FINAL RCRA FACILITY INVESTIGATION REPORT

Former Bethlehem Steel Corporation Facility
Lackawanna, New York

PART I
EXECUTIVE SUMMARY

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RCRA FACILITY INVESTIGATION
FORMER BETHLEHEM STEEL CORPORATION FACILITY
LACKAWANNA, NEW YORK

FOREWORD

Tecumseh Redevelopment, Inc. ("Tecumseh") owns approximately 1100 acres of property located along the west side of Route 5, Lackawanna, New York (the "Tecumseh Property") comprising a significant portion of the former Bethlehem Steel Corporation – Lackawanna facility (referred to in this Foreward and in the Executive Summary as the "Site" and by various terms in the remainder of this document[1]) that was the subject of an Administrative Order on Consent (Docket No. II RCRA-90-3008(h)-0201) (the "AOC") entered into between Bethlehem Steel Corporation ("BSC") and the United States Environmental Protection Agency, dated August 13, 1990.

Subsequent to the entry of the Order, BSC filed for protection under the United States Bankruptcy Code and Tecumseh acquired the Tecumseh Property pursuant to an Asset Purchase Agreement that was approved by the United States Bankruptcy Court for the Southern District of New York on April 23, 2003 (Case No. 01-15288 (Jointly Administered)).

Tecumseh thereafter assumed the related cleanup obligations at the Tecumseh Property, including completion of this Final RCRA Facility Investigation Report (the "RFI Report"). Tecumseh, however is not the owner of several portions of the Site that were included in the scope of the AOC, including the manufacturing operations formerly owned by BSC on the east side of Route 5 (which are now owned in part by ISG Lackawanna, Inc. and in part by Republic Engineered Products, Inc.) and approximately 232 acres of property on the west side of Route 5 that were sold by BSC prior to the April 23, 2003 asset purchase agreement and which, upon information and belief, are currently owned by Gateway Trade Center, Inc. and Genesee & Wyoming, Inc.

[1] Terms used in the remainder of this document to refer to the facility that was the subject of the AOC include but are not limited to "Lackawanna site," "BSC Lackawanna site," "site," "Lackawanna property," "BSC facility," "Lackawanna Plant," "BSC Lackawanna, New York Facility, " and "Bethlehem Steel site."

As the field investigation for the RFI Report was completed by BSC before Tecumseh's acquisition of the Tecumseh Property, portions of this RFI Report may not draw a clear distinction between those areas that, while subject to the AOC and part of the Site, are neither owned nor operated by Tecumseh and that therefore are not Tecumseh's responsibility. To the extent that this RFI Report does include information regarding areas formerly owned by Bethlehem but not now owned by Tecumseh, this information is included for the benefit of EPA and shall not be construed in any way as an assumption of responsibility by Tecumseh for those areas or a waiver of any defenses or claims that Tecumseh may have relating to those areas outside of the Tecumseh Property.

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EXECUTIVE SUMMARY

ES1.0 INTRODUCTION

The former Bethlehem Steel – Lackawanna facility (the "Site") that was the subject of an Administrative Order on Consent (Docket No. II RCRA-90-3008(h)-0201) (the "AOC") entered into between Bethlehem Steel Corporation ("BSC") and the United States Environmental Protection Agency, dated August 13, 1990 is located on the eastern end of lake Erie and south of the City of Buffalo. A Site vicinity map is provided in Figure ES-1.

In 1988, on behalf of USEPA Region II, the USEPA National Enforcement Investigations Center (NEIC) conducted a RCRA Facility Assessment (RFA) of the Site. The investigation identified 104 Solid Waste Management Units (SWMUs) and six surface water bodies (watercourses) that received or could have received solid wastes containing hazardous constituents. These SWMUs and watercourses are shown on Figure ES-2.

On August 13, 1990, BSC and USEPA Region II entered into the AOC. In broad terms, BSC agreed to perform a RCRA Facility Investigation (RFI) to identify the nature and extent of any release(s) of hazardous constituents from the SWMUs to the environment and mitigate any emergency situations that might be discovered during the course of the investigation. No Interim Corrective Measures (ICMs) were prescribed by the 1990 Order.

The AOC allowed a phased approach to conducting the Site investigation. A Phased Site Investigation Work Plan, which provided the details for Phase I of the investigation, was developed with input from and approval by both the USEPA and the New York State Department of Environmental Conservation (NYSDEC). Five phases of investigation (Phases I, II-A, II-B, II-C and III) as well as four supplemental investigations (1999 Comprehensive Groundwater Investigation, 2000 Shoreline Investigation, 2000 Supplemental SWMU Investigation, and 2001 Supplemental Ecological Investigation) were performed.

The AOC also specified that Preliminary SWMU Assessments should be conducted concurrently with the phased RFI investigation. As such, a Preliminary SWMU Assessment Plan was included as an additional attachment to the AOC. Preliminary Assessment Reports for 86

SWMUs and six watercourses were submitted to and reviewed by the USEPA and NYSDEC between December 1988 and July 1992. On the basis of these reports, the Agencies determined that 59 SWMUs and one watercourse did not require further assessment under the RFI. Since 1992, Supplemental Assessment Reports have been prepared for the 27 SWMUs and five watercourses that did require further assessment by the Agencies as well as for the remaining 18 SWMUs not addressed in the original Preliminary Assessment Report submittals. The SWMU Assessment reports are provided in Parts V, VI, and VII of this RFI Report.

ES1.1 Site History

The Site has been used for iron and steel production since the beginning of the 20th century. Steel-making operations were discontinued by the end of 1983, and, by the mid 1990s, most of the steel-making facilities on the west side of Hamburg Turnpike (US Route 5) had been demolished. In September 2001, BSC's coke oven operation was closed leaving only a galvanized products mill operated by BSC at the Site. The galvanizing operations were acquired by ISG Lackawanna, Inc. pursuant to the asset purchase agreement that was approved by the Bankruