peninsula" property in the north, of which a large portion of the 40 acres are located in a Special Flood Hazard Area. The site does not appear to be in this floodplain area. Development activities within the Special Flood Hazard Area are regulated by the City of Buffalo's Flood Damage Prevention Law (Article 31), which requires a Floodplain Development Permit. New development must be constructed at or above the mapped base flood elevation. However, the Special Flood Hazard Area is not a significant impediment to redevelopment.

*Wetlands*

In the general area there are large areas that are designated either as a State freshwater wetlands or mapped on the National Wetlands Inventory (NWI), as indicated on Map 3.24 - Wetlands. State freshwater wetlands are located within and adjacent to the site, including the newly constructed wetlands adjacent to the north and small areas adjacent to the Alltift Landfill (NYSDEC Site 915054) and Marilla Street Landfill (NYSDEC Site 915 047). The Buffalo River and Lake Erie are also identified as NWI waters

The above information can also be found at the following web site:

http://www.ecidany.com/documents/nomination-doc-7-14.pdf

The site is currently a vacant parcel and there are no structures present, but several foundations and floor slabs from previous buildings remain. There are no roads or parking areas associated with or adjacent to the site. The previous access road (Colgate Avenue) which ran along the northern border from Hopkins Street has been blocked at Hopkins Street to prevent uncontrolled dumping at the site. This road did allow access to northern adjacent properties but is now currently abandoned.

The site characteristics are dominated by two large carbide lime material piles measuring approximately 113,000 cubic yards in total, that are located on the property. The rest of the site contains concrete pads/floors of former buildings, a soil and debris pile, and weed covered vacant areas. These areas are covered with soil comingled with pieces of brick, concrete and stone. Recently, the site was used by a contractor to re-cycle/crush construction materials including brick, cement, and stone. When active, these materials were stored in large piles adjacent to the carbide lime material piles. It is probable that much of the materials currently observed across the site surface were materials left when the former piles were removed and/or from the demolition of the former site structures. As mentioned, a large pile of wood debris and a large weed-covered soil pile are located along the northeastern border.

The topography in the immediate vicinity of the site is generally flat and slopes slightly from southeast to northwest towards the wetlands north of the property. However, elevated closed landfills are located west and northwest of the site which artificially alters the topography in those areas.

## 3.2 Site Geology/Hydrogeology

The project area is situated within the Erie Lake Plain physiographic province, one of the two physiographic provinces of Erie County (the Allegheny Plateau is the other). The lake plain province is located along Lake Erie and has topography typical of an abandoned lake bed with little significant relief except for narrow ravines carved by the area streams. Elevations within this physiographic province range from 153 to 275 meters (570 to 900 feet) above mean sea level. However, along its southern and eastern boundaries, the province has characteristics typical of glacial lake beaches where the topography quickly transitions to the Allegheny Plateau (Owens et al. 1986:2). Elevations rise from approximately 177 meters in the City of Buffalo along Fuhrmann Boulevard/Rte 5 and Ohio Street. The site area is relatively flat to gently sloping.

In general, bedrock underlying Erie County formed in bands oriented east-west more than four hundred million years ago during the Silurian and Devonian periods. The oldest formations are in the northern portion of the county, becoming progressively younger toward the southern part. The linear project area traverses a variety of bedrock formations. Bedrock beneath the property area includes the Skaneateles formation and bands of Onondaga limestone closer to the City of Buffalo and the Buffalo River and limestone and shale of the Hamilton Group under the City of Lackawanna and the northern section of the Town of Hamburg. Relatively flat, the bedrock underlying Erie County tilts to the southwest at approximately 15 m (50 ft) per mile (Owens et al. 1986:2-4).

From previous investigations, and confirmed by water level measurements in the RI monitoring wells, groundwater beneath the site is relatively shallow (1.5 to 4.5 feet below grade) and flows from the southeast to the northwest, towards the wetlands north of the site and Lake Erie.

## 3.3 Demography and Land Use

The 90 Hopkins Street site is owned by the City of Buffalo and consists of an approximately 8-acre parcel located in a heavily industrial area of Hopkins Street within the City of Buffalo. The site is zoned commercial/industrial. The 90 Hopkins Street site is bounded to the north by a common access way/rail spur and the Alltift Landfill/Ramco Pond hazardous waste landfill remedial action areas (DEC Site No's 915054 and 91 5046B) and remediation area wetlands. Commercial and private property is located to the northeast, including the former Ramco Steel/Niagara Cold Drawn (former Bliss & Laughlin) and an industrial facility (Mardan Technologies Inc.). A large automobile scrap yard (LKQ Corp.) is located to the east and southeast, and the LTV Manila St. Landfill (formerly Republic Steel) site (DEC Site No. 915047) is located to the south-southwest. A railroad right-of-way is located immediately along the west/southwestern side of the site.

The Union Carbide Company (or various named units of this company) operated the site at 90 Hopkins Street as an acetylene gas manufacturing facility from the 1930's until about 1964.The site appeared to be owned from 1964 to 1986 by Sloan Auto Parts (Iroquois Gas Corp. and National Fuel obtained utility easements around 1974). The City of Buffalo obtained the site in 1987 through the tax foreclosure process, and currently owns the site.

The site is currently a vacant parcel and does not contain any structures, but several foundations and floor slabs from previous buildings remain. Several former structures were demolished sometime during 2002. These structures, part of the original acetylene manufacturing facility, included a gas holder, transformer house, oil house, generator building, and a purifying/compressor building. Two carbide lime material piles (by-product from the carbide lime acetylene manufacturing process) previously measuring approximately 121,900 cubic yards in total occupy most of the property. Between 2011 and 2013, approximately 9,000 cubic yards were removed from the site. The current estimate of lime at the site as of 2013 is approximately 113,000 cubic yards. The rest of the site contains concrete pads/floors of former buildings and weed covered vacant areas. These areas are covered with soil comingled with pieces of brick, concrete and stone. The site was leased by the City of Buffalo, from approximately 2002 to 2005, to a contractor to re-cycle/crush construction materials including brick, concrete, and stone. When active, these materials were stored in large piles adjacent to the carbide lime piles. It is probable that much of the materials currently observed across the property surface were materials left when the former crushed concrete piles were removed. A large pile of wood debris and a large weed-covered soil pile exist along the central eastern border.

*Population*

The City of Buffalo and the Buffalo-Niagara Falls metropolitan statistical area (MSA) experienced significant population loss. The City of Buffalo lost 11 % of its population between 1990 and 2000 and a further 6% between 2000 and 2007. Households experienced similar rates of decline with a 10% loss between 1990 and 2000 and a 4% loss between 2000 and 2007. Overall, the Buffalo-Niagara MSA experienced a much lower population loss and a marginal household gain, although recent estimates (2000 to 2007) show a decline in the region’s households. As a comparison, both the State of New York’s and the United States’ households grew in both time periods. These demographic growth trends in the City and MSA reflect overall demographic stagnation, as well as both the movement of people from the City into the suburbs and the changing demographic trend towards smaller household size. In the 1950s, the City of Buffalo was the 15th largest city in the United States with just under 600,000 residents. From the period of 1990 to 2000 the City lost 11 percent of its population leaving approximately 293,000 residents, 123,000 households, and 67,000 families in the City. Average income, particularly in the City of Buffalo, is considerably lower than the State average.

*Land Use*

The site is located in the southwest portion of the City of Buffalo, Erie County, in the western region of New York. This area represents the portion of the City having the largest geographic concentration of former heavy industries. The areas is categorized by a mix of land uses, including existing light and heavy industrial, rail yard, closed landfills, scrap yard, commercial, residential, natural heritage, and park and open space uses, in addition to vacant, abandoned (unoccupied) and /or underutilized sites that formerly served heavy steel manufacturing industries. The site area includes active light and heavy industrial and warehousing along Hopkins Street corridors as well as vacant industrial lands. A cluster of landfills and junkyards are within this areas commercial uses.

The above information can also be found at the following web site:

http://www.ecidany.com/documents/nomination-doc-7-14.pdf

# 4.0 NATURE AND EXTENT OF CONTAMINATION

## 4.1 Introduction

This section discusses the results of the Remedial Investigation activities, and in particular the nature and extent of contaminants in the media investigated and based on the limits of the investigation performed.

## 4.2 Potential Sources

The historical use of the site includes use as an acetylene gas manufacturing facility from the 1930's until about 1964. The acetylene manufacturing facility included a gas holder, transformer house, oil house, generator building, and a purifying/compressor building. When this manufacturing use ended, two carbide lime material piles, previously totaling approximately 121,900 cubic yards (by-product from the carbide lime acetylene manufacturing process), and the structures were left on-site. From 1964 to 1968 the site was owned and operated by Sloan Auto Parts presumably using the original structures for its auto parts business. After the City of Buffalo obtained the site parcel, the former structures were demolished sometime during 2002. The site was most recently leased by the City of Buffalo from approximately 2002 to 2005 to a contractor to re-cycle/crush construction materials including brick, concrete and stone. These materials were stored in large piles on the site. Adjacent property use included manufacturing (steel), landfills and auto scrap/junk yards. The auto junk yards have encroached onto portions of the site during past years. Additionally, railroad lines are located adjacent to the west and north of the site. Materials used to construct the lines and the contamination associated with rail cars and engine exhaust can be potential sources of environmental impact.

These uses all have the potential to have impacted the site because of the use, storage and/or release of materials that possibly resulted in release to the environment of volatile organic compounds, semivolatile organic compounds, polynuclear aromatic hydrocarbons (PCBs) and metal compounds as well as the presence of high pH materials related to the lime effecting surface and groundwater.

The RI program was designed to assess the potential for these impacts. Soil, carbide lime and groundwater samples were collected and analyzed for chemical constituents. Observations were made and measurement obtained to better refine the amount of carbide lime at the property as well as understanding fill conditions across the site. Soil samples collected and analyzed from both surface and subsurface soils during the boring and test trenching program indicated the presents of low concentrations of a number of metal compounds and SVOCs, primarily PAH compounds. Several VOCs were also detected in several of the subsurface samples. The investigation also indicated the aerial extent of the carbide lime.

The potential source of these compounds detected in the soils is most likely the historic industrial operations at the site and its surroundings as described above. The top several feet of material beneath and adjacent the carbide lime piles is composed of soil fill and C & D material (concrete, metal debris, wood, etc.). The C & D material is most likely from the demolition of the various historic buildings and structures that housed previous industrial operations and/or from C&D debris brought in from off-site by the most recent tenants, a C&D recycling business, as discussed above and in Section 1.2 Background. Also an active railroad operates along the western property perimeter.

Environmental contamination associated with these past off-site and on-site uses are known to include elevated levels of metals and PAH compounds in the associated soils.

PAHs are a group of chemicals that are formed during incomplete burning of wood, coal, gas, garbage or other organic substances and are widely distributed in the environment and particularly in older urban environments where coal, gas, and petroleum were burned for heat and other energy uses. PAH compounds are common constituents of fill material found in urban environments, and are typically associated with both fill material and C&D debris.

Metals are also associated with industrial uses on and adjacent to the property. Most metals occur in nature and their concentrations in fill and natural soil will exhibit considerable variability both stratigraphically and spatially. This variability is related to the variable composition of the fill, natural soils, protolith, weathering processes that chemically and physically modify soil and groundwater interactions that modify the geochemistry.

Volatile organic compounds as most likely associated with the process and operation in the former manufacturing facility, including the energy generation equipment. However, this may also be associated with the past use of the property/adjacent property for auto parts and junk/scrap auto uses.

The large amount of carbide lime across the site is most likely responsible for the elevated pH in the groundwater samples (pH of 12-13) in all three wells. Elevated petroleum related VOCs detected in MW-01 located along the east perimeter of the site is most likely related to the junk yard operations immediately to the east of the well or possibly past site related activities as described above. It is probable that over time petroleum related compounds associated with the junked autos and parts has seeped into the soils and groundwater

## 4.3 Soil/Lime Sampling and Analytical Program

Sampling of soil, lime material and groundwater were completed during this RI.

Samples collected for this program were sent to Test America, a NYSDOH ELAP certified analytical laboratory. Samples were analyzed following the full Contract Laboratory Program (CLP), NYSDEC Analytical Services Protocol (ASP) Category B analytical data package deliverables format (10/95 edition). Samples were analyzed for VOCs, SVOCs, metals and PCBs in accordance with the approved work plan. The results were compared to recommended soil cleanup objectives contained in the NYSDEC Final Restricted Use Soil Cleanup Objectives (SCOs) as presented in 6 NYCRR Part 375-6.8 (b). Surface soil samples were not analyzed for TCL volatile compounds.

Analytical results were sent to Chemworld Environmental, Inc., a certified WBE firm to complete data validation. In accordance with the work plan, the data validation was limited to a review of the following criteria:

- Data completeness;
- Comparison of surrogate, spike, and duplicate recoveries to validation criteria;
- Blank contamination;
- 10% quantitation check that reported sample results are correct;
- Proper sample analysis; and,
- Holding times.

Chemworld provided a NYSDEC Data Usability Summary Report (DUSR) utilizing USEPA Region II and NYSDEC guidelines, as required and as stipulated in the project work plan. A copy of the DUSR is provided in Appendix C.

Analytical results from the soil/lime sampling program are summarized in Tables 2-4. The tables present a summary of the data and provide a comparison with the NYSDEC Final Restricted Use Soil Cleanup Objectives (SCOs) as presented in 6 NYCRR Part 375-6 Commercial and Industrial Soil Cleanup Objectives. At the bottom of each table is a separate table denoting the type of material sampled (lime, interface, soil etc.) for each sample. Parameters that exceeded commercial use SCOs are depicted in Figure 4. The complete set of laboratory analytical data is being kept on file at PEI's office. A compact disk containing lab data is contained in Appendix E

As described, both surface and subsurface soil/carbide lime samples were obtained from various locations across the site using a combination of trenching and borings. Soil/waste lime from each trench/boring was visually described and screened using an organic vapor analyzer (MiniRae with a 10.2 eV Lamp). Stratification of material in the trenches/borings and observations were noted on the trench and boring logs (refer to test pit and boring logs provided in Appendix B). At each test pit and boring the following was performed:

- The depth of the cover soil/fill/lime was recorded;
- Depth to bedrock, if encountered, was documented; and,
- General soil descriptions and other observations were recorded.

Photographs of field activities are contained in Appendix D. Prior to conducting the subsurface investigation, all utilities were located and areas identified as noted above.

Each test trench was backfilled and compacted prior to moving to the next in accordance with the project work plan.

A total of four surface soil samples were collected from test trenches and one surface sample of the carbide lime material from the south lime pile borings were collected for analysis. A total of 12 subsurface soil/carbide lime samples were collected from test trenches and borings (refer to Figure 4 for sample locations). Surface soil samples were collected from the upper two inches below the surface either prior to advancing the trench or from the sides of the trench. The carbide lime sample was collected below the top 2 inches from the boring auger. Subsurface soil samples were collected from the fill layer based on visual observations. At only one location were above background readings observed on the PID.

One subsurface carbide lime sample (PEI-TP-1 1L) was collected from test trench PEI-TP-11 and one surface carbide lime sample (PEI-BH-04A) from PEI-BH-04. The analytical results for the carbide lime samples are discussed below and have been included in Table 6-Historic Lime Pile Analytical Results to compare with carbide lime sampling analytical results from previous investigation programs. No contaminants of concern were detected in samples collected from the carbide lime piles, but trace levels of silver and acetone were detected in the carbide lime. See below for further discussion.

## Volatile Organic Compounds

VOC compounds methylene chloride and acetone were detected in most subsurface test trench and boring samples at concentrations well below Part 375 soil cleanup objectives. Both of these compounds, methylene chloride and acetone, are common laboratory contaminants and may not be indicative of these compounds in the soil. However, acetone was used in the acetylene bottling process, and tanks and permits for acetone storage are note in the Phase 1ESI. The acetone revealed at the site may have been a result of the documented acetone usage at the site. Nominal levels of acetone found above unrestricted use SCGs were contained in soils below the carbide lime pile and in the carbide lime material.

Several petroleum related compounds were detected in Test Trench 3 sample PEI-TP-03B. This test trench was located just west of the eastern property line and north of the southern carbide lime pile. The sample was collected at the soil/carbide lime interface and where a PID reading of 7.5 ppm was noted. This was the only location where a PID reading was noted above background in any of the test trenches or borings. The concentration levels detected in this sample, however, were well below Part 375 soil cleanup objectives. Only one other VOC (2-Butanone) was detected in several samples from both the test trenches and borings in the soil fill layer at concentrations well below Part 375 soil cleanup objectives (refer to Table 2 and 4).

## Semi-Volatile Organic Compounds

Numerous SVOCs consisting primarily of PAHs were detected in both surface and subsurface soil/fill samples (refer to Table’s 2-4). PAHs, as well as metals, are not, in general, very mobile in soils and have low solubility's with water and tend to adsorb to the soil grains. These compounds do not readily breakdown in the environment. PAHs deposited from the historical combustion of coal or other fuels will most likely still be present in soils today. Based on their low volatility and their association with soil, the primary concern for potential human exposure to PAHs includes inhalation, ingestion and dermal contact.

Analytical results from the surface soil samples indicated the presence of several PAHs at concentrations that slightly exceeded Part 375 commercial and/or industrial soil cleanup objectives (refer to Table 3). PAHs were also detected in the boring and test trench subsurface samples at concentrations, in general, well below Part 375 commercial and industrial soil cleanup objectives. As described above, PAH compounds are common constituents of fill material in urban and industrial environments. These compounds are also typically elevated in urban and industrial areas due to the long history of fossil fuel burning.

Five PAH compounds were detected in the four surface soil/fill samples at concentrations that exceeded Part 375 Commercial and/or Industrial use soil cleanup objectives. The four surface soil samples were collected from non-lime covered areas in the north central section of the site where the historic acetylene gas manufacturing facility was located and from the debris pile area along the east perimeter of the site (refer to Figure 4). The samples were collected from primarily fill material at the surface that also contained C & D debris material. PAH exceedances in surface soil samples included:

- benzo(a)pyrene exceeded Part 375 Commercial (1 ppm) and Industrial (1.1 ppm) cleanup objective concentrations in surface soil samples PEI-TP-04A (14.0 ppm), PEI-TP-05A (6.3 ppm), PEI-TP-08A (9.0 ppm) and PEI-TP-09A (3.5 ppm);
- benzo(a)anthracene exceeded Part 375 Commercial use (5.6 ppm) and Industrial use (11 ppm) cleanup objectives concentrations in sample PEI-TP-04A (12.0 ppm) and exceeded Commercial use only in PEI-TP-5A (5.6 ppm) and PEI-TP-8A (9.2 ppm);
- benzo(b)fluoranthene exceeded Part 375 Commercial use (5.6 ppm) and Industrial use (11 ppm) cleanup objectives concentrations in sample PEI-TP-04A (15.0 ppm) and exceeded Commercial use only in sample PEI-TP-05A (7.7 ppm) and PEI-TP-08A (10.0 ppm);
- dibenzo(a,h)anthracene exceeded Part 375 Commercial use (0.56 ppm) and Industrial use (1.1 ppm) guidance concentrations in sample PEI-TP- 04A (2.3 ppm), PEI-TP-05A (1.2 ppm) and PEI-TP-08A (1.8 ppm) and exceeded Commercial use only in PEI-TP09A (0.72 ppm); and
- indeno(1,2,3-cd)pyrene exceeded Part 375 Commercial use guidance concentrations (5.6 ppm) in sample PEI-TP-04A (8.7 ppm) and PEI-TP-08A (5.8 ppm).

Only one PAH compound (benzo(a)pyrene) was detected in a subsurface sample that exceeded Part 375 Commercial use (1.0 ppm) and Industrial use (1.1 ppm) cleanup objectives concentrations. Soil sample PEI-TP-03B collected at 2 feet bgs had a concentration of 3.0 ppm (refer to Table 2).

A number of other SVOCs were detected at concentrations significantly below their Part 375 Commercial use and/or Industrial use SCOs (refer to Table's 2-4). Contaminants in soil exceeding commercial use SCOs are depicted in Figure 4.

**PCBs**

Only one PCB compound (Aroclor 1242) was detected in two test trench subsurface soil samples (PEI-TP-03B and PEI-TP-05B). The Aroclor 1242 concentration exceeded Part 375 Commercial use (1 ppm) cleanup objective in sample PEI-TP-03B (4.6 ppm) and the concentration in sample PEI-TP-05B was significantly below the Commercial use SCO. Sample PEI-TP-03B was collected from the test trench advanced between the south carbide lime pile and the easterly property line adjacent the junkyard. As noted under the VOC section above, this sample was collected from fill material that included C & D debris and also had a slightly elevated PID reading. The detection of elevated concentrations of PCBs in this trench sample is most likely due to the long time historic use of the adjacent property as a junk yard where various petroleum and oil related fluids that could contain PCBs may have been discharged to the adjacent soils. However, historic Sanborn maps also suggest that some of the previous facility support and process buildings may have been located in this area. It is possible that PCB containing equipment may have been located in this area. The EPA implemented a PCB cleanup at the site in the late 1990s. Possible sources may have been from the period when acetylene manufacturing occurred or when the site was operated as a metal/auto scrap facility by Sloan Auto. Contaminants in soil exceeding commercial use SCOs are depicted in Figure 4.

**Metals**

Metal compounds were detected in all of the surface and subsurface soil samples. The results indicate the presence of only one metal compound at a concentration that slightly exceeded Part 375 Commercial use SCOs. The concentration of lead exceeded Part 375 Commercial use (1,000 ppm) SCO in subsurface sample PEI-TP-03B (1,080 ppm). Contaminants in soil exceeding commercial use SCOs are depicted in Figure 4.

Most metals are naturally present in soil and fill materials. Concentrations of metals in soil and fill exhibit considerable variability, both stratigraphically and spatially. This variability is related to the composition of the fill, natural soils' origin, weathering processes that chemically and physically modify soil and, groundwater interactions that modify the geochemistry.

Silver was found in the carbide lime nominally above the unrestricted use SCG and appears that silver may have been a naturally occurring element in the raw material for the carbide lime.

## 4.4 Groundwater Sampling and Analytical Program

Groundwater samples were collected in accordance with the approved work plan. One groundwater sample was collected from each of the three wells along with a duplicate sample from MW-01 (PEI-MW-01D) All samples were submitted to Test America, a

NYSDEC certified contract laboratory, and analyzed for TAL metals, TCL VOCs and SVOCs, and PCBs.

Compounds detected in groundwater samples are summarized in Table 5 and discussed in detail below. Parameters exceeding ambient NYSDEC water quality standards are presented in Figure 3. The table also provides a comparison of the analytical results with NYSDEC TOGs 1.1.1 GA Groundwater Regulations. Complete analytical results are provided in Appendix E.

**pH**

pH was measured in the field at the time of sampling using an YSI 556 MPS instrument. High pH readings were detected in each well as follows: 12.96 in MW-01; 13.05 in MW-02 and 13.14 in MW-03. NYSDEC TOGS 1.1.1 standards call for the pH of groundwater to be between 6.5 and 8.5. The elevated readings most probably are associated with releases from carbide lime material on site which has a pH value of 12-13.

**Volatile Organic Compounds**

A number of VOCs were detected in groundwater samples collected from the wells. Acetone was detected in all three samples and at elevated concentrations above the TOGS standard of 50 ppb. The sample from monitoring well MW-02 had a reported concentration of 190 ppb and the sample from MW-03 was 350 ppb. Acetone is known as common laboratories contaminate, however, it was not detected in the blank QA/QC sample and the fairly high concentrations of acetone detected in MW-02 and MW-03 likely indicates that acetone is present in the groundwater at these locations as acetone was used in the acetylene bottling process.

Several petroleum related VOCs were detected at elevated concentrations above TOGS standards in the sample from monitoring well MW-01.These included:

- Benzene at a concentration of 28 ppb (TOGS 1 ppb);
- Ethylbenzene at a concentration of 9.8 ppb (TOGS 5 ppb);
- Xylenes, total at a concentration of 88 ppb (TOGS 5 ppb);
- Methyl tert-Butyl Ether at a concentration of 32 ppb (TOGS 10 ppb); and
- Toluene at a concentration of 74 ppb (TOGS 5 ppb).

None of these VOCs were detected in either of the other monitoring well samples. The only other VOC detected other than acetone in MW-02 and MW-03 was 2-butanone in MW-03 for which there is no TOGS standard.

Monitoring well MW-01 is located in the south east portion of the site, east and adjacent to the southern waste lime pile and along the property border with the auto junk yard (refer to Figure 3). Since MW-02 and MW-03 appear to be down gradient from MW-01 the petroleum related contaminates detected in MW-01 appears to be localized and have not migrated down gradient. Similar related petroleum VOCs were also detected in a subsurface soil sample (PEI-TP-03B) from test trench PEI-TP-03 located adjacent MW-01.The detection of petroleum related compounds in both the soil and groundwater in this area is most likely due to the influence of the long historic use of the adjacent property to the east as a junk yard. Until recently, before the property line fence was installed, junked vehicles, parts and other debris were stored on portions of the site up to the toe of the southern waste lime pile. Additionally, former site structures/processes may have been located in this portion of the site.

**Semi-Volatile Organic Compounds**

With one exception, several SVOCs were detected in monitoring wells MW-02 and MW-03 groundwater samples at concentrations below TOGS standard. Phenol (TOGS 1 ppb) was detected in monitoring well MW-02 sample at 17 ppb and MW-03 at 44 ppb. No SVOCs were detected in the MW-01 sample. Parameters exceeding ambient NYSDEC water quality standards are presented in Figure 3.

**PCBs**

No PCBs were detected in any of the groundwater samples.

**Metals**

A number of metals were detected in each of the groundwater samples. However, only three metal compounds were detected at concentrations that exceeded TOGs standards as follows:

- Aluminum exceeded TOGS (2,000 ppb) in the sample from monitoring well MW-01 with a concentration of 4,940 ppb, in the MW-02 sample with a concentration of 8570 ppb and in the MW-03 sample with a concentration of 2,570 ppb;
- Iron exceeded TOGS (600 ppb) in the MW-01 sample with a concentration of 4480 ppb, in the MW-02 sample with a concentration of 5,740 ppb and in the MW-03 sample with a concentration of 1,670 ppb; and
- Sodium exceeded TOGS (20,000 ppb) in the monitoring well MW-01 with a sample concentration of 26,900 ppb, in the sample from MW-02 with a concentration of 40,200 ppb and in the sample from MW-03 with a concentration of 83,600 ppb.

The detection of a number of metal compounds in the groundwater, similar to that found in the site soil samples, is most likely the result of the significant metal debris found in the fill across the site. Additionally, past uses on the site as well as some of the adjacent property uses (landfills, junk yards, metal machining and tooling) as well as natural conditions may have contributed to groundwater metal concentrations. Parameters exceeding ambient NYSDEC water quality standards are presented in Figure 3.

# 5.0 CONTAMINANT FATE AND TRANSPORT

The migration of chemical constituents through various media is governed by the physical and chemical properties of the detected chemicals and the surface and subsurface media through which the chemicals are transferred. In a general way, chemical constituents and structures with similar physical and chemical characteristics will show similar patterns of transformation, transport, or attenuation in the environment. Solubility, vapor pressure data, chemical partitioning coefficients, degradation rates, and Henry's Law Constant provide information that can be used to evaluate specific contaminant mobility in the environment. Partitioning coefficients are used to assess the relative affinities of compounds for solution or solid phase adsorption. However, the synergistic effects of multiple migrating compounds and the complexity of soil/water interactions, including pH and oxidation- reduction potential (Eh), grain size, and clay mineral variability, are typically unknown.

The results of the remedial investigation indicate that the primary potential physical characteristics and contaminants of concern (COC) in the site environment include the following:

- The significant amount of carbide lime material both above and below the surface of the site with a high pH value (12-13) which is effecting the pH in soil, groundwater and surface water runoff;
- Low levels of chemical compounds including metals, VOCs, SVOCs in soils beneath the carbide lime piles;
- Elevated petroleum related VOC and SVOC compounds detected in the groundwater below a portion of the site (MW-01); and
- Elevated pH in local groundwater samples (13 +/-) across the site.

Organic Compounds – VOC and SVOC compounds may be transformed or degraded in the environment by various processes, including hydrolysis, oxidation/reduction, photolysis, volatilization, biodegradation, or biotransformation. The half-life (time required to naturally reduce chemical concentration by one-half) of organic compounds in various media can vary from minutes to years, depending on environmental conditions and the chemical structures of the compounds. Organic degradation may either enhance (through the production of more toxic byproducts) or reduce (through concentration reduction) the toxicity of a chemical in the environment.

Petroleum and petroleum products are highly complex and varied mixtures. Hydrocarbons (compounds containing only carbon and hydrogen atoms) compose the majority of the components in petroleum. When petroleum compounds are released into the environment, the compounds undergo physical, chemical, and biological changes collectively referred to as weathering. The degree to which various types of petroleum hydrocarbons degrade under these changes depends on the physical and chemical properties of the hydrocarbons.

Crude oil weathering processes include adsorption of hydrocarbons to soil particles, volatilization of hydrocarbons, and dissolution of hydrocarbons in water. Most of the petroleum does not dissolve in water. Aromatic hydrocarbons, especially BTEX, tend to be the most water-soluble fraction of petroleum compounds. Benzene (10 times more soluble than ethylbenzene or xylenes) is the most water soluble of the BTEX compounds. BTEX compounds also are the most volatile of the aromatic compounds and are considered to be VOCs. BTEX compounds have the lowest soil organic carbon sorption coefficients (Koc) of the most common aromatic hydrocarbons. Koc is the ratio of the amount of a compound sorbed to the organic matter component of soil or sediment to the amount of the compound in the aqueous phase at equilibrium, and has been used as one variable in predicting the mobility of a compound from soil to ground water. Benzene (Koc of 59) is considered to be highly mobile in soil, toluene (Koc of 182) is considered to be moderate to highly mobile in soil, and xylenes (Koc of 363 to 407) are considered to be moderately mobile in soil (U.S. Environmental Protection Agency, 1995). Benzene often is the main groundwater contaminant of concern at petroleum release sites because of its high toxicity and mobility (as compared to other petroleum hydrocarbons).

Biodegradation is a major weathering process of petroleum in the environment and an important natural attenuation process. Rates of biodegradation vary with different microbial populations, hydrocarbons, and geochemical and hydrological conditions present in the subsurface. Nearly all soils and sediments have populations of bacteria and other organisms capable of degrading petroleum hydrocarbons.

Most PAHs, because of their low volatility, are classified as SVOCs. In general, PAHs do not easily dissolve in water and are more likely to partition into sediments and soils rather than into ground water because of their low solubility and high Kocs. As a result, transport of PAHs tends to be associated primarily with erosion of contaminated soils and sediments. PAHs sorbed to sediments may potentially affect aquatic communities downstream of contaminated sites.

<u>pH</u> - The high pH may affect absorption rates, biodegradation rates and other factors that influence the fate and transport of the site contaminants.

<u>Metals</u> - A number of metal compounds were also detected in the soils but, in general, did not exceed Part 375 soil cleanup requirements. Metals are ubiquitous inorganic constituents in soil, sediment and ground and surface water. The transport of these materials from unsaturated soils to the underlying groundwater is controlled by the physical processes of precipitation infiltration, chemical interaction with the soil, and downward transport of removed metal ions by continued infiltration. The additional physical mechanism of erosive transport is important for surface soil and sediment dispersal into surface water bodies. The chemistry of inorganic interaction with percolating precipitation and varying soil conditions is complex and includes numerous chemical transformations that may result in altered oxidation states, ion exchange, adsorption, precipitation, or complexation. The chemical reactions, which are affected by environmental conditions including pH, oxidation/reduction conditions, and the type and amount of organic matter, clay, and the presence of hydrous oxides, may act to enhance or reduce the mobility and toxicity of the metal ions. In general, these reactions are reversible and add to the variability commonly observed in distributions of inorganics in soil and sediment.

The primary potential routes of migration of COCs include surface water runoff, groundwater movement, leaching and airborne fugitive dust/volatilization. Each of these routes of migration as they relate to the site COCs are discussed below.

**Surface Water Runoff**

Carbide lime pile erosion due to surface water runoff has historically occurred and will continue to be a concern as a migration pathway until the lime piles are removed. Carbide lime material from the carbide lime piles has been carried off site by runoff/erosion beyond the north, west and south property limits where the toe of both the north and south lime piles extends to the site property line in many locations. Carbide lime material is evident at the surface in several areas outside the site property boundary. An interim remedial measure (IRM) to control stormwater runoff from the site was implemented in 2012. The IRM involved the construction of a stormwater detention pond. Stormwater runoff from the lime piles is intercepted via constructed swales and detained in the detention pond that allows the lime sediment to settle and normalize the pH of the water.

**Leaching and Groundwater Movement**

As noted previously, based on groundwater monitoring well water levels and regional information, groundwater appears to flow from the southeast to the northwest. Nearby landfills may alter groundwater direction possibly due to groundwater mounding effects near the landfills. Groundwater is also fairly shallow with groundwater depth in MW-01 at 4.2 feet bgs, in MW-02 at 3.2 feet bgs and in MW-03 at 1.4 feet bgs. In most areas the groundwater level appears to be within the site fill material that encompasses C & D debris and the subsurface waste lime material. Several chemical compounds detected in the fill/carbide lime material are also present in the groundwater most likely caused by infiltration, not precipitation and leaching from the fill/carbide lime material. Groundwater flow across the site is a potential migration pathway.

**Airborne Fugitive Dust/Volatilization**

Carbide lime material prevalent across the site and non-volatile chemical compounds present in the soil/fill can be released to the ambient air as a result of fugitive dust generation. This migration pathway will become even more relevant when the carbide lime or soil is disturbed such as when the carbide lime piles are removed at some time in the future and if any future site development requires excavation of the site fill material.

Also, volatile chemicals present in the groundwater and soil maybe released to the ambient air during potential future site development that may disturb site soils and/ or groundwater. In-door air could also be affected if future building development occurs over the existing soils/fill material.

# 6.0 QUALITATIVE EXPOSURE ASSESSMENT

A qualitative exposure assessment consists of characterizing the exposure setting, physical environment and exposure pathways and their potential effect on human and ecological receptors. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements:

1) a contaminant source;
2) contaminant release and transport mechanisms;
3) a point of exposure;
4) a route of exposure; and
5) a receptor population.

## 6.1 Public Exposure Assessment

The identification of potential human receptors is based on the physical characterization of the site, potential future land uses and surrounding land use. The site is presently vacant with no buildings or structures and no commercial/industrial operations exist at the site. There is no open public access to the site; however, the site is not fenced, so trespass can occur. The site is surrounded by railroad tracks and open land to the west and southwest; wetlands and industrial building to the north and a small industrial/commercial building and a junk yard to the east. The nearest population center is a residential neighborhood located across Hopkins Road to the east several hundred feet from the site. At this time there is no identified or planned development for the site. However, recent area planning discussions have included potential site use for commercial or recreational (golf course) uses.

An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. The exposure pathway for this site is a follows:

- Contaminant Source – surface and near-surface carbide lime with high pH; surface soil with relatively low levels of elevated metal and SVOC (mainly PAHs) compounds; subsurface soil with relatively low levels of metals, SVOC (mainly PAHs) and some VOCs (mostly petroleum-related compounds); surface water/sediment with the potential for carbide lime with high pH; and groundwater with relatively low levels of elevated metals and VOC compounds in specific locations;
- Contaminant release – contaminants have the potential for release to surface soils, surface water and groundwater via groundwater migration and re-charge, stormwater, and air particulate transport;
- Point and route of exposure – involves contact, ingestion or inhalation of lime,

soil, surface or groundwater impacted by site contaminants; and,

- Receptor population – under the current un-remediated site conditions direct human contact with site soils or the carbide lime piles is minimal and restricted to possible trespassers on the site which could include adults and youth. During remediation, the receptor population would potentially include remediation workers and off-site population (adjacent property workers and/or nearby residential population) from potential increased off-site migration due to site disturbances. After remediation, the receptor population would include construction workers, maintenance workers and general public if the end use is recreational.

Upon completion of site remediation with the anticipated removal of the site carbide lime material and possibly surface-near-surface materials/fill, the site would be available for commercial/industrial and or recreational use development. As stated, at this time there is no identified or planned development for the site. However, recent area planning discussions have included potential site use for commercial or recreational (golf course) uses. Each would result in different potential exposure pathways. These exposures could result from fugitive dust and volatilization from construction excavation and other soil disturbances. Also, surface water runoff and groundwater exposure could result in dermal contact of contaminants in this media.

Human exposure related to these potential uses would include:

- Potential exposure to site workers involved with the remediation of the site;
- Potential exposure to maintenance workers for either the commercial or recreational uses;
- Potential exposure to future utility installation and maintenance workers; and,
- Potential exposure to the public users of a recreational facility.

Potential exposure routes to on-site workers and the public would potentially include:

- Dermal contact with site soils or lime material;
- Ingestion of site soil particles; and,
- Inhalation of dust containing site soil or lime particles.

Exposure potential would be highest during active remediation or maintenance activities when site soils are disturbed.

As noted in the previous section, identified migration pathways have resulted in some contaminants leaving the site boundaries by the routes of surface erosion runoff and possible fugitive dust. There is the possibility of workers from adjacent business operations (railroad, junkyard, industrial facilities) coming in contact with, in particular, the carbide lime material and possibly site fill material as well as groundwater if any excavation work has transpired on these adjacent properties.

## 6.2 Ecological Exposure Assessment

At present, there are no buildings on site and the site is vacant and unoccupied. The site classification for future development will be limited to commercial development.

The site provides little or no wildlife habitat of note or pond/water features. There is very little vegetation except along the site perimeters where scrub bushes and grasses exist that could be used by bird life or small mammals. The runoff from the carbide lime piles and possible blowing lime dust during dry seasons could affect animal and or bird life in these areas. The open areas and fringe brush and wetland areas associated with the adjoining landfill sites, and fallow industrial land offer habitat to a number of mammal species in the area, including deer, turkey, geese, duck, fox, coyotes, woodchuck, muskrat and other smaller species of mammals. Small notable populations of these mammals are thriving in these areas as they offer a protected urban refuge.

There are extensive wetlands just to the north of the site that could be affected by carbide lime pile runoff. Also, high pH groundwater from the site may feed the wetlands. As noted the groundwater at the site is shallow and flows in the northerly direction towards the wetlands.

As noted in Section 4.4, groundwater analytical results for MW-01 indicated the presence of elevated concentrations of several petroleum related compounds that, for the present, are localized to the area of this well and have not been detected in the northern monitoring wells. These contaminants may remain localized in the future, however, they also could flow over time to the north and possibly influence the wetlands north of the site.

# 7.0 REMEDIAL ALTERNATIVES ANLYSIS

## 7.1 Introduction

This Alternatives Analysis Report (AAR) presents details of the remedial alternative assessment and is part of the Remedial Investigation/Alternatives Analysis Report (RI/AAR) for the 90 Hopkins Street Site (Site # 915181). The purpose of this AAR is to evaluate remedial alternatives needed to address the concerns at the property identified during the RI stage. These concerns include a large quantity of stockpiled carbide lime material located at the property as well as impacts to soil and groundwater which were investigated and assessed during the RI stage. The RI data and site information were used to develop and screen alternatives. Potential remedial action alternatives have been developed that may be used to remediate the property and mitigate any off-site impacts. These alternatives also include alternatives that incorporate a beneficial re-use of the carbide lime material.

The process of evaluating the alternatives and the remedial action selection considered the following main aspects of the project:

- The results of the remedial investigation completed in 2010 and summarized in the Site Investigation RI report dated October 2010;
- The proposed future use of the site for commercial purposes;
- Possible beneficial uses for the site carbide lime material that is currently stockpiled at the property; and,
- Praxair's pilot scale lime removal project that is currently being completed at the Site regarding beneficial use of the carbide lime for agricultural purposes.

This AAR was completed in accordance with the following NYSDEC documents:

- NYSDEC "DER-10 Technical Guidance for Site Investigation and Remediation (DER-10)," dated May 3, 2010;
- Title 6 of the New York Code of Rule and regulations (6 NYCRR) Part 375 Dated December 14, 2006; and,
- NYSDEC DER-31 Green Remediation, dated August 11, 2010, revised January, 20, 2011.

## 7.2 Remedial Action Objectives

Remedial goals and Remedial Action Objectives (RAOs) have been developed for the site based on the investigation findings provide in the RI and the future use of the property. RAOs are site-specific statements that convey the goals for minimizing or eliminating substantial risks to public health and the environment. The goal of the remedial selection process is to select a remedy for a site that is fully protective of public health and the environment, taking into account the current and/or intended and reasonably anticipated future land use of the property. The New York State Brownfields Program divides the remedial actions into Cleanup Tracks. Each cleanup track can result in a remedy that is protective of public health and the environment, but the remedy for each track will differ in respect to the specifics of the cleanup, restrictions on future site use, and the application of controls. The future use for this site is anticipated to be commercial and the RAOs are designed for commercial re-use.

Appropriate RAOs for the 90 Hopkins Street Site are:

- Removal of the on-site carbide lime material for beneficial reuse and/or dispose of the material at an off-site landfill. The purpose is to prevent future off-site release of lime material, normalize the elevated pH of surface water runoff and groundwater by removing this source and allow for future site development.

- Remediate the site to prevent the ingestion or direct contact with carbide lime and soil/fill that contains contaminates of concern above Part 375 Commercial Use SCOs; and,
- Prevent ingestion of or direct contact with groundwater containing concentrations of contaminants of concern above TOGs groundwater standards.

Standards, criteria and guidance (SCGs) are promulgated (“standards” and “criteria”) and non-promulgated guidelines (“guidance”) that govern the investigation and remediation of a site. SCGs incorporate both the concept of applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) category of non-enforceable criteria or guidance, consistent with United States Environmental Protection Agency (USEPA) remediation programs.

The SCGs for soil at Brownfield sites are the numerical soil cleanup objectives presented in Part 375. For this site, the RAOs are found under restricted use criteria and the criteria for protection of the nearby surface water, groundwater and ecological resources. Commercial/industrial use is appropriate for the site based on current land use and surrounding land use as described in the South Buffalo Brownfields Opportunity Area (BOA). As such the soil cleanup objective for the Hopkins site will meet NYSDEC Part 375regulations for commercial use.

## 7.3 Remedial Selection Process

The following is a detailed description of the alternatives analysis and remedy selection process.

### 7.3.1 Identification of Remedial Technologies

Remedial technologies specific to the environmental impacts at the site were identified and reviewed for potential applicability. The need to prevent continued impacts to adjacent wetlands and the potential for beneficial reuse of the carbide lime focused the potential remedial technologies. The no-action alternative was not determined applicable due to the impacts to surface water runoff from the carbide lime piles. The following remedial technologies were identified and reviewed for potential applicability at the Site:

- Excavation and Offsite Disposal including Beneficial Use of the carbide lime;
- Onsite Lime Processing and Offsite Beneficial Use; and,
- Onsite Containment and Covering.

Each of the above technologies is discussed in the following sections.

**Excavation and Offsite Disposal**

This technology would entail excavating the carbide lime material from across the site. Excavated lime material would be disposed off-site either in a landfill or for beneficial use as discussed in section 4.5. Impacted soil/fill (non-lime) material may also be excavated for offsite disposal to contaminant levels meet Part 375 commercial use criteria for the site.

The volume and depth of impacted soil/fill material to be removed depends on the soil criteria applicable to the future use as defined in Part 375. This is assumed to be commercial use criteria. Backfill areas will be graded to promote drainage and prevent ponding of water. Erosion control measures will be implemented to control surface water runoff during the work to protect the adjacent wetlands.

**Onsite Lime Processing and Offsite Beneficial Use**

This technology would include lime process handling systems such as an onsite liquefaction system to add water to the lime to create lime slurry for off-site use in process/treatment systems such as a solid waste incinerator/waste to energy process facility. Another option for lime processing for beneficial use may include an on-site lime drying system to dry the lime for beneficial agricultural purposes (Refer to Section 4.5 for beneficial use determination alternatives). Stormwater and erosion control best management practices would apply during these activities.

**Onsite Containment/Covering**

Covering technologies are widely used for some of the impacts associated with this site. This involves two potential alternatives as follows:

- Containment of the entire site, including the lime areas and impacted non-lime areas; and,
- Removal of lime off-site and containment/covering of impacted non-lime fill areas.

This technology would include covering the lime material with a clean fill cover system meeting commercial use criteria to prevent stormwater infiltration into the lime and impacted soil/fill and prevent erosion off-site and runoff of lime and impacted soil sediment. Containment measures may also include the diversion of groundwater around the site with the use of vertical hydraulic barriers along with possible groundwater interception and treatment. Vertical hydraulic barriers may consist of steel sheet piling, slurry walls that are underground structural or non-structural barriers constructed to impede the flow of groundwater. Soil-bentonite slurry or cement-bentonite slurry are the most common excavation fluids used in a slurry barrier wall. Sheet pile walls consist of driving prefabricated interlocking steel sheeting into the ground using standard installation techniques and equipment and the seams are sealed using available equipment to create a water-tight barrier.

A variation of the covering alternative would involve removal of the lime material and capping the remainder of the impacted site fill with clean fill to prevent contact with the site fill material impacted with low contaminant levels as appropriate for commercial use of the site(refer to 4.1.1).

This technology, covering of the lime material, was not considered further because it would not remove a major contaminant of concern and would limit the future development of the site. However, covering of remaining impacted site fill/soil is considered as part of the remedial action objectives.

### 7.3.2 Remedial Alternative Evaluation Criteria

The evaluation of alternatives is based on the following nine evaluation criteria presented in Part 375 Section 1.8(f):

- Overall protection of public health and the environment;
- Standards, criteria, and guidance;
- Long term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contamination through treatment;
- Short term impacts and effectiveness;
- Implementability;
- Cost;
- Community acceptance; and,
- Land use, provided the NYSDEC determines that there is reasonable certainty associated with such use.

Each of the criteria is described below based on definitions presented in Part 375 Section 1.8(f) or from Section 4.2 of the DER-10, where definitions are not provided in Part 375.

**Overall Protection of Public Health and the Environment -** This criterion is an evaluation of the remedy's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced, or controlled through removal, treatment, engineering controls, or institutional controls.

**Standards, Criteria and Guidance (SCGs) -** Compliance with SCGs addresses whether a remedy will meet applicable environmental laws, regulations, standards, and guidance.

**Long Term Effectiveness and Permanence -** This criterion evaluates the long term effectiveness of the remedy after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: the magnitude of the remaining risks i.e., will there be any significant threats, exposure pathways, or risks to the community and environment from the remaining wastes or treated residuals; the adequacy of the engineering and institutional controls intended to limit the risk; the reliability of these controls; and, the ability of the remedy to continue to meet RAOs in the future.

**Reduction in Toxicity, Mobility or Volume of Contamination through Treatment -** This criterion evaluates the remedy's ability to reduce the toxicity, mobility, or volume of Site contamination. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

**Short Term Impacts and Effectiveness -** Short-term effectiveness is an evaluation of the potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during construction and/or implementation. This includes a discussion of how the identified adverse impacts and health risks to the community or workers at the Site will be controlled, and the effectiveness of the controls. This criterion also includes a discussion of engineering controls that will be used to mitigate short term impacts (i.e., dust control measures), and an estimate of the length of time needed to achieve the remedial objectives.

**Implementability -** The implementability criterion evaluates the technical and administrative feasibility of implementing the remedy. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

**Cost -** Capital, operation, maintenance, and monitoring costs are estimated for the remedy and presented on a present worth basis.

**Community Acceptance** - This criterion evaluates the public's comments, concerns, and overall perception of the remedy.

### 7.3.3 Land Use Evaluation

In developing and screening remedial alternatives, NYSDEC's Part 375 regulations require that the reasonableness of the anticipated future land use be factored into the evaluation. According to Part 375 the use of the site shall be for either unrestricted or restricted use. Unrestricted use is a use without imposed restrictions, such as, environmental easements or other land use controls. Restricted use is a use with imposed restrictions, such as, environmental easements as part of the remedy with a site management plan which relies on institutional or engineering controls to manage exposure to contamination remaining at the site. There are 16 criteria that are considered including:

- Current use and historical and/or recent development patterns;
- Applicable zoning laws and maps;
- Brownfield opportunity areas;
- Applicable comprehensive community master plans, local waterfront revitalization plans or other formally adopted community/municipal plan;
- Proximity to real property currently used for residential use, and to urban, commercial, industrial, agricultural, and recreational areas;
- Written or oral comments by the public pursuant to the citizens participation plan;
- Environmental justice concerns;
- Federal or state land use designations;
- Population growth patterns and projections;
- Accessibility to existing infrastructure;
- Proximity to important cultural resources;
- Natural resources, including proximity to waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species;
- Potential vulnerability of groundwater to contamination that might emanate from the site;
- Proximity to flood plains;
- Geography and geology; and,
- Current institutional controls applicable to the site.

These 16 criteria are addressed in the City South Buffalo Brownfields BOA and other recent master plans.

The anticipated future land use for the 90 Hopkins Street site is commercial use as indicated in current zoning and area plans (i.e., see South Buffalo Brownfield Opportunity Area documents). The area surrounding the site is a mixture of commercial, industrial and residential. The remedy selected will comply with all of the requirements for the commercial use category under Part 375 requirements.

### 7.3.4 Identification of Remedial Alternatives

For the 90 Hopkins Street Site, a number of remedial alternatives were reviewed. These included standard alternatives and those associated with beneficial reuse of the lime material. The following is a list of remedial alternatives identified for the 90 Hopkins Street site:

Alternative 1 – No action;

Alternative 2 – Restoration to Pre-Disposal or Unrestricted Site Conditions;

Alternative 3 – Carbide Lime/Fill Material Excavation with Off-site Disposal at an Operating Landfill

Alternative 4 –Carbide Lime/Fill Material Excavation with Off-site Disposal at the Marilla St. Landfill; and,

Alternative 5 – Carbide Lime for Off-site Beneficial Reuse and Impacted Soil/Fill Excavation/Off-site Disposal at an Operation Landfill.

The following sections provide a description and detailed evaluation of these five remedial alternatives.

## 7.4 Alternatives Evaluation

### 7.4.1 Alternative 1 - No Action

**Description**

Under this alternative, the Site would remain in its current state, with no additional controls in-place.

**Evaluation**

**Overall Protection of Public Health and the Environment –** The alternative is not protective of human health and the environment and does not meet the remedial action objectives. Specifically, this alternative does not reduce or eliminate impacts to groundwater and surface water (adjacent wetlands) caused by the lime or low levels of site soil/fill contaminants. No action will also result in the absence of institutional controls which will prevent future site use. Accordingly, no further action is not protective of public health and does not satisfy the RAOs.

**Compliance with SCGs** – The no action alternative does not meet numerous local and state SCGs especially those related to groundwater and surface water and those effecting wetland ecology nor does it meet even the least stringent Part 375 Commercial or Industrial Use category SCOs.

**Long-Term Effectiveness and Permanence –** The no action alternative does not provide long-term effectiveness or performance toward achieving the RAOs.

**Reduction of Toxicity, Mobility, or Volume with Treatment –** The no action alternative does not reduce toxicity, mobility or volume of the contaminants of concern.

**Short-Term Effectiveness –** The **"**no action" alternative would create no additional short-term adverse impacts and risks to the community, workers, or the environment attributable to implementation of the no action alternative. Adverse impacts to the community and the environment will continue to exist by leaving the site in its current condition.

**Implementability –** No technical or administrative implementability issues are associated with the "no action" alternative.

**Cost** –There would be no capital or long-term operation, maintenance, or monitoring costs associated with the "no action" alternative.

**Community Acceptance –** Community acceptance is currently unknown until a "no action" remedy is presented to the public.

### 7.4.2 Alternative 2 – Restoration to Pre-Disposal or Unrestricted Use Condition

**Description**

A Pre-Disposal Condition-Unrestricted Use alternative would necessitate removal of the carbide lime and impacted soil/fill material with contaminant concentrations that exceed the Unrestricted SCOs per 6NYCRR Part 375 Tables 8a through 8d. For Unrestricted Use scenarios, excavation and off-site disposal of carbide lime and impacted soil/fill is generally regarded as the most applicable remedial measure, because institutional controls cannot be used to supplement the remedy. Therefore, the Unrestricted Use alternative assumes that those areas which exceed Unrestricted Use SCOs would be excavated and disposed at an off-site commercial solid waste landfill.

To meet unrestricted use SCOs, the carbide lime material would be removed as in Alternatives 3, 4 and 5 along with all impacted soil/fill material that does not meet Part 375 unrestricted use SCOs. To meet this requirement, an approximately 5 +/- feet of additional impacted soil/fill material would need to be excavated from the non-lime areas below the one foot removal required to meet Part 375 commercial use requirements. This would result in the removal of an approximate additional 15,000 CY of impacted soil/fill. An additional 4,000 cubic yards (cy) of slightly impacted fill from the soil/fill material removed to access the buried lime layer extending from the toe of the lime piles would also have to be removed offsite. In alternatives 3 and 4 this approximate 4,000 cy of impacted soil/fill was assumed to meet Part 375 commercial use criteria and would be used as backfill on site. These two quantities total 19,000 cy. An approximate additional 19,000 CY of clean fill would also be required to fill the additional excavation to grade level to promote positive drainage and prevent ponding. The amount of clean fill required to prevent ponding and promote drainage of stormwater would be 73,700 +/- CY. Volume estimates are contained in Appendix F.

With the excavation of the carbide lime material and all impacted soil/fill, potential source areas of groundwater contamination will have been removed. This alternative assumes that, with the complete removal of source material, groundwater exceedances will be reduced by natural attenuation and that no groundwater remediation or long-term monitoring would be required.

## Schedule

The total volume of lime and soil/fill material estimated to be removed to a landfill, based on the above, is 143,900 cubic yards. Using a 1.3 conversion factor for converting cubic yards to tons the total tonnage to be removed is estimated to be 187,070 tons. Assuming a maximum of 1,000 tons per day could be excavated and transferred to a Niagara Falls landfill, it would take approximately 11 to 12 months to remove all of the lime and impacted soil fill material, with an estimated total time of 14 to 15 months to complete the entire remediation.

## Evaluation

**Overall Protection of Public Health and the Environment –** The Unrestricted Use alternative would achieve the corresponding Part 375 SCOs, which are designed to be protective of human health and the environment under any reuse scenario.

**Compliance with SCGs** – With the removal of the lime material, debris pile and all of the impacted soil/fill, this alternative is fully protective of human health and the environment and successfully achieves all RAOs for the Site.

**Long-Term Effectiveness and Permanence –** The Unrestricted Use alternative would achieve removal of all residual impacted soil/fill; therefore, no soil/fill exceeding the Unrestricted SCOs would remain on the Site. As such, the Unrestricted Use alternative would provide long-term effectiveness and permanence. Post-remedial monitoring and certifications would not be required.

**Reduction of Toxicity, Mobility, or Volume with Treatment –** Through removal of all lime and impacted soil/fill material, the Unrestricted Use alternative would permanently and significantly reduce the toxicity, mobility, and volume of Site contamination.

**Short-Term Effectiveness –** There will be short term impacts in implementing this alternative. During the remedial action, there will be some exposure to the community and workers during excavation and transporting of the lime and soil materials. To mitigate these effects, a health and safety plan will be required along with a Community Air Monitoring Program and/or possibly a Community and Environmental Response Plan (CERP) during all remedial activities. Engineering controls such as dust control measures will also be implemented. The remediation schedule may exceed one year in length making a moderate impact on the environment during remediation. Strict stormwater controls will also be required to protect the adjacent wetlands.

**Implementability –** No technical implementability issues are associated with implementation of this alternative. Some administrative issues may be associated with this alternative. These include:

- Hauling of such a large amount of material;
- The possible extension of the project schedule;
- Drying of saturated lime to meet landfill disposal requirements, and
- The transport distance.

The implementation will require securing permits for trucking through city streets and multiple states, and community outreach for public concerns regarding dust, noise and traffic.

**Cost** – The estimated cost to implement this alternative is $11,722,000 (refer to Appendix F for details). There would be no annual inspection or reporting under the unrestricted alternative since there will be no requirement for an environmental easement or SMP. Volume and cost estimates are contained in Appendix F.

### 7.4.3 Alternative 3 – Carbide Lime/Fill Material Excavation with Offsite Disposal at an Operating Landfill

**Description**

This alternative includes the excavation of the carbide lime material and specific portions of the impacted soil/fill materials from areas of the site as follows:

- Carbide lime material from the lime piles and subsurface locations as identified in the RI (113,000 +/- cubic yards);
- The impacted fill material pile along the eastern property line to a depth of one foot below existing grade (6,000 +/- cubic yards);
- The top one foot of existing impacted soil/fill material across the non-lime areas of the site (3,000 +/- cubic yards); and,
- Impacted soil fill located above buried lime material that extends from the toe of slope of each lime pile (2,900 +/- cubic yards).

Excavated material will be transported to an active approved landfill for disposal. For costing purposes, under the cost evaluation section for this alternative, transport by trucking was assumed. The excavation remaining after lime and soil/fill removal would be backfilled with approximately 54,700 CY of approved offsite clean fill to prevent ponding and promote positive drainage. Volume estimates are contained in Appendix F. With the removal of the lime material, the elevated pH level in the groundwater should be reduced by natural attenuation. Use of groundwater would be restricted through institutional controls described below. This alternative is basically the same as the IRM designed at the initiation of the ERP process (2006).

Due to slightly elevated contamination levels (PAHs and metals) in the site soils remaining at the site below the proposed clean fill layer, Institutional and Engineering Controls (IC/EC) will be implemented as follows:

- Execution and recording of an Environmental Easement to restrict land use to commercial use per NYSDEC Part 375 regulations, restricting use of groundwater at the site and minimize/control future exposure to any contamination remaining at the site; and,

- Development and implementation of a Site Management Plan (SMP) for long term management of engineering controls for remaining contamination and monitoring of groundwater at the site perimeter to assess natural attenuation related to reduction of the elevated pH value.

The SMP would specify the methods necessary to ensure compliance with implemented ECs and ICs required by the Environmental Easement for contamination that remains at the site. The SMP would also include an Excavation Work Plan that details procedures to be implemented to minimize human and ecological exposure if future work on site requires the disturbance of the remaining impacted soil on site (Refer to section 4.6 for a description of IC/EC).

**Schedule**

The total volume of lime and soil/fill material estimated to be removed to a landfill, based on the above, is 124,900 cubic yards. Using a 1.3 conversion factor for converting cubic yards to tons the total tonnage to be removed is estimated to be 162,370 tons. Assuming a maximum of 1,000 tons per day could be excavated and transferred to a regional landfill, it would take approximately 10 to 11 months to remove all of the lime and impacted soil fill material, with an estimated total time of 13 to 14 months to complete the entire remediation.

**Evaluation**

**Overall Protection of Public Health and the Environment –** This alternative will result in the following:

- The removal of the lime material;
- The removal of impacted soil/debris pile;
- The removal of select impacted soil/fill material; and
- Backfilling of the site with clean fill to grade.

These will result in the protection of human health and the environment after the remediation. Current elevated groundwater pH levels should mitigate through natural attenuation once the lime material is removed and thus, minimizing effects to adjacent surface water. The property is located in an industrial/commercial area that is served by City water, and groundwater is not currently being used for drinking water nor anticipated for future use.

Instituting IC/EC will mitigate human exposure to the remaining slightly impacted site soils and groundwater during future development.

**Compliance with SCGs** – The removal of the lime material, debris pile and select impacted soil/fill, along with ICs and ECs is acceptable for commercial re-use per

NYSDEC Part 375 regulations and will be protective of human health and the environment. This alternative will successfully achieve all RAOs for the Site. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the site; and a site-wide inspection program to assure that the ICs placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial use under Part 375.

**Long-Term Effectiveness and Permanence –** The removal of the lime material, debris pile and select impacted soil/fill, together with ICs and ECs will achieve long term effectiveness and permanence under the commercial re-use scenario. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during future development and maintenance activities; groundwater monitoring plan; and a Site-wide Inspection program will be necessary to assure that the Institutional Controls placed on the Site have not been altered and remain effective. As such, this alternative is expected to provide long-term effectiveness and permanence.

**Reduction of Toxicity, Mobility, or Volume with Treatment –** The removal of the lime and impacted soil/fill material exceeding commercial use SCOs under this alternative will significantly reduce the toxicity, mobility, and volume of Site contamination. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development and maintenance activities; groundwater monitoring plan; and a Site-wide inspection program to assure that the I Cs placed on the Site have not been altered and remain effective will be required. Accordingly, this alternative satisfies this criterion.

**Short-Term Effectiveness –** There will be short term impacts in implementing this alternative. During the remedial action, there will be some exposure to the community and workers during excavation and transporting of the lime and soil materials. To mitigate these effects, a health and safety plan will be required along with a Community Air Monitoring Program (CAMP) and/or possibly a Community and Environmental Response Plan (CERP) during all remedial activities. Engineering controls such as dust control measures will also be implemented. The remediation schedule may exceed one year in length making a moderate impact on the environment during remediation. Strict stormwater controls will also be required to protect the adjacent wetlands.

**Implementability –** No technical implementability issues are associated with implementation of this alternative. Some administrative issues may be associated with this alternative. These may include:

- Hauling of such a large amount of material;
- The possible extension of the project schedule;
- Drying of saturated lime to meet landfill disposal requirements and,
- The transport distance.

The implementation will require securing permits for trucking through city streets and community outreach for public concerns regarding dust, noise and traffic.

An Environmental Easement and a soils management plan will be implemented documenting the controls placed on the site.

**Cost** – The total cost to implement this alternative is estimated to be $10,149,000 (refer to Appendix F-Remedial Alternatives Cost Estimates and volume estimates). There would also be an ongoing cost for periodic site inspection and reporting related to the effectiveness of the ICs and ECs put in place at the site. This yearly cost is estimated at $3,000/yr.

### 7.4.3 Alternative 4 – Carbide Lime/Fill Material Excavation with Offsite Disposal at the Marilla St. Landfill

**Description**

This alternative is the same as Alternative 3 with the exception that the lime and impacted soil fill material would be hauled to the adjacent Marilla Street landfill also known as the Former Republic Steel Landfill. The Marilla Street Landfill is an officially closed and a capped Class 2 Landfill (NYSDEC Site 915047). The present owners of the landfill have expressed interest in reopening the landfill for land filling of the Hopkins Site lime/fill material. The landfill would have to be re-opened with the NYSDEC approval and a Record of Decision (ROD) amendment issued.

This alternative includes the excavation of lime and impacted soil/fill materials from the following areas of the site and disposing at the Marilla Street Landfill located directly west of the site across the CSX Corporation owned rail road tracks and right of way:

- Carbide lime material from the lime piles and subsurface locations as identified in the RI (113,000 +/- CY);
- The impacted fill/debris material pile along the eastern property line to a depth of one foot below existing grade (6,000 +/- CY);
- The top one foot of existing impacted soil/fill material across the non-lime areas of the site (3,000 +/- CY); and,
- Impacted soil fill located above buried lime material that extends from the toe of slope of each lime pile (2,900 +/- CY).

The excavation remaining after lime and soil/fill removal would be backfilled with approved off-site clean fill to existing grade (54,700 +/- CY) to prevent ponding and promote positive drainage. Volume estimates are contained in Appendix F. With the removal of the lime material, the elevated pH level in the groundwater should be reduced by natural attenuation and restricted use through engineering controls described below.

Due to slightly elevated contamination levels (PAHs and metals) in the site soils remaining at the site below the proposed clean fill layer, ICs/ECs will be implemented as follows:

- Execution and recording of an Environmental Easement to restrict land use to commercial use per NYSDEC Part 375 regulations restricting use of groundwater at the site and minimize/control future exposure to any contamination remaining at the site; and,
- Development and implementation of an SMP for long term management of engineering controls for remaining contamination and monitoring of groundwater at the site perimeter to assess natural attenuation related to reduction of the elevated pH value.

The SMP would specify the methods necessary to ensure compliance with implemented ECs and ICs required by the Environmental Easement for contamination that remains at the site. The SMP would also include an Excavation Work Plan that details procedures to be implemented to minimize human and ecological exposure if future work on site requires the disturbance of the remaining impacted soil on site (Refer to section 4.6 for a description of IC/EC).

**Schedule**

The total volume of lime and soil/fill material estimated to be removed to a landfill, based on the above, is 124,900 cubic yards. Using a 1.3 conversion factor for converting cubic yards to tons the total tonnage to be removed is estimated to be 162,370 tons. Assuming a maximum of 2,000 tons per day could be excavated and transferred to the adjacent landfill, it would take approximately 5 to 6 months to remove all of the lime and soil fill material. The estimated total time to complete the entire remediation would be 8 to 9 months. It should be noted that the Marilla Landfill will have to be closed upon completion of the placement of the Hopkins site lime and fill materials in the landfill. Closure of the landfill could take an additional 3 to 4 months to accomplish.

**Evaluation**

**Overall Protection of Public Health and the Environment –** This alternative will result in the following:

- The removal of the lime material;
- The removal of impacted soil/debris pile;
- The removal of select impacted soil/fill material; and,
- Backfilling of the site with clean fill to promote drainage.

These will result in the protection of human health and the environment after the remediation. Current elevated groundwater pH levels should mitigate through natural attenuation once the lime material is removed and thus, minimizing effects to adjacent surface water. The property is located in an industrial/commercial area that is served by City water, and groundwater is not currently being used for drinking water nor anticipated for future use.

Instituting IC/EC will mitigate human exposure to the remaining slightly impacted site soils and groundwater during future development.

**Compliance with SCGs** – The removal of the lime material, debris pile and select impacted soil/fill, along with ICs and ECs is acceptable for commercial use per NYSDEC Part 375 regulations and will be protective of human health and the environment. This alternative will successfully achieve all RAOs for the Site. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the site; and a site-wide inspection program to assure that the Institutional Controls placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial use under Part 375.

It should be noted, that the opening of the closed Marilla Landfill to accommodate the Hopkins site lime/fill material will require: a review of regulatory policy issues; assessment of applicable environmental regulations; amending the present ROD; and, an assessment of public reaction.

**Long-Term Effectiveness and Permanence –** The removal of the lime material, impacted soil/debris pile and select impacted soil/fill, together with ICs and ECs will achieve long term effectiveness and permanence under the commercial re-use scenario. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the site; and a site-wide inspection program to assure that the ICs placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial re-use under Part 375.

**Reduction of Toxicity, Mobility, or Volume with Treatment –** The removal of the lime and impacted soil/fill material exceeding commercial use SCOs under this alternative will significantly reduce the toxicity, mobility, and volume of Site contamination. The SMP will include an excavation work plan to address any impacted soil/fill encountered during post-development and maintenance activities. A Site-wide inspection program to assure that the ICs placed on the Site have not been altered and remain effective will be required. Accordingly, this alternative satisfies this criterion.

**Short-Term Effectiveness –** There will be short term impacts in implementing this alternative. During the remedial action, there will be some exposure to the community and workers during excavation and transporting of the lime and soil materials. To mitigate these effects, a health and safety plan will be required along with a CAMP and/or possibly a CERP during all remedial activities. Engineering controls such as dust control measures will also be implemented. Strict stormwater controls will also be required to protect the adjacent wetlands.

The overall impact on the immediate environment to the Hopkins site will be greater than Alternative 2 since the hauling of the lime/fill material will be to the Marilla Landfill, directly to the west of the site (less than 500 feet). Thus, a much larger local area will be disturbed for the overall remediation. The overall environmental impact during remediation will be considered moderate to high. The Alternative 4 remediation schedule may be closer to that of Alternate 3 if the Marilla Street Landfill is re-closed upon completion of the lime/fill placement, which would include reconstructing the cap over the Marilla Street Landfill.

**Implementability –** No technical implementability issues are associated with implementation of this alternative. Some administrative issues may be associated with this alternative. These include:

- Hauling of such a large amount of material;
- The possible extension of the schedule;
- Drying of saturated lime to meet landfill disposal requirements and,
- The haul distance.

The implementation will require securing permits for trucking through city streets and community outreach for public concerns regarding dust, noise and traffic.

An Environmental Easement and a soils management plan will be implemented documenting the controls placed on the site.

**Cost** – The estimated cost for implementing this alternative is $8,396,000. It has been assumed that the disposal fee for use of the Marilla landfill would be approximately the same as the placement fee in a commercial operating landfill used in Alternative 2. The fee would cover the Marilla Landfill owners cost to open the landfill including: removal of the cover; spreading of material; cover replacement; and, administrative cost for opening and closing to adhere to regulations. The primary savings over Alternative 2 is in transportation costs. There would also be an ongoing cost for periodic site inspection and reporting related to the effectiveness of the ICs and ECs put in place at the site. This yearly cost is estimated at $3,000/yr. Volume and cost estimates are contained in Appendix F.

### 7.4.5 Alternative 5 – Carbide Lime Material Excavation for Offsite Beneficial Uses and Impacted Soil/Fill Material Excavation/Offsite Landfill Disposal at an Operating Landfill

**Introduction**

This alternative would entail excavating the carbide lime material above and below grade, across the site and backfilled with clean soil to prevent ponding and promote positive drainage. Excavated lime material would be handled for beneficial reuse consistent with DER -31. Impacted soil/fill (non-lime) material will also be excavated to contaminant levels that meet Part 375 commercial use criteria. The excavated material will be transported to a licensed disposal facility for disposal.

The volume and depth of impacted soil/fill material to be removed will be based on the soil criteria applicable for future commercial use of the property as defined in Part 375. Excavated areas will be backfilled with clean fill to prevent ponding and promote positive drainage. Stormwater and erosion control best management practices would apply during these activities.

As noted previously in this report, Praxair is currently conducting a pilot scale lime removal project that is currently being completed at the Site regarding beneficial use of the lime for agricultural purposes. Along with this program Praxair has contacted a number of potential beneficial users of lime material with the following items discussed:

- The quality and characteristics of the lime material required for their specific use;
- Quantities of lime they might use over time;
- Pilot programs to assess suitability and/or effectiveness;
- Costs to move the lime to the source of beneficial use;
- Possible treatment and/or physical characteristic requirements (screening, monitoring quality and moisture content, dewatering, slurrying etc.); and,
- Other potential user requirements for a specific beneficial use.

A number of beneficial uses for the lime material were developed by Praxair based upon these discussions and Praxair's experience at similar sites. A number of these outlets presented by Praxair are discussed below and may be considered and/or pursued during the implementation of the alternative as the selected alternative:

- As demonstrated by Praxair, there is a need for pH adjustment of soil to enhance agricultural activities in the region surrounding the City of Buffalo. Due to ongoing manure management at active farms and acidification of soil from manure use, this on-going use as an agricultural soil amendment has the potential to be the highest and best use of carbide lime stored at the Site. There are also a number of vendors, who operate lime distribution businesses, and farmers like the material for a number of reasons – primarily there is virtually no dust issue when the lime is applied and blended with the soil;
- Carbide lime is often used by municipalities to treat sewage sludge to enable it to be beneficially applied to the land as a nutrient. The optimal fraction of lime would be material with the highest calcium hydroxide content as this material will be most effective in adjusting the pH of the sewage sludge so it can meet requirements for land application. Many cities in the region may be interested in carbide lime for this purpose;
- Lime has been used to make a fertilizer product from bio-solids;
- Carbide lime is commonly used for soil stabilization. This can be a very economical management option for the lime. Carbide lime, which has high levels of calcium hydroxide, has been used for many soil stabilization projects on interstate highways and airport runways throughout the US. Contractors often purchase calcium oxide that must be hydrated for use, and a 55% cake

of calcium hydroxide with the dry solids at 86% calcium hydroxide is often an attractive option for such projects;

- Environmental remediation activities are considered to be one of the better beneficial uses since it typically utilizes the lime for pH adjustment and converts the lime to a salt. Abandoned mine reclamation efforts also utilize lime for soil treatment or use in treating acid run-off from tailing piles. There are many such activities in New York and Pennsylvania. Carbide lime has also been used to neutralize ponds of acid rich run-off, treating soil rich with sulfur compounds, and creating barriers for acid run-off along haul roads and dikes containing tailings; and,

- Carbide lime is also used by many industrial waste water treatment plants as a replacement for sodium hydroxide to adjust pH and precipitate heavy metals. Use of lime for this purpose changes lime from a strong base to an insoluble salt, with the added benefit of aiding capture of heavy metals that precipitate in the treatment process. Many industrial users prefer carbide lime over other strong base chemicals to neutralize strong acids due to the comparatively calm neutralizing reaction.

For purposes of this AAR, Praxair's beneficial use approach was adopted which focuses upon the excavation and beneficial use of the lime material as an agricultural soil amendment. Praxair has successfully demonstrated the efficacy of this alternative as part of the on-going pilot test, markets and vendors have been identified and prices are known and established. Praxair anticipates that this market will grow as this alternative proceeds and other avenues for re-use develop, including those listed above as well as others that are not currently known or identified.

The NYSDEC does not require that a beneficial use determination (BUD) petition be submitted for agricultural use of carbide lime. However, a BUD would be required for any non-agricultural use identified as a potential use for the material.

To meet Part 375 Commercial Use requirements, select impacted soil/fill from non-lime areas that exceed Part 375 commercial use SCOs would need to be removed and disposed at an approved landfill. Also, the excavation remaining from the lime and impacted soil/fill removal would need to be backfilled to existing grade.

**Description**

This alternative includes the excavation and transport of the lime material for beneficial use as an agricultural liming agent or soil amendment. As mentioned previously it is anticipated that additional non-agricultural beneficial re-use alternatives will be developed during the implementation of this alternative.

To restore and complete remediation of the Site to meet Part 375 Commercial Use requirements under this alternative, excavation of impacted soil/fill materials exceeding Part 375 commercial use SCOs from the following areas of the Site and transported to an active approved landfill for disposal will be required, assuming none of this material is used as fill material or site grading/construction activities (such as roadways or similar hard paving options):

- Lime material from the lime pile locations as identified in the RI, (estimated to be approximately 113,000 cubic yards) for beneficial reuse;
- Any contaminated carbide lime that cannot be beneficially used or comingled with debris shall be disposed in a permitted landfill;
- Impacted fill/debris containing lead and PCBs above commercial use SCOs along the eastern property line to an estimated depth of one to two feet below existing grade (estimated 750 +/- CY) for disposal in a permitted landfill;
- The top one foot of existing impacted soil/fill material across the non-lime areas of the site (3,000 +/- CY); and,
- post excavation sampling to determine if commercial use SCOs have been achieved; and
- Depending on confirmation sampling results, remove impacted soil/fill material across the non-lime areas of the site that exceed commercial use SCOs (estimated 3,000 to 9000 CY) for landfill disposal.
- If post-excavation sampling determines a limited amount of impacted soil/fill material above commercial use SCOs remains, a site cover will be required. The cover will consist of either hard surfacing from structure floor pads and foundations, pavement, and sidewalks comprising site development or a one foot soil cover in areas where the upper one foot of exposed soil will meet commercial use SCOs.

The above remedy is depicted in Figure 5. The excavation remaining after lime and soil/fill removal would be backfilled with approved offsite clean fill, to prevent ponding and promote positive drainage (approximately 45,000 to 50,000 CY). With the removal of the lime material, the elevated pH level in the groundwater should be reduced by natural attenuation and restricted use through engineering controls described below. Volume estimates are contained in Appendix F.

Subsequent to remediation, IC/EC may be implemented as follows:

- Execution and recording of an Environmental Easement to restrict land use to commercial use per NYSDEC Part 375 regulations, restricting use of groundwater at the site, and minimize/control future exposure to any contamination remaining at the site; and,

- Development and implementation of an SMP for long term management of remaining contamination, including monitoring of groundwater at the site perimeter to assess natural attenuation related to reduction of the elevated pH value.

The SMP would specify the methods necessary to ensure compliance with implemented ECs and ICs required by the Environmental Easement for contamination that remains at the site. The SMP would also include an Excavation Work Plan that details procedures to be implemented to minimize human and ecological exposure if future work on site requires the disturbance of the remaining impacted soil on site (Refer to section 4.6 for a description of IC/EC).

**Schedule**

The total volume of lime and soil/fill material estimated to be removed to a landfill, based on the above, is 124,900 CY. The total tonnage to be removed is estimated to be 132,790 tons. At the current rate of demand for the lime to be used as an agricultural supplement, it would take approximately 84 months to remove all of the lime and impacted soil fill material, with an estimated total time of 90 months to complete the entire remediation.

**Evaluation**

**Overall Protection of Public Health and the Environment –** This alternative will result in the following:

- Removal of the lime material;
- The removal of select impacted soil/fill material; and
- Restoration of the site to existing grade.

These actions will result in the protection of human health and the environment after the remediation. The property is located in an industrial/commercial area that is served by City water, and groundwater is not currently being used for drinking water nor anticipated for future use.

Instituting IC/EC will mitigate human exposure to the remaining slightly impacted site soils and groundwater during future development or maintenance activities. The end use of the lime material as a neutralization agent saves considerable landfill space as opposed to Alternatives2, 3 and 4 and permanently eliminates any future environmental concerns regarding the final disposition of the lime material.

**Compliance with SCGs** – The removal of the lime material select impacted soil/fill, along with IC and EC is acceptable for commercial re-use per NYSDEC Part 375 regulations and will be protective of human health and the environment. This alternative will successfully achieve all RAOs for the Site. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the site; and a site-wide inspection program to assure that the ICs placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial use under Part 375.

**Long-Term Effectiveness and Permanence –** The removal of the lime material and select impacted soil/fill, together with IC and EC will achieve long term effectiveness and permanence under the commercial use scenario. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the site; and a site-wide Inspection program to assure that the ICs placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial re-use under Part 375. As such, this alternative is expected to provide long-term effectiveness and permanence.

**Reduction of Toxicity, Mobility, or Volume with Treatment –** The removal of the lime and impacted soil/fill material exceeding commercial use SCOs under this alternative will significantly reduce the toxicity, mobility, and volume of site contamination. The SMP will include: an excavation work plan to address any impacted soil/fill encountered during post-development maintenance activities; a groundwater monitoring plan to assess natural attenuation of the groundwater leaving the Site; and a site-wide Inspection program to assure that the Institutional Controls placed on the Site have not been altered and remain effective will be necessary as required by NYSDEC requirements for commercial re-use under Part 375.

Accordingly, this alternative satisfies this criterion.

**Short-Term Effectiveness –** There will be short term impacts in implementing this alternative. During the remedial action, there will be some exposure to the community and workers during excavation and transporting of the lime and soil materials. To mitigate these effects, a health and safety plan will be required along with a CAMP and/or possibly a CERP during all remedial activities. Engineering controls such as dust control measures will also be implemented. The remediation schedule may exceed two years in length making a moderate to high impact on the environment during remediation. Strict stormwater controls will also be required to protect the adjacent wetlands.

**Implementability –** No technical implementability issues are associated with implementation of this alternative. Some administrative issues may be associated with this alternative. These include:

- Transportation of such a large amount of material;
- The possible extension of the project schedule; and,
- The transport distance.

The implementation may require securing permits for trucking through city streets and multiple states, and community outreach for public concerns regarding dust, noise and traffic.

An Environmental Easement and a SMP will be implemented documenting the controls placed on the Site.

**Cost** – The estimated cost for implementing this alternative is approximately $3,982,000 (refer to Appendix F). There would also be an ongoing cost for periodic site inspection and reporting related to the effectiveness of the IC and EC put in place at the site. This cost is estimated at $3,000/yr.

## 7.5 Institutional and Engineering Controls

For all the alternatives presented (with the exception of Alternative 1-No Action and Alternative 2-Unrestricted) controls will be required to restrict and manage community or future site worker exposure, as well as impacts to the environment (adjacent wetlands). These will mainly be directed at exposure to the remaining impacted soils. As such, the final remedy for the site will also include ICs and ECs as established under Part 375 regulations for commercial development. Part 375 regulations describe the IC/EC general requirements for the various site classifications for future development. To restrict future development of the site to commercial use, the following IC/EC will be required.

**Institutional Controls**

The following ICs for the site are recommended:

1. Maintain commercial use zoning for the site;
2. Impose an environmental easement (EE) on the entire site;
3. Prepare an SMP for the site as detailed in the Part 375 regulations.

The EE for the site would mandate the following:

- limiting the use and development of the site within the easement area to commercial use;
- restricting groundwater use at the site
- Development and implementation of a Site Management Plan (SMP) for long term management of remaining contamination, including restricting use of groundwater as a source of potable or process water without further testing and necessary water quality treatment as determined by the New York State Department of Health (NYSDOH) and monitoring of groundwater at the site perimeter to assess natural attenuation related to reduction of the elevated pH value.
- The property owner to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls.

**Engineering Controls**

There will be areas of the site with slightly elevated levels of metals and PAHs in some remaining lime and fill material. Therefore, engineering controls (EC) may be required for future development (commercial) to comply with the SMP and mitigate human exposure or environmental impact from fill material beneath the clean fill layer, where required.

The SMP includes an Excavation Work Plan that will detail procedures to be implemented to minimize human and ecological exposure if future work on site requires the disturbance of the remaining impacted soil on site.

## 7.6 Summary of Alternatives Evaluation

### 1. Overall Protection of Human Health and the Environment

Alternatives 2 through 5 pose minimal environmental risks and exposure to human health and the environment after remediation of the site.

### 2. Compliance with SCGs

Alternatives 2 through 5 achieve the removal of the lime material, impacted fill/debris pile and select impacted soil/fill, along with ICs and ECs, these alternatives adhere to commercial re-use per NYSDEC Part 375 regulations and will be protective of human health and the environment. These alternatives achieve all RAOs for the Site.

### 3. Long-Term Effectiveness and Permanence

No additional remedial actions should be required after completion of Alternative 2 through 5. All alternatives with the exception of Alternative 2 may require implementation of a post closure groundwater monitoring program. The necessity for further groundwater mitigation cannot be determined but may be possible for these alternatives.

These alternatives are expected to provide long-term effectiveness and permanence.

### 4. Reduction of Toxicity, Mobility or Volume with Treatment

Through removal of the lime and impacted soil/fill material exceeding Part 375 commercial use SCOs, Alternative 5 significantly reduce the toxicity, mobility, and volume of Site contamination. Groundwater monitoring may be required for these alternatives to assess that natural attenuation is working.

### 5. Short-Term Effectiveness

There will be short term impacts in implementing Alternatives 2 through 5. During the remedial actions there will be some exposure to the community and workers during excavation and transporting of the lime and soil materials. Alternative 4 will result in the greatest local exposure to workers and the local community. This alternative calls for reopening the Marilla landfill directly west of the site to dispose of the lime and fill materials.

The estimated timeframes it will take to implement the various alternatives are as follows:

- Alternative 2 – 14-15 months;
- Alternative 3 – 13-14 months;
- Alternative 4 – 8-9 months;
- Alternative 5 – 84-90 months;.

### 6. Implementability

No technical implementability issues regarding removal of lime and fill materials from the site are associated with any of the alternatives. However, the following possible administrative issues may apply to some or all of the alternatives:

- For all of the alternatives the following issues may apply - hauling large quantities of material; the lengthy time frame; the considerable haul distances; potential dewatering or drying of the lime; and public concerns regarding dust, noise and traffic.
- Direct disposal of the lime to a landfill or the Marilla Street site may require measures to dry the lime to meet maximum moisture level requirements at the landfill and to prevent any issues with spreading and compacting lime, especially when excavated from a saturate zone.
- Public and regulatory implementation issues may be associated with Alternative 4 related to opening a closed landfill; modification/re-issue of the Record of Decision (ROD) for the facility; and, the movement of the lime and fill material to an adjacent property that may affect the future planned use the Marilla Landfill site.
- Several additional outlets identified for Alternative 5 may require securing a BUD modification, the necessity for the BUD or similar permits would be evaluated and addresses as new markets or outlets are added.

### 7. Cost

A cost breakdown for each alternative is provided in Appendix F. The estimated total cost for each alternative from lowest to highest is as follows:

- Alternative 5 - $3,982,000;
- Alternative 4 - $8,396,000 Exc. & Disposal Marilla landfill ;
- Alternative 3 - $10,149,000 Exc. & Disposal Commercial Landfill,; and,
- Alternative 2 - $11,722,000 Unrestricted Use-Exc. & Landfill, 14-15 mo.

## 7.7 Recommended Remedial Measure

Based on the Remedial Alternatives Analysis evaluation, Alternative 5 is the recommended final remedial approach for the 90 Hopkins Street. This alternative was selected based on cost and that it allows for beneficial use of the lime material, which supports the “Green Remediation” objectives of DER-31. This selected remedy fully satisfies the remedial alternative objectives for commercial re-use and is protective of human health and the environment.

## 7.8 References/Contacts

1. NYSDEC 6 NYCRR Part 375 - Environmental Remediation Programs (December 2006)
2. NYSDEC DER-10-Technical Guidance for Site Investigation and Remediation (May 2010)
3. NYSDEC 6 NYCRR Part 376 - Land Disposal Restrictions
4. NYSDEC CP-51-Soil Cleanup Guidelines (October 2010)
5. Panamerican Environmental, Inc., Draft Remedial Investigation Report, 90 Hopkins Street, Site Number 31570006, September 2010.
6. Carbide Lime Its Value and Uses, Compressed Gas Association, Inc. , Third Edition, 1998
7. George Baggett- Praxair Distribution, Inc.–Kansas City, MO.- 816-931-8713, georgebaggett@gmail.com

# 8.0 SUMMARY AND CONCLUSIONS

## Remedial Investigation

The primary goals of the RI were to:

- Assess/verify the extent of the carbide lime material below grade;
- Assess, as necessary, the chemical characteristics of carbide lime material for beneficial reuse;
- Visually inspect and describe carbide lime and soil/fill conditions across the site;
- Characterize site fill/soils for contaminants of concern; and,
- Install monitoring wells to assess groundwater quality and flow information.

This was accomplished using a combination of borings, test trenches and monitoring wells (refer to Figure 3). All work was performed in accordance with the NYSDEC approved work plan. To assist in preparing the RI portion of the work plan a Phase I Environmental Site Assessment was conducted and is provided in Appendix A. The waste lime/soil assessment consisted of installing a total of 10 test trenches from the toe of the waste lime piles and across open areas of the site and installing 5 borings through the lime piles (three in the north pile and two in the south pile) Three groundwater monitoring wells were installed – one in the southwest perimeter, one along the north perimeter and one at the northwest corner of the site.

The test trenches revealed that the carbide lime material extends below existing grade from the south pile toe all the way to the eastern site property fence/property line (where the trenches stopped) and appears to extend further to the east beyond the site property line. Test trenches extended to the west from the western toe of slopes of the north and south waste lime piles reveal the carbide lime material extends below existing grade to the end of the brush line along the railroad tracks. The borings through the piles indicated that the south carbide lime pile material extended approximately one foot deeper than earlier estimates or approximately ten (10) feet below existing grade. The borings through the north pile confirmed the earlier extent of the carbide lime material below grade of approximately 7 feet. The extent of the carbide lime based on the RI data is depicted on Figure 3. The estimated additional volume of carbide lime with in the cross hatched area in the figure is approximately 2500 cubic yards. The boring program also indicated that the depth of carbide lime beneath the south carbide lime pile is approximately one foot deeper than previously estimated which amounts to approximately an additional 1400 cubic yards of waste lime. The 2006 assessment estimated the total volume of carbide lime to be approximately 118,000 cubic yards. Adding the additional volumes from this assessment the total volume of carbide lime is now estimated to be approximately 121,900 cubic yards. Following lime removal from 2011 to 2013, the revised lime volume estimate is approximately 113,000 cubic yards.

Analytical results of carbide lime samples indicated that the carbide lime material chemistry was similar to what was found in previous programs. Table 6 provides historic carbide lime pile sample analytical results that identifies and compares carbide lime sample analytical results from previous investigation programs. Analytical results from soil/fill samples below the carbide lime piles and in other non-lime pile areas indicated the presence of low concentrations of a number of SVOCs, a metal and a few VOC compounds. In almost all cases concentrations were below Part 375 commercial use soil cleanup requirements. One PCB compound was detected with a concentration slightly above Part 375 commercial use soil cleanup requirements in a sample from a test trench (TP-03) located adjacent the westerly property line near the off-site junk yard.

The groundwater assessment indicated that groundwater was relatively shallow (1.5 to 4.5 feet bgs) and flows from the southeast toward the north-northwest across the site. Groundwater samples indicated the presence of a number of metal compounds in all of the wells and SVOCs, and petroleum-type compounds and acetone in specific wells at relatively low concentrations. The elevated petroleum compounds detected in MW-01 appear to be localized at present since none of these compounds were detected in the down gradient wells (MW-02 and MW-03). The pH level in all samples was elevated (12 +/-) which is indicative of the influence of the large quantity of carbide lime on site.

Fate and transport and qualitative exposure evaluations reveled that current public exposure to site contaminants are minimal due to there being no active operations on site and the lack of official public access to the site. However, the site is not fenced and can be accessed by local residents. Remedial activities and future site uses potentially could result in worker and off-site residential exposure to carbide lime dust and other soil contaminants particularly during site disturbances. Runoff or fugitive dust from the carbide lime piles/fill areas to adjacent properties particularly the wetlands to the north is a potential human and an ecological exposure concern. High pH groundwater moving offsite toward the wetlands is also a possible ecological concern. At present the elevated petroleum compounds detected in MW-01 appear to be localized but may in the future move to the north and towards the wetlands. The acetone revealed in MW-02 and MW03 may be the result of residual acetone in the carbide lime.

**<u>Remedial Alternatives Evaluation and Selected Alternative</u>**

Remedial goals and Remedial Action Objectives (RAOs) were developed for the site based on the investigation findings provide in the RI and the future use of the property. RAOs are site-specific statements that convey the goals for minimizing or eliminating substantial risks to public health and the environment.

The following RAOs were developed for the 90 Hopkins Street Site:

- Removal of the carbide pH lime material for beneficial reuse and/or dispose of the material at an off-site landfill. The purpose is to prevent future off-site release of lime material, normalize the elevated pH of surface and groundwater by removing this source and allow for future site development.
- Remediate the site to prevent the ingestion or direct contact with the carbide lime or soil/fill that contains contaminants of concern above Part 375 Commercial Use SCOs; and,
- Prevent ingestion of or direct contact with groundwater containing concentrations

of contaminants of concern above TOGs groundwater standards.

Based on the RAOs, a number of remedial alternatives were reviewed. These included standard alternatives and those associated with beneficial reuse of the lime material. The following is a list of remedial alternatives that were evaluated:

Alternative 1 – No action;

Alternative 2 – Restoration to Pre-Disposal or Unrestricted Conditions;

Alternative 3 – Carbide Lime/Fill Material Excavation with Off-site Disposal at an Operating Landfill;

Alternative 4 –Carbide Lime/Fill Material Excavation with Off-site Disposal at the Marilla St. Landfill; and,

Alternative 5 – Carbide Lime Material Excavation for Offsite Lime Beneficial reuse and Impacted Soil/Fill Excavation/Off-site Disposal at an Operating Landfill.

Based on the Remedial Alternatives Analysis evaluation, Alternative 5 is the recommended final remedial alternative for the 90 Hopkins Street. This alternative was selected based on cost and that it allows for beneficial use of the lime material, which supports the “green remediation” objectives of DER-31. This selected remedy fully satisfies the remedial alternative objectives for commercial use and is protective of human health and the environment.

## TABLE 1 - 90 HOPKINS PROPERTY HISTORY SUMMARY

Property History Summary

| Year | Information Sources | Property Owner | Sanborn Maps/Aerial Photographs/History | Environmental Agencies/Reports/Info | Adjacent Properties/Information |
|---|---|---|---|---|---|
| 2006 | 1)Aerial Photograph 2) Previous Investigation Reports | City of Buffalo | Two Lime Piles on property. No Structures. Structures on adjacent 110 Hopkins and 88 Hopkins. Junk yard shown on adjacent east. Capped landfill to the southwest across RxR | "lime Pile Investigation Summary, 90 Hopkins Street, City of Buffalo, New York". Prepared by Clough Harbour & Associates for Honeywell, July 28, 2006 - completed limited investigation of lime piles (horizontal and Vertical Limits and including analysis of the lime and installation of three groundwater piezometers. The piezometers were removed after samples and reading were taken. pH was 12.8 however bottom was reported in lime. Groundwater was reported about 4-5 feet below ground surface. | |
| 2005 | Government Database Report | City of Buffalo | | Listed in SWL/LF, ERP and HSWDS databases - Vacant 8-acre parcel with two piles of lime approx. 118,000 cu yds total. File suggests that site was subject to a USEPA removal of drums, PCB soil, and building demo. | |
| 2004 | Government Database Report | City of Buffalo | | | 100 Hopkins Street - Manifest and RCRA- CESQG (conditionally exempt small quantity generator) databases - D008 lead Waste in Drums - no violations. |
| 2003 | Government Database Report | City of Buffalo | | | 88 Hopkins - Pravia Manufacturing Property listed in LTANK, NY SPILL and HIST LTANK database - Drums found on paper street/vacant lot - Colgate Street - Spill # 0375462 Drums removed |
| 2001 | Government Database Report | City of Buffalo | | | 88 Hopkins - Pravia ManufacturingProperty listed in LTANK, NY SPILL and HIST LTANK database - while completing bank trans. Found concrete vault full of tar - tar removed/soil excavated - cleaned closed - Spill # 0175247. 2) Ramco-Fitzsimmons Steel Corp - FINDS, CERC-NFRAP, MANEFEST, RCRA-CESQG databases |
| 2000 | Previous Investigation Reports | | | *Petition For Determination of Beneficial Use For Calcium Carbonate Product Located At Hopkins Street, South Buffalo*. Prepared by Malcolm, Inc for BERC. January 2000. | |
| 1999 | 1) Government Database Report 2) Previous Investigation Reports | City of Buffalo | | 2)- Technical Assistance for the Sloan Auto/90 Hopkins Street Site, Buffalo, New York. Brownfields Technology Support Center. Completed by USEPA contractor Tetra Tech EM Inc. March 1999 | 1) 88 Hopkins - Pravia ManufacturingProperty listed in LTANK, NY SPILL and HIST LTANK database - while removing a fuel oil UST soil contamination was removed and excavated - clean closed - Spill # 9975438 2)110 Hopkins Street - Former Ramco Steel/Bliss & Laughlin property - Inactive Hazardous Waste Disposal Site in New York (SHWS) - vacant land and pond behind the current Niagara Lasalle Steel Company - based on previous work that included 1983 NUS investigation, 1989 Phase I RI by a PRP in 1994, A rod was issued in 1996 - remedial action including removal os soil and re-establishment of pond and wetlands was completed in 2005. |
| 1998 | 1) Government Database Report 2) US Army Corps Of Engineers - FUSRAP Fact Sheet/News Release/US Department of Energy Office of Environmental Management internet site 3) Previous Investigation Reports | City of Buffalo | | 1) CERCLIS No Further Remedial Action Planned (CERCLIS-NFRAP) site - Listed as Sloan Auto Parts Inc. - transferred to state 3) A - Soil Sampling, Sloan Auto, Buffalo, New York. Completed by Weston for USEPA ERTC. October 29, 1998 B - Report "Characterization of City of Buffalo Hopkins Street Lime Piles - Attachment A" Prepared by Malcolm Pirnie - report indicates that the lime "could be of carbide lime origin" with high pH of 12.6 and 12.7 | 1) 110 Hopkins - Niagara Lasalle - NY Spills and NY Hist Spills database - Spill # 9875127 - Oil found inside and outside of the plant - uncovered drums full of oil - sloppy housekeeping - spill closed. 2) 110 Hopkins - Former Bliss & Laughlin Site - 1998-1999 Record of Decsion and disposal of waste at a licensed facility in Utah- In 1952 - performed machining and straightening operations on uranium rods to support Manhattan Engineering District operations. for National Lead of Ohio - performed in special area called the "Special Finishing Area" - low-level radioactive contamination |
| 1997 | 1) Government Database Report 2) Previous Investigation Reports | City of Buffalo | | 2) - See also 1998 Report date - Report "Characterization of City of Buffalo Hopkins Street Lime Piles - Attachment A" Prepared by Malcolm Pirnie - report indicates that the lime "could be of carbide lime origin" with high pH of 12.6 and 12.7 | 110 Hopkins Street - NY Spills and NY Hist Spills - Spill #9708082- facility remanufactures steel raw stock into end use products - oil soaked soil in piles around bld closed |
| 1995 | Aerial Photograph | City of Buffalo | The two lime piles and 5 buildings and other structures including gas holder shown on the property. Structures on adjacent 110 Hopkins and 88 Hopkins. Junk yard shown on adjacent east. Capped landfill to the southwest across RxR | | |
| 1993 | Government Database Report | City of Buffalo | | | 110 Hopkins - Niagara Cold Drawn- NY Spills and NY Hist Spills database - Spill #9214110 |
| 1992 | Us Army Corps Of Engineers - FUSRAP Fact Sheet/News Release/US Department of Energy Office of Environmental Management internet site | City of Buffalo | | | 110 Hopkins - Former Bliss & Laughlin Site - March 1992 - Oak Ridge Institute for Science and Education completes a radilogical survey and confirms fixed residual natural uranium on the floor columns, and ceiling in the finishing - Designated as FUSRAP site. |
| 1987 | Title Search | Title Search - City of Buffalo - Deed 9797, Page 389 - tax lein | | | |

# TABLE 1 - 90 HOPKINS PROPERTY HISTORY SUMMARY

**Property History Summary**

| | | | | | |
|---|---|---|---|---|---|
| 1986 | Sanborn Maps | Sloan Auto Parts | Sloan Auto Parts - shows numerous buildingsfrom 1919 including Charging Building, Generator Bld, Purifying and Compressing rooms. Gas Holder | | |
| 1984 | City of Buffalo Permits | Sloan Auto Parts | | | 110 Hopkins - Ramco-Steel - install barrier security |
| 1983 | City of Buffalo Permits, Aerial Photograph | Sloan Auto Parts | The two lime piles and 5 buildings and other structures including gas holder shown on the property. Structures on adjacent 110 Hopkins and 88 Hopkins. Junk yard shown on adjacent east. Active landfill to the southwest across RxR | | 88 Hopkins - NP Pla Machine Shop |
| 1981 | City of Buffalo Permits | Sloan Auto Parts | | Permit for eight motors for scrap melter | |
| 1980 | Internet - Source - http://www.loansenseplus.com/loan.asp?ln=705624 | Sloan Auto Parts | Listed as scrap and waste material business | Small Busness Loan - Jpmorgan Chase Bank Natl Assoc | |
| 1979 | Title Search, Building Permits | Raymond Yohannes and Sigmund Gibalski ? | | | 110 Hopkins - Ramco Steel - place two fiberglass tanks for removal of acid and rinse waters |
| 1978 | Buffalo Permits, Aerial Photograph | Raymond Yohannes and Sigmund Gibalski ? | The two lime piles and 5 buildings and other structures including gas holder shown on the property. Structures on adjacent 110 Hopkins and 88 Hopkins. Junk yard shown on adjacent east. Active landfill to the southwest across RxR | | 110 Hopkins - Ramco-Steel - install industrial sump pupm and catch basins |
| 1974 | 1) Title Search 2) Buffalo Permits | 1) Iroquois Gas Corporation sold property to National Fuel Gas - Deed 8189, Page 13 2) Raymond Yohannes and Sigmund Gibalski | | | |
| 1973 | 1) Buffalo Permits 2) Buffalo Fire Prevention Bureau | Raymond Yohannes | | 1) Deed 2) - permit to place 550-gallon underground waste oil tank | |
| 1972 | 1)Title Search 2)Buffalo Permits 3) US Department of Energy Office of Environmental Management site | Zigmund F. Gibalski sold property to Raymond F. Yohannes - Deed 8115, page 525 Buffalo Permits shows property owned by Sloan Auto Parts | Sloan Auto Parts | | 110 Hopkins - Bliss & Laughlin Inc. sold facility to Ramco Steel, Inc. 105 Hopkins - Irving Zubkoff - convert and use junk yard |
| 1971 | 1) City Permits | Raymond H. Yohannes and Zigmund F. Gibalski | | | 95 - Hopkins - Ben Rubenstein - Construct Steel Building for pipe storage |
| 1970 | City of Buffalo Permits | Raymond H. Yohannes and Zigmund F. Gibalski | | | 110 Hopkins - Bliss & Laughlin Inc. - repair building |
| 1967 | City of Buffalo Permits | Raymond H. Yohannes and Zigmund F. Gibalski | | | 110 Hopkins - Bliss & Laughlin Inc. - repair building |
| 1966 | Aerial Photograph | Raymond H. Yohannes and Zigmund F. Gibalski | The two lime piles and 5 buildings and other structures including gas holder shown on the property. Structures on adjacent 110 Hopkins and 88 Hopkins. Junk yard shown on adjacent east. Active landfill to the southwest across RxR | | |
| 1964 | City of Buffalo Permits | 3-25-1964 - Union Carbide and Carbon Corp. sold property to Raymond H. Yohannes and Zigmund F. Gibalski, tenants in common (Deed 6995, Page 481). 10-7-1964 - Raymond H. Yohannes and Zigmund F. Gibalski sold to Iroquois Gas Corporation (Deed 7079, Page 19) | | Use for wrecking Yard | |
| 1962 | City of Buffalo Permits | Union Carbide and Carbon Corporation - Linde Air Products Company Division | | | 88 Hopkins - Fla Tool & Mfg. Co.<br>110 Hopkins - Bliss & Laughlin - repair factory |
| 1960 | City of Buffalo Permits | Union Carbide and Carbon Corporation - Linde Air Products Company Division | | | 110 Hopkins - Bliss & Laughlin -repairs |

# TABLE 1 - 90 HOPKINS PROPERTY HISTORY SUMMARY

**Property History Summary**

| | | | | | |
|---|---|---|---|---|---|
| 1958 | Aerial Photograph | Union Carbide and Carbon Corporation - Linde Air Products Company Division | The two lime piles and 5 buildings and other structures including gas holder shown on the property. Structures on adjacent 110 Hopkins and 88 Hopkins. No junk yard shown on adjacent east. Active landfill to the southwest across RxR | | |
| 1953-1954 | 1) Title Search 2)Buffalo City Permits | Union Carbide and Carbon Corporation - Linde Air Products Company Division | | License for 1954 and storage of chemicals, cylinders, etc. to include maximum amount stored at anyone time - 15 drums of acetone and 6,560 lbs of acetone in strage tank, 360 tons of calcium carbide, 2,500 cylinders of acetylene, 400 cylinders of oxygen, 300 cylinders of helium | 88 Hopkins - Maryland Haberl - Construct Concrete light manufacturing & storgae bld & boiler room 95 Hopkins - Ben Rubinstein - construct steel building for storage |
| 1952 | 1)Buffalo Fire Prevetion Bureau | Union Carbide and Carbon Corporation - Linde Air Products Company Division | | | 110 Hopkins - Former Bliss & Laughlin Site - In 1952 - performed machining and straightening operations on uranium rods to support Manhattan Engineering District operations. for National Lead of Ohio - performed in special area called the "Special Finishing Area" - low-level radioactive contamination |
| 1951 | Us Army Corps Of Engineers - FUSRAP Fact Sheet | The Linde Air Products Company sold property to Union Carbide and Carbon Company - Deed 4858, Page 120 | | | 110 Hopkins - contsruct steel mill 110 Hopkins - Bliss & Laughlin - performed machining and straightening operations on uranium rods for National Lead of Ohio - performed in special area called the "Special Finishing Area" - low-level radioactive contamination 109 Hopkins - Florence Gern - Place frame building for office |
| 1950 | 1)Buffalo Permits 2) Sanborn Map | The Linde Air Products Company sold property to Union Carbide and Carbon Company - Deed 4858, Page 120 | The Linde Air Products Co. Buffalo Acetylene Plant - shows numerous buildings including Charging Building, Generator Bld, Purifying and Compressing rooms. Gas Holder . | License for 1950 for storage of chemicals and cylinders, etc. to include maximum amount stored at anyone time - storage of assorted chemicals (refer to list), 360 tons of calcium carbide, 135 cylinders of Pyrofax/proppane, 2,500 cylinders of acetylene, 400 cylinders of oxygen, 225 cylinders of hydrogen | 110 Hopkins - Bliss & Laughlin - construct steel mill |
| 1949 | Title Search | | | | |
| 1946 | 1)Buffalo Fire Prevetion Bureau | | | | |
| 1944 | 1)Buffalo Fire Prevetion Bureau | | | Listed maximum amount of storage for various chemicals - refer to separate list. | 110 Hopkins - Bliss & Laughlin - enlarge steel building for factory and storage |
| 1941 | Buffalo Permits | | | | 110 Hopkins - enlarge steel factory |
| 1940 | 1) City of Buffalo Permits 2) Sanborn Map | | Sanborn - 90 Hopkins - The Prest-O-Lite Company Inc. - shows numerous buildings including Charging Building, Generator Bld, Purifying and Compressing rooms. Gas Holder 110 Hopkins - Bliss& Laughlin Inc. - Cold Drawn Steel & Bearings | | 88 Hopkins - Art Clemens - demolish deweling 110 Hopkins - Bliss & Laughlin - enlarge steel annealing building - Annealing - causing changes in metals properties such as strength and hardness. It is a process that produces conditions by heating to above the re-crystallization temperature. In the cases of copper, steel, silver and brass this process is performed by substantially heating the material (generally until glowing) for a while and allowing it to cool slowly. In this fashion the metal is softened and prepared for further work such as shaping, stamping, or forming. |
| 1937 | 1)Buffalo Permits 2)Sanborn Maps | Prest-O-Lite Co. | Sanborn - 90 Hopkins - The Prest-O-Lite Company Inc. - shows numerous buildings including Charging Building, Generator Bld, Purifying and Compressing rooms. Gas Holder | Alter Brick Factory and construct steel pump house | 110 Hopkins - Bliss& Laughlin Inc. - Cold Drawn Steel & Bearings. 110 Hopkins permit - Bliss & Laughlin - enlarge steel factory |
| 1935 | Buffalo Permits | Prest-O-Lite Co. | | Construct steel private garage | 110 Hopkins - Bliss & Laughlin - enlarge steel factory |
| 1930 | Buffalo Permits | International Oxygen Company sold the property to The Linde Air Products Company (Deed 2105, Page 145) | | | |
| 1928 | Title Search and Buffalo permits | | | | 110 Hopkins - Bliss & Laughlin - brick building for manufacturing |
| 1926 | Aerial | | Property area is vacant land | | |
| 1920 | Internet - Source - http://www.unioncarbide.com/history/ | | First commercial ethylene plant is completed in West Virginia | | |
| 1919 | City of Buffalo Permits | | | | 88 Hopkins - Buffalo Asphalt Block Co. - Steel and Iron Bld. |
| 1916-1917 | 1) Internet - Source - http://www.unioncarbide.com/history/ 2) Sanborn Map | | Union Carbide & Carbon Corporation incorporated and acquires Linde Air Products Co., National Carbon Co., Inc., Prest-O-Lite Co., Inc. and Union Carbide Company. 2) Sanborn Map shows vacant property. Map also shows Buffalo Asphalt Block Company at 88 Hopkins along Hopkins Street. Vacant property is located at 110 Hopkins (eventually the location of Bliss & Laughlin | | 88 Hopkins - Lockport Paving Co. 1916 office and factory 1917- Buffalo Asphalt Block Company - erect addition, steel press room, storage building, brick transformer bld |

## TABLE 2 - 90 Hopkins Sub-Surface Soil Test Trench Analytical Results

| Sample Number | PEI-TP-03B | PEI-TP-05B | PEI-TP-11B | PEI-TP-11L | PEI-TP-13B | NYSDEC | NYSDEC | NYSDEC |
|---|---|---|---|---|---|---|---|---|
| Sample Date | 4/13/2010 | 4/13/2010 | 4/14/2010 | 4/14/2010 | 4/14/2010 | PART 375 | PART 375 | PART 375 |
| Sample depth | 2' BGS | 4' BGS | 6.5' BGS | 6' BGS | 4' BGS | Commercial | Industrial | Unrestricted Use |
| Compounds | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| **Metals** | | | | | | (a) | (b) | (c) |
| Aluminum | 9880 | 4670 | 7400 | 7890 | 6140 | N/A | N/A | N/A |
| Antmony | 0.9 J | ND | ND | ND | ND | N/A | N/A | N/A |
| Arsenic | **14.4 ( c)** | 2.6 | 2.0 J | 6.7 | 4.1 | 16 | 16 | 13 |
| Barium | 200 | 14.7 | 60.8 | 79.2 | 53.7 | 400 | 10000 | 350 |
| Beryllium | 0.82 | 0.185 J, | 0.387 | 0.79 | 0.469 | 590 | 2700 | 7.2 |
| Cadmium | **3.95 ( c)** | 0.178 J | 0.231 J | 0.41 J | 0.236 | 9.3 | 60 | 2.5 |
| Calcium | 109000 D08,J | 703 J | 5130 J | 279000 D08,J | 6000 J | N/A | N/A | N/A |
| Chromium | **36.5 ( c)** | 4.49 | 9.61 | 11.3 | 9.46 | 400 | 800 | 30 |
| Cobalt | 4.93 | 3.75 | 4.43 | 3.4 | 4.94 | N/A | N/A | N/A |
| Copper | **96.5 ( c)** | 10.8 | 8.3 | 11.3 | 15.9 | 270 | 10000 | 50 |
| Iron | 20100 | 8810 | 10900 | 15300 | 12600 | N/A | N/A | N/A |
| Lead | **1080 (a)** | 5.3 | 6.4 | 18.3 | 9 | 1000 | 3900 | 63 |
| Magnesium | 26100 | 1130 | 1360 | 1360 | 1680 | N/A | N/A | N/A |
| Manganese | 1120 | 82.4 | 88.9 | 261 | 85.6 | 10000 | 10000 | 1600 |
| Mercury | **0.503 ( c)** | ND | 0.0249 | ND | 0.0246 | 2.8 | 5.7 | 0.18 |
| Nickel | 15.6 | 9.7 | 10.2 | 8.72 J | 12.3 | 310 | 10000 | 30 |
| Potassium | 1600 | 361 | 302 | 468 | 243 | N/A | N/A | N/A |
| Silver | 0.198 J | ND | ND | ND | ND | 1500 | 6800 | 2 |
| Sodium | 465 | 46.3 J | 21.5 J | ND | 29.2 J | N/A | N/A | N/A |
| Thallium | ND | ND | 0.6 J, | ND | 0.6 J, | N/A | N/A | N/A |
| Vanadium | 25.7 | 7.7 | 16.6 | 15.3 | 20.4 | N/A | N/A | N/A |
| Zinc | **425 B ( c)** | 28.5 | 24.7 | 64.4 | 36.4 | 10000 | 10000 | 109 |
| **Semi-Volatile Organics** | | | | | | (a) | (b) | (c) |
| Anthracene | 1.1 D12,J | 0.015 J | ND | ND | ND | 500 | 1000 | 100 |
| Benzo(a)anthracene | **2.9 D12,J ( c)** | 0.036 J | ND | ND | ND | 5.6 | 11 | 1 |
| Benzo(a)pyrene | **3.0 D12,J (a)(b)( c)** | 0.03 J | ND | ND | ND | 1 | 1.1 | 1 |
| Benzo(b)fluoranthene | **3.8 D12,J ( c)** | 0.035 J | ND | ND | ND | 5.6 | 11 | 1 |
| Benzo(g,h,I)perylene | 2.3 D12,J | 0.019 J | ND | ND | ND | 500 | 1000 | 100 |
| Benzo(k)fluoranthene | **1.3 D12, J ( c)** | 0.014 J | ND | ND | ND | 56 | 110 | 0.8 |
| Bis(2-ethylhexyl) | 3.9 D12,J | ND | ND | ND | ND | N/A | N/A | N/A |
| Chrysene | **2.7 D12,J ( c)** | 0.031 J | ND | ND | ND | 56 | 110 | 1 |
| Fluoranthene | 6.6 D12,J | 0.079 J | ND | ND | ND | 500 | 1000 | 100 |
| Indeno(1,2,3-cd)pyrene | **1.9 D12,J ( c)** | ND | ND | ND | ND | 5.6 | 11 | 0.5 |
| Phenanthrene | 4.9 D12,J | 0.047 J | ND | ND | ND | 500 | 1000 | 100 |
| Pyrene | 5.2 D12,J | 0.062 J | ND | ND | ND | 500 | 1000 | 100 |
| **PCBs** | | | | | | (a) | (b) | (c) |
| Aroclor 1242 | **4.6 D08,QSU (a)( c)** | 0.017 QSU,J | ND | ND | ND | 1 | 25 | 0.1 |
| **Volatile Organics** | | | | | | (a) | (b) | (c) |
| 4-Methyl-2-pentanone | 0.0079 J | ND | ND | ND | ND | N/A | N/A | N/A |
| Ethylbenzene | 0.0041 J | ND | ND | ND | ND | 390 | 780 | 1 |
| Xylenes, total | 0.035 | ND | ND | ND | ND | 500 | 1000 | 0.26 |
| 2-Butanone | 0.021 J | 0.0044 J | 0.0028 J | ND | ND | N/A | N/A | N/A |
| Methylene Chloride | 0.0043 J | 0.0078 | 0.0084 | 0.017 | 0.0089 | 500 | 1000 | 0.05 |
| Acetone | **0.21 ( c)** | 0.031 J | 0.037 | 0.089 ( c) | 0.019 J | 500 | 1000 | 0.05 |

N/A - Not Applicable ND - Non-detect
bgs - below ground surface TICs - Tentitively Identified Compounds
**Shading & (a) (b) and/or ( c) - above specified Results for each NYSDEC SCO column**
B - Analyte was detected in the associated Method Blank.
D02 - Dilution required due to sample matrix effects
D08 - Dilution required due to high concentration of target analyte(s)
D10 - Dilution required due to sample color
QFL - Florisil clean-up (EPA 3620) performed on extract
QSU - Sulfur (EPA 3660) clean-up performed on extract
J - Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

| Sample | Material |
|---|---|
| **TP-03B** | **soil/fill** |
| **TP-05B** | **soil/fill** |
| **TP-11B** | **lime/soil interface** |
| **TP-11L** | **lime** |
| **TP-13B** | **lime/soil interface** |

| TABLE 3 - 90 Hopkins Surface Soil Test Trench Analytical Results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sample Number** | **PEI-TP-04A** | **PEI-TP-05A** | **PEI-TP-08A** | **PEI-TP-09A** | **PEI-TP-09AD** | **NYSDEC** | **NYSDEC** | **NYSDEC** |
| **Sample Date** | **4/15/2010** | **4/15/2010** | **4/15/2010** | **4/15/2010** | **4/15/2010** | **PART 375** | **PART 375** | **PART 375** |
| **Sample depth** | **Surface** | **Surface** | **Surface** | **Surface** | **Surface** | **Commercial** | **Industrial** | **Unrestricted Use** |
| **Compounds** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** |
| **Metals** | | | | | | **(a)** | **(b)** | **( c)** |
| Aluminum | 7270 | 8620 | 7380 | 6340 | 6430 | N/A | N/A | N/A |
| Arsenic | 6.2 | 5.9 | 6.1 | 4.3 | 3.8 | 16 | 16 | **13** |
| Barium | 104 | 164 | 187 | 104 | 86.3 | 400 | 10000 | 350 |
| Beryllium | 0.613 | 0.716 | 0.536 | 0.483 | 0.395 | 590 | 2700 | 7.2 |
| Cadmium | 0.539 | 0.756 | 0.625 | 0.373 | 0.708 | 9.3 | 60 | 2.5 |
| Calcium | 129000 D08, | 116000 D08, | 89000 D08, | 135000 D08, | 118000 D08, | N/A | N/A | N/A |
| Chromium | 15.2 | 18.9 | 14.7 | 12.3 | 13 | 400 | 800 | 30 |
| Cobalt | 3.95 | 4.68 | 4.43 | 3.77 | 3.93 | N/A | N/A | N/A |
| Copper | 27.5 | 33.3 | 26.2 | 21.7 | 17.5 | 270 | 10000 | 50 |
| Iron | 11800 | 15400 | 11500 | 9390 | 9880 | N/A | N/A | N/A |
| Lead | **129 ( c)** | **201 ( c)** | **144 ( c)** | **69.5 ( c)** | **66.4 ( c)** | 1000 | 3900 | 63 |
| Magnesium | 13800 | 16900 | 18700 | 31800 | 30400 | N/A | N/A | N/A |
| Manganese | 563 | 497 | 407 | 388 | 522 | 10000 | 10000 | 1600 |
| Mercury | 0.156 | 0.0974 | 0.208 | 0.16 | 0.182 | 2.8 | 5.7 | 0.18 |
| Nickel | 10.6 | 12.4 | 11.1 | 8.91 | 9.56 | 310 | 10000 | 30 |
| Potassium | 1220 | 1460 | 1210 | 1080 | 978 | N/A | N/A | N/A |
| Silver | 0.104 J | 0.081 J | ND | ND | ND | 1500 | 6800 | 2 |
| Sodium | 302 | 270 | 215 | 172 | 141 J | N/A | N/A | N/A |
| Vanadium | 16.1 | 17.6 | 15.8 | 13.5 | 14.9 | N/A | N/A | N/A |
| Zinc | **146 ( c)** | **212 ( c)** | **243 ( c)** | **125 ( c)** | **137 ( c)** | 10000 | 10000 | 109 |
| **Semi-Volatile Organics** | | | | | | **(a)** | **(b)** | **( c)** |
| Acenaphthene | 1.2 D08,J | ND | 1.4 D08,J | 0.7 D08,J | ND | 500 | 1000 | 20 |
| Anthracene | 2.8 D08,J | 1.6 D08,J | 3 D08,J | 1.3 D08,J | ND | 500 | 1000 | 100 |
| Benzo(a)anthracene | **12 D08 (a (b)( c)** | **5.6 D08,J (a)( c)** | **9.2 D08 (a)( c)** | **3.7 D08,J ( c)** | **2.9 D08,J ( c)** | 5.6 | 11 | 1 |
| Benzo(a)pyrene | **14 D08 (a)(b)( c)** | **6.3 D08,J (a)(b)( c)** | **9 D08,J (a)(b)( c)** | **3.5 D08,J (a)(b)( c)** | **2.5 D08,J (a)(b)( c)** | 1 | 1.1 | 1 |
| Benzo(b)fluoranthene | **15 D08 (a)(b)( c)** | **7.7 D08,J (a) ( c)** | **10 D08 (a)( c)** | **4.2 D08 ( c)** | **3.1 D08,J ( c)** | 5.6 | 11 | 1 |
| Benzo(g,h,I)perylene | 10 D08 | 4.9 D08,J | 6.8 D08,J | 2.7 D08,J | 1.9 D08,J | 500 | 1000 | 100 |
| Benzo(k)fluoranthene | **6.1 D08,J ( c)** | **2.9 D08,J ( c)** | **4.5 D08,J ( c)** | **1.9 D08,J ( c)** | **1.4 D08,J ( c)** | 56 | 110 | 0.8 |
| Butyl benzyl phthalate | ND | ND | ND | 92 D08 | ND | N/A | N/A | N/A |
| Carbazole | 1.3 D08,J | 0.77 D08,J | 1.5 D08,J | 0.92 D08,J | ND | N/A | N/A | N/A |
| Chrysene | **11 D08 ( c)** | **5.6 D08,J ( c)** | **8.1 D08,J ( C)** | **3.3 D08,J ( c)** | **2.4 D08,J ( c)** | 56 | 110 | 1 |
| Dibenzo(a,h)anthracene | **2.3 D08,J (a)(b)( c)** | **1.2 D08,J (a)(b)( c)** | **1.8 D08,J (a)(b)( c)** | **0.72 D08,J (a)( c)** | ND | 0.56 | 1.1 | 0.33 |
| Fluoranthene | 25 D08 | 13 D08 | 22 D08 | 9.8 D08 | 6.3 D08,J | 500 | 1000 | 100 |
| Fluorene | ND | 0.73 D08,J | 1.3 D08,J | 0.85 D08,J | ND | 500 | 1000 | 30 |
| Indeno(1,2,3-cd)pyrene | **8.7 D08,J (a)( c)** | **3.9 D08,J ( c)** | **5.8 D08,J (a)( c)** | **2.3 D08,J ( c)** | ND | 5.6 | 11 | 0.5 |
| Phenanthrene | 13 D08 | 8 D08,J | 14 D08 | 7.7 D08 | 4.6 D08,J | 500 | 1000 | 100 |
| Pyrene | 19 D08 | 9.8 D08 | 15 D08 | 6.4 D08 | 4.5 D08,J | 500 | 1000 | 100 |

N/A - Not Applicable ND - Non-detect
bgs - below ground surface TICs - Tentitively Identified Compounds
**Shading & (a) (b) and/or ( c) - above specified Results for each NYSDEC SCO column**
D02 - Dilution required due to sample matrix effects
D08 - Dilution required due to high concentration of target analyte(s)
D10 - Dilution required due to sample color
QFL - Florisil clean-up (EPA 3620) performed on extract
QSU - Sulfur (EPA 3660) clean-up performed on extract
J - Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

## TABLE 4 - 90 Hopkins Soil Boring Analytical Results

| **Sample Number** | **PEI-BH-01B** | **PEI-BH-01C** | **PEI-BH-02B** | **PEI-BH-02C** | **PEI-BH-03B** | **PEI-BH-03C** | **PEI-BH-04A** | **PEI-BH-04C** | **NYSDEC** | **NYSDEC** | **NYSDEC** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Date** | **4/19/2010** | **4/19/2010** | **4/19/2010** | **4/19/2010** | **4/20/2010** | **4/20/2010** | **4/19/2010** | **4/19/2010** | **PART 375** | **PART 375** | **PART 375** |
| **Sample depth** | **20' BGS** | **22' BGS** | **17' BGS** | **19' BGS** | **24' BGS** | **29' BGS** | **Surface** | **23' BGS** | **Commercial** | **Industrial** | **Unrestricted Use** |
| **Compounds** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** |
| **Metals** | | | | | | | | | **(a)** | **(b)** | **(c)** |
| Aluminum | 5350 | 6190 | 6080 | 5800 | 6330 | 5090 | 6090 | 6730 | N/A | N/A | N/A |
| Antmony | ND | ND | ND | ND | ND | ND | ND | ND | N/A | N/A | N/A |
| Arsenic | 2.4 J | 5.3 | 3.6 | 4.8 | 1.3 J | 2.1 J | 1.0 J | 4.3 | 16 | 16 | 13 |
| Barium | 11.5 | 112 | 10.7 | 19 | 6.99 | 28.7 | 8.06 | 34.3 | 400 | 10000 | 350 |
| Beryllium | 0.852 | 0.359 | 1.15 | 0.383 | 0.81 | 0.179 J | 1.11 | 0.325 | 590 | 2700 | 7.2 |
| Cadmium | ND | 0.28 J | 0.227 J | 0.122 J | ND | 0.044 J | ND | 0.195 J | 9.3 | 60 | 2.5 |
| Calcium | 429000 D08 | 48000 | 410000 D08 | 2240 | 458000 D08 | 18000 | 465000 D08 | 2160 | N/A | N/A | N/A |
| Chromium | 20.2 | 7.23 | 5.65 | 6.25 | 18.1 | 5.98 | 3.2 | 8.92 | 400 | 800 | 30 |
| Cobalt | 0.689 J | 2.46 | 1.06 | 5.48 | 0.27 J | 1.8 | 0.622 J | 6.43 | N/A | N/A | N/A |
| Copper | 5.8 | 7.1 | 7.6 | 11.6 | 3.6 | 2.2 | 3.8 | 5.8 | 270 | 10000 | 50 |
| Iron | 4190 J | 17700 J | 4840 J | 11100 J | 1080 J | 6000 J | 1850 J | 17300 J | N/A | N/A | N/A |
| Lead | 6.8 | 20.3 | 22.8 | 7.7 | 3.5 | 3.9 | 5.4 | 6.9 | 1000 | 3900 | 63 |
| Magnesium | 535 | 680 | 734 | 1290 | 433 | 677 | 485 | 1350 | N/A | N/A | N/A |
| Manganese | 67.3 J | 225 J | 144 J | 100 J | 14.8 J | 56.5 J | 39.1 J | 235 J | 10000 | 10000 | 1600 |
| Mercury | 0.0336 | 0.0738 | ND | ND | ND | 0.0229 J | ND | ND | 2.8 | 5.7 | 0.18 |
| Nickel | 3.39 J | 4.54 J | 4.3 J | 12.8 | 2.14 J | 4.03 J | 4.26 J | 10.2 | 310 | 10000 | 30 |
| Potassium | 59.2 | 483 | 91.7 | 524 | 30.8 J | 262 | 62.3 | 352 | N/A | N/A | N/A |
| Selenium | 0.9 J | ND | 0.7 J | 0.5 J | ND | ND | 1.4 J | ND | 1500 | 6800 | 2 |
| Sodium | 41.8 | 126 J | ND | 64.1 J | ND | 64.7 J | ND | 56.3 J | N/A | N/A | N/A |
| Thallium | ND | ND | 0.9 J | 0.3 J | ND | 0.5 J | ND | ND | N/A | N/A | N/A |
| Vanadium | 5.67 | 11.3 J | 5.93 | 11 | 2.79 | 11.7 | 4.08 | 16.4 | N/A | N/A | N/A |
| Zinc | 26.3 J | **109 J ( c)** | 60.6 J | 32.6 J | 8.5 J | 21.3 J | 20.7 J | 30.2 J | 10000 | 10000 | 109 |
| **Semi-Volatile Organics** | | | | | | | | | **(a)** | **(b)** | **(c)** |
| Benzo(a)anthracene | 0.061 J | ND | ND | ND | ND | ND | ND | ND | 5.6 | 11 | 1 |
| Benzo(a)pyrene | 0.059 J | ND | ND | ND | ND | ND | ND | ND | 1 | 1.1 | 1 |
| Benzo(b)fluoranthene | 0.076 J | ND | ND | ND | ND | ND | ND | ND | 5.6 | 11 | 1 |
| Benzo(g,h,I)perylene | 0.040 J | ND | ND | ND | ND | ND | ND | ND | 500 | 1000 | 100 |
| Benzo(k)fluoranthene | 0.023 J | ND | ND | ND | ND | ND | ND | ND | 56 | 110 | 0.8 |
| Bis(2-ethylhexyl) | 0.32 J | ND | ND | 0.14 J | ND | ND | ND | 0.15 J | N/A | N/A | N/A |
| Chrysene | 0.052 J | ND | ND | ND | ND | ND | ND | ND | 56 | 110 | 1 |
| Dibenzo(a,h)anthracene | ND | ND | ND | ND | ND | ND | ND | ND | 0.56 | 1.1 | 0.33 |
| Fluoranthene | 0.14 J | ND | ND | ND | ND | ND | ND | ND | 500 | 1000 | 100 |
| Fluorene | ND | ND | ND | ND | ND | ND | ND | ND | 500 | 100 | 30 |
| Indeno(1,2,3-cd)pyrene | 0.032 J | ND | ND | ND | ND | ND | ND | ND | 5.6 | 11 | 0.5 |
| 4-Methylphenol | ND | ND | ND | 0.045 J | ND | ND | ND | ND | N/A | N/A | N/A |
| Phenanthrene | 0.086 J | ND | ND | ND | ND | ND | ND | ND | 500 | 1000 | 100 |
| Phenol | ND | ND | ND | ND | ND | 0.026 J | ND | 0.078 J | 500 | 1000 | 0.33 |
| Pyrene | 0.099 J | ND | ND | ND | ND | ND | ND | ND | 500 | 1000 | 100 |
| **Volatile Organics** | | | | | | | | | **(a)** | **(b)** | **(c)** |
| Carbon Disulfide | ND | ND | ND | ND | ND | 0.0033 J | ND | ND | N/A | N/A | N/A |
| 2-Butanone | 0.0057 J | 0.0099 J | ND | 0.005 J | 0.0082 J | 0.0061 J | ND | 0.0047 J | N/A | N/A | N/A |
| Methylene Chloride | ND | ND | 0.0052 J | ND | ND | ND | ND | 0.0027 J | 500 | 1000 | 0.05 |
| Acetone | **0.14 ( c)** | **0.099 ( c)** | 0.015 J | **0.062 ( c)** | **0.1 ( c)** | **0.059 ( c)** | 0.024 J | 0.049 | 500 | 1000 | 0.05 |

N/A - Not Applicable ND - Non-detect

bgs - below ground surface

**Shading & (a) (b) and/or ( c) - above specified Results for each NYSDEC SCO column**

B - Analyte was detected in the associated Method Blank.

D02 - Dilution required due to sample matrix effects

D08 - Dilution required due to high concentration of target analyte(s)

D10 - Dilution required due to sample color

QFL - Florisil clean-up (EPA 3620) performed on extract

QSU - Sulfur (EPA 3660) clean-up performed on extract

J - Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

| **Sample** | **Material** |
|---|---|
| **BH-01A** | **Lime (on hold not analyzed)** |
| **BH-01B** | **lime-soil interface** |
| **BH-01C** | **Soil** |
| **BH-02B** | **lime-soil interface** |
| **BH-02C** | **soil** |
| **BH-03B** | **lime-soil interface** |
| **BH-03C** | **soil** |
| **BH-04A** | **lime** |
| **BH-04C** | **lime-soil interface** |

## TABLE 5 - 90 Hopkins Groundwater Analytical Results

| Sample Number | PEI-MW-03 | PEI-MW-02 | PEI-MW-01 | PEI-MW-01D | NYSDEC |
|---|---|---|---|---|---|
| **Sample Date** | **4/22/2010** | **4/22/2010** | **4/22/2010** | **4/22/2010** | **PART 703** |
| | | | | | **NYSDEC TOGS** |
| **Compounds** | **ug/L** | **ug/L** | **ug/L** | **ug/L** | **ug/L** |
| **Metals** | | | | | |
| Aluminum | **2570** | **8570** | **4940** | 369 | 2000 |
| Barium | 994 | 551 | 113 | 100 | 2000 |
| Beryllium | 0.8 J | 1.4 J | 0.9 J | 0.6 J | 11 |
| Cadmium | ND | ND | 0.3 J | ND | 10 |
| Calcium | 937000 D08 | 1140000 D08 | 898000 D08 | 908000 D08 | N/A |
| Chromium | 2.1 J | 9.2 | 7.6 | 0.9 J | 100 |
| Cobalt | 0.7 J | 1.8 J | 1.4 J | ND | 5 |
| Copper | 2.7 J | 11.8 | 9.1 J | 1.6 J | 1000 |
| Iron | **1630** | **5740** | **4480** | 232 | 600 |
| Lead | ND | 18 | 14.8 | ND | 50 |
| Magnesium | 389 | 1770 | 2810 | 174 J | 35000 |
| Manganese | 28.9 | 80.9 | 87.4 | 4.4 | 600 |
| Nickel | 13.8 | 9.8 J | 9.4 J | 4.2 J | 200 |
| Potassium | 4 | 18200 | 14800 | 14700 | N/A |
| Sodium | **83600** | **40200** | **26900** | **27700** | 20000 |
| Vanadium | 2.3 J | 10.3 | 9.1 | 1.2 J | 14 |
| Zinc | ND | 44.6 | 45.2 | ND | 5000 |
| **Semi-Volitile Organics** | | | | | |
| Acetophenone | 0.7 J | 0.62 J | ND | ND | N/A |
| Isophorone | 0.89 J | ND | ND | ND | 50 |
| 4-Methylphenol | 12 | 7.0 J | ND | ND | N/A |
| Phenol | **44** | **17** | ND | ND | 1 |
| **Volitile Organics** | | | | | |
| Benzene | ND | ND | **28 D03** | **28 D03** | 1 |
| Ethylbenzene | ND | ND | **9.8 D03** | **9.1 D03** | 5 |
| Xylenes, total | ND | ND | **88 D03** | **85 D03** | 5 |
| 2-Butanone | 25 D03 | ND | ND | ND | N/A |
| Methyl tert-Butyl Ether | ND | ND | **32 D03** | **31 D03** | 10 |
| Toluene | ND | ND | **74 D03** | **71 D03** | 5 |
| Acetone | **350 D03** | **190 D03** | 47 D03 | 44 D03 | 50 |
| **Field Parameters** | | | | | |
| Ph | **13.14** | **13.05** | **12.95** | NA | 6.5 - 8.5 |

N/A - Not Applicable  ND - Non-detect
bgs - below ground surface  TICs - Tentitively Identified Compounds
Shading - Results above NYSDEC TOGS Objectives
B - Analyte was detected in the associated Method Blank.
D02 - Dilution required due to sample matrix effects
D08 - Dilution required due to high concentration of target analyte(s)
D10 - Dilution required due to sample color
QFL - Florisil clean-up (EPA 3620) performed on extract
QSU - Sulfur (EPA 3660) clean-up performed on extract
J - Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
PEI-MW-01D - Duplicate Sample

# TABLE 6
## HISTORIC LIME PILE SAMPLING ANALYTICAL RESULTS
## HOPKINS STREET SITE

| Program | Malcolm Pirnie (1) | | | | | | | | | | CHA (2) | PEI (3) | | NYSDEC | NYSDEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Location | South Lime Pile TP | | | | | North Lime Pile TP | | | | | N. Lime Pile | S.Lime Pile | N.Pile Toe | PART 375 | PART 375 |
| Sample Number | A-1 | A-2 | A-3 | A-4 | A-5 | B-1 | B-2 | B-3 | B-4 | B-5 | LP-1 | PEI-BH-04A | PEI-TP-11L | Commercial | Industrial |
| Sample Depth (ft) | 0 - 4 | 4 - 8 | 8 - 12 | 12 - 16 | 16 - 20 | 0 - 4 | 4 - 8 | 8 - 12 | 12 - 16 | 16 - 20 | Surface | Surface | 6 | ppm | ppm |
| Collection date | 12/8/1997 | 12/8/1997 | 12/8/1997 | 12/8/1997 | 12/8/1997 | 12/10/1997 | 12/10/1997 | 12/10/1997 | 12/10/1997 | 12/10/1997 | 7/13/2006 | 4/19/2010 | 4/14/2010 | | |
| Compound | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | (a) | (b) |
| | | | | | | | | | | | | | | | |
| **Metals** | | | | | | | | | | | | | | | |
| Aluminum | 5240 | 5480 | 4610 | 4870 | 6120 | 5380 | 4460 | 4920 | 4940 | 5300 | 3950 | 6090 | 7890 | N/A | N/A |
| Aresnic | 1.89 | ND | 2.01 | 3.18 | 7.34 | 2.91 | 3.07 | 3.58 | 2.32 | 2.23 | ND | 1 | 6.7 | 16 | 16 |
| Barium | 4.78 | 4.71 | 6.27 | 7.23 | 22.6 | 11.2 | 5.15 | 7.08 | 6.15 | 11 | 4.2 | 8.06 | 79.2 | 400 | 10,000 |
| Beryillium | 1.16 | 1.06 | 1.34 | 1.57 | 1.14 | 1.46 | 1.09 | 1.7 | 1.51 | 1.17 | 0.88 | 1.11 | 0.79 | 590 | 2,700 |
| Calcium | 476000 | 450000 | 459000 | 445000 | 436000 | 439000 | 461000 | 437000 | 421000 | 444000 | 508000 | 465000 | 279000 | N/A | N/A |
| Chromium | 3.06 | ND | 2.03 | 3.22 | 12.4 | 2.76 | ND | 3.85 | 4.33 | 15.3 | 2.9 | 3.2 | 11.3 | 400 | 800 |
| Copper | 6.13 | 5.46 | 5.12 | 5.95 | 9.2 | 5.69 | 5.92 | 4.9 | 9.66 | 7.77 | 3.6 | 3.8 | 11.3 | 270 | 10,000 |
| Iron | 1230 | 578 | 792 | 2430 | 10000 | 5520 | 1270 | 3130 | 4100 | 1430 | 1080 | 1850 | 15300 | N/A | N/A |
| Lead | ND | ND | ND | ND | 15.5 | ND | ND | ND | ND | ND | 3.6 | 5.4 | 18.3 | 1,000 | 3,900 |
| Magnesium | 557 | 316 | 374 | 464 | 612 | 502 | 416 | 431 | 678 | 594 | 323 | 485 | 1360 | N/A | N/A |
| Manganese | 37.6 | 11.8 | 9.49 | 48.6 | 210 | 67.2 | 27.2 | 50.8 | 64.2 | 21 | 47.9 | 39.1 | 261 | 10,000 | 10,000 |
| Nickel | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 4.4 | 4.26 | 8.72 | 310 | 10,000 |
| Selenium | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.4 | ND | 1500 | 6,800 |
| Silver | 3.07 | 3 | 3.04 | 3.2 | 3.35 | 3.14 | 3.05 | 3.02 | 3.03 | 2.88 | ND | ND | ND | 1,500 | 6,800 |
| Sodium | 155 | 189 | 165 | 123 | 209 | 136 | 191 | 125 | 211 | 158 | ND | ND | ND | N/A | N/A |
| Vanadium | ND | ND | 18 | ND | ND | ND | ND | ND | ND | ND | 11.2 | 4.06 | 15.3 | N/A | N/A |
| Zinc | 40 | 12.7 | 11.7 | 19.8 | 74.8 | 38.9 | 17.5 | 17.4 | 33.7 | 16.3 | 10.5 | 20.7 | 4.4 | 10,000 | 10,000 |
| | | | | | | | | | | | | | | | |
| **PCB's/Pest** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | ND | N/A | ND | 1 | 25 |
| | | | | | | | | | | | | | | | |
| **Semi-Volatile Organics** | | | | | | | | | | | | | | | |
| 2-methylnaphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.068 J | ND | ND | N/A | N/A |
| Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.190 BJ | ND | ND | 500 | 1,000 |
| | | | | | | | | | | | | | | | |
| **Volatile Organics** | | | | | | | | | | | | | | | |
| Methylene chloride | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.014 B | ND | 0.017 | 500 | 1,000 |
| Acetone | 0.059 | 0.097 | 0.061 | 0.018 | 0.011 | ND | 0.049 | 0.046 | 0.067 | 0.1 | 0.016 BJ | 0,024 | 0.089 | 390 | 780 |
| Trichlorofluoromethane | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.002 BJ | ND | ND | 500 | 1,000 |
| | | | | | | | | | | | | | | | |
| **Metals TCLP (Leachable)** | | | | | | | | | | | | | | | |
| Calcium (mg/L) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 816 | N/A | N/A | N/A | N/A |
| Magnesium (mg/L) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | <0.20 | N/A | N/A | N/A | N/A |
| | | | | | | | | | | | | | | | |
| **Wet Chemistry Analyses** | | | | | | | | | | | | | | | |
| Leachable Total Hardness (mg/L) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 14700 | N/A | N/A | N/A | N/A |
| Leachable Ammonia (mg/kg) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2.6 | N/A | N/A | N/A | N/A |
| Leachable Total Alkalinity (ug/g) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 14400 | N/A | N/A | N/A | N/A |
| Total Kjeldahl Nitrogen (TKN) (ug/g) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 210 | N/A | N/A | N/A | N/A |
| Total Cyanide (ppm) | 2.57 | N/A | N/A | N/A | N/A | 2.03 | N/A | N/A | N/A | N/A | 4.5 | N/A | N/A | N/A | N/A |
| Total Moisture Content (%) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 37.4 | 50 | 56 | N/A | N/A |
| Total Residue (103 deg C) (%) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 62.6 | N/A | N/A | N/A | N/A |
| Effective Neutralizing Value | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 3.25 | N/A | N/A | N/A | N/A |
| Corrosivity (pH) (S.U.) | 12.6 | 12.6 | 12.7 | 12.7 | 12.7 | 12.6 | 12.6 | 12.7 | 12.6 | 12.6 | 12.3 | N/A | N/A | N/A | N/A |

**Key:**

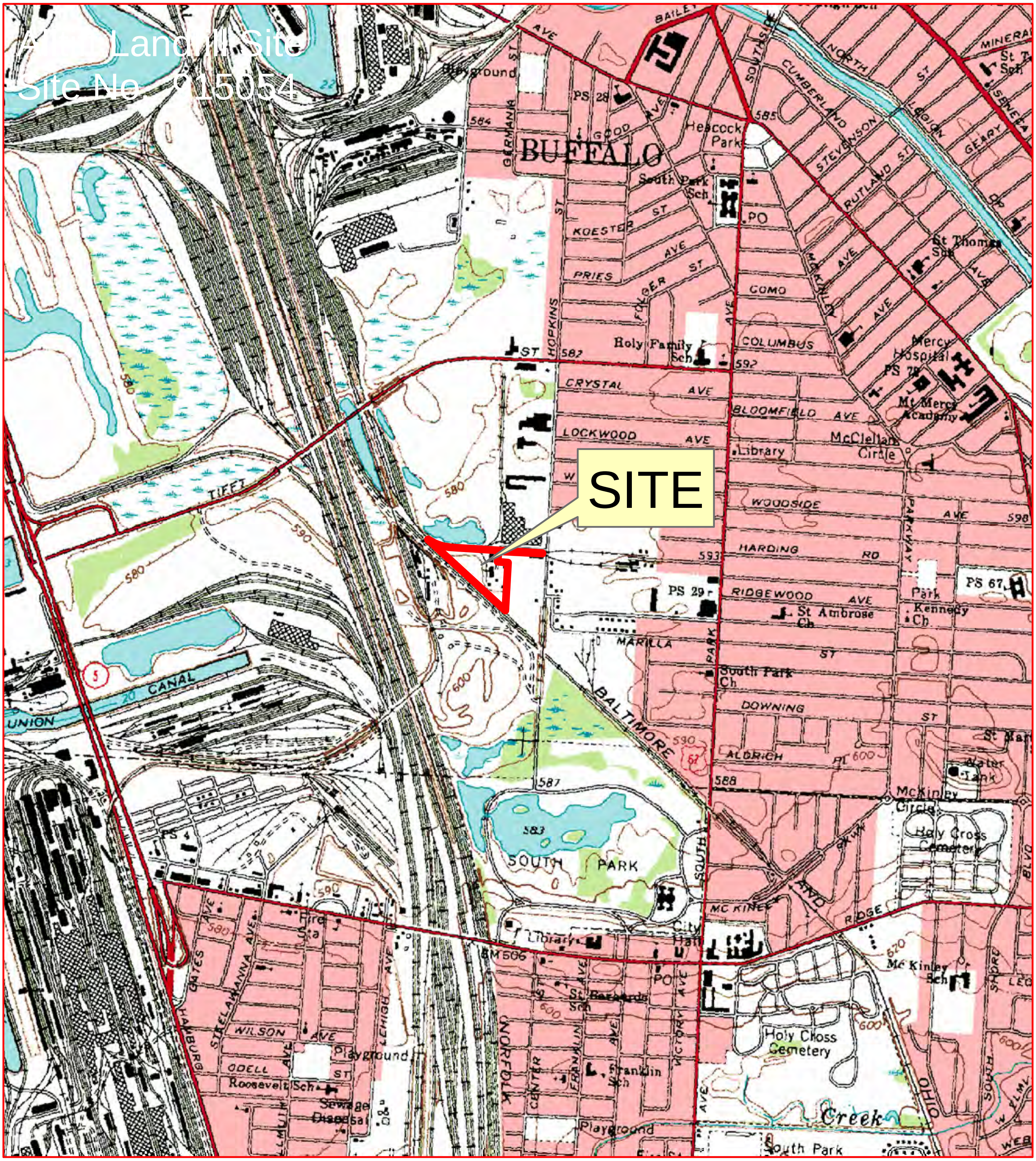
mg/kg - milligrams per kilograms (parts per million)
ND - Not Detected
J - The result is an estimated quantity
B - Analyte found in blank and in sample
(a) - Value exceeded this NYSDEC Commercial cleanup objective
(b) - Value exceeded this NYSDEC Industrial cleanup objective

ppm - parts per million
N/A - Not Applicable

**(1) - Malcolm Pirnie report - Characterization of City of Buffalo Hopkins Street Lime Piles - February 2, 1998**
**(2) - Clouch Harbour & Associates (CHA) Report - Lime Pile Investigation Summary - July 31, 2006**
**(3) - Panamerican Environmental Inc.- Remedial Investigation Report - September 2010**

**Malcolm Pirnie (1)**
**Lime Pile Sampling**
**Comparison of Analyses**

| Parameter | Lime Pile Sample Analysis (Percent) | Typical Carbide Lime Analysis (Percent) | Typical Commercial Hydrate Lime Analysis (Percent) |
|---|---|---|---|
| Free Carbon | 31 | 0.54 | 0.00 |
| Iron and Alumina Oxides | 0.89 | 2. | 0.64 |
| Magnesium Oxide | 0.046 | 0.07 | 0.91 |
| | | | |




0 1,200 2,400 3,600 4,800 Feet

N W E S

# Figure 1

## Site Location Map

90 Hopkins St. ERP Site
City of Buffalo, Erie Co.
Site No. E915181

DEPARTMENT OF ENVIRONMENTAL CONSERVATION • NEW YORK STATE •


# Figure 2

## Site Plan

90 Hopkins ERP Site
City of Buffalo, Erie Co.
Site No. E915181

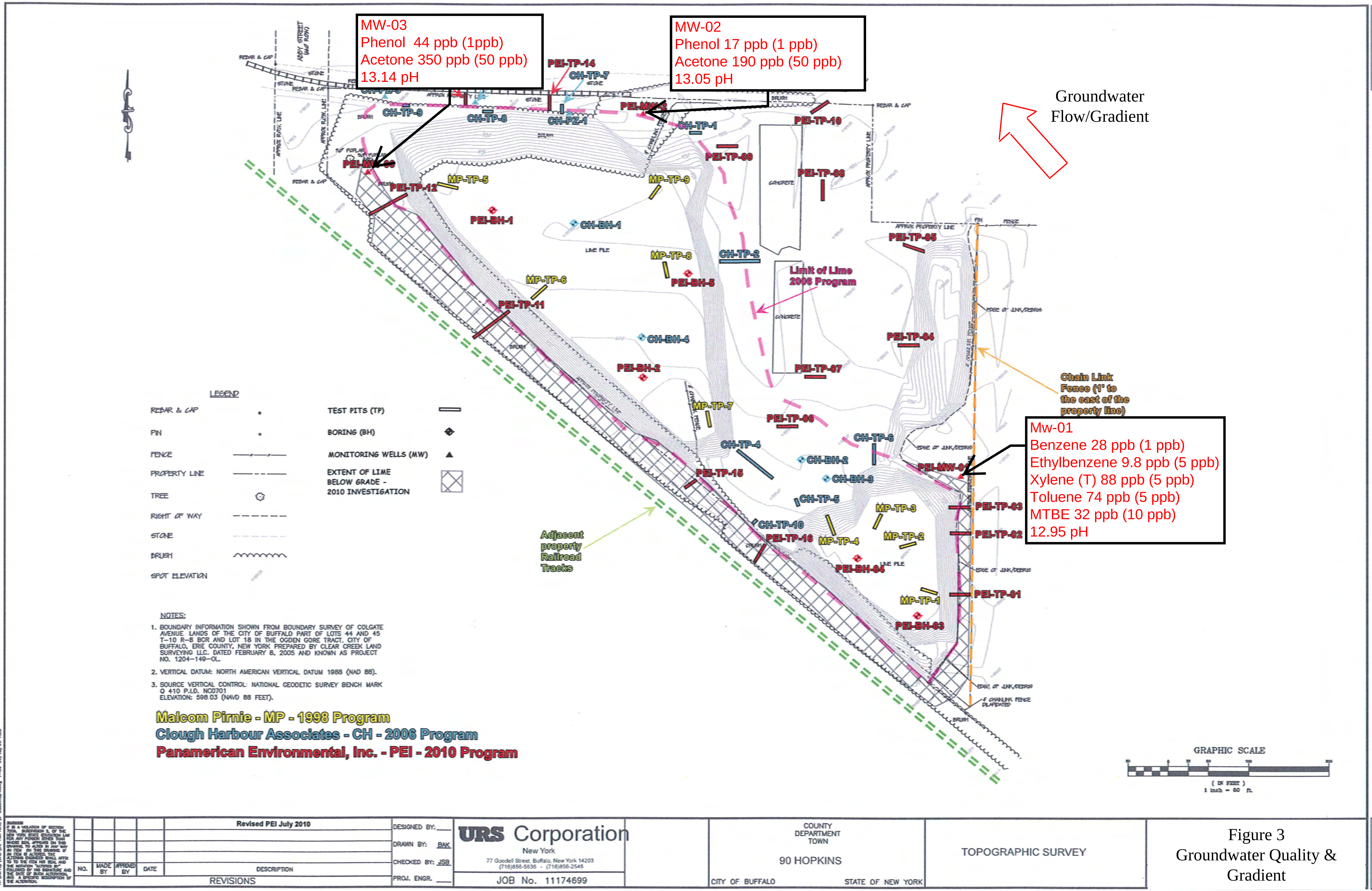
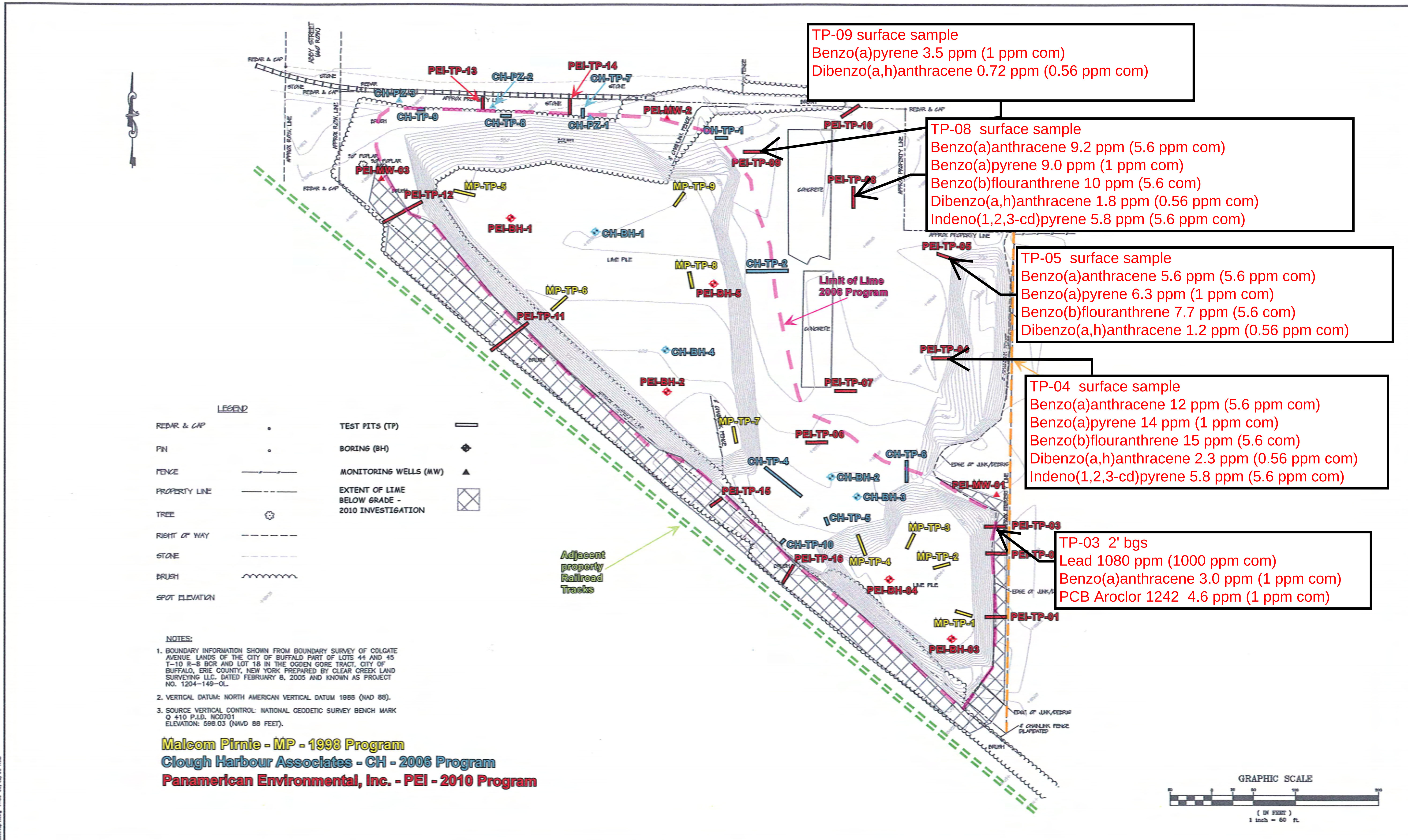



Figure 3
Groundwater Quality & Gradient




Revised PEI July 2010

| NO. | MADE BY | APPROVED BY | DATE | DESCRIPTION |
|---|---|---|---|---|

REVISIONS

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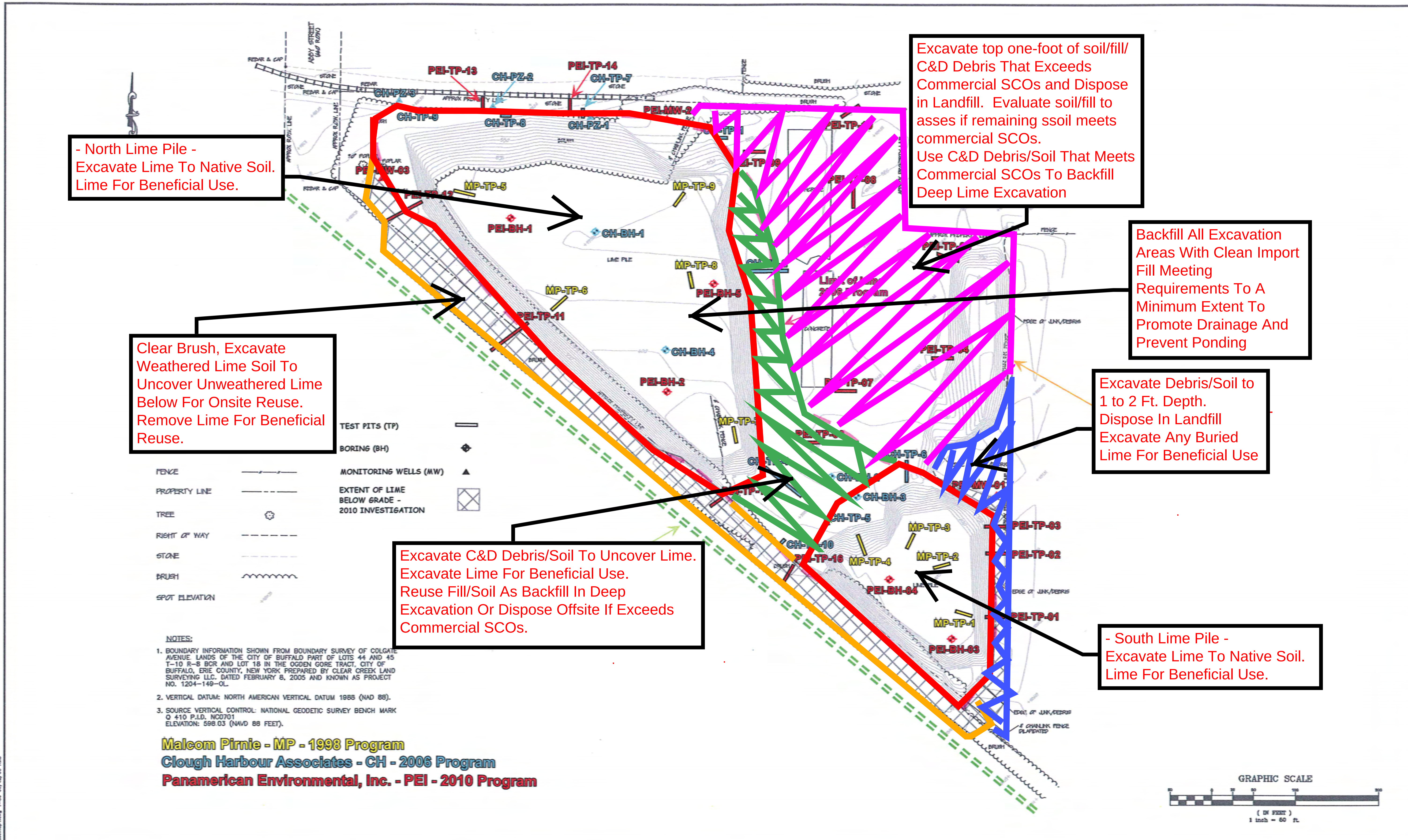
COUNTY
DEPARTMENT
TOWN
90 HOPKINS
CITY OF BUFFALO STATE OF NEW YORK

TOPOGRAPHIC SURVEY

Figure 4
Soil Contamination Above Commercial SCOs

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|---|---|---|---|---|
| | | | | Revised PEI July 2010 |

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TOPOGRAPHIC SURVEY

Figure 5
Alternative 5 Concept Plan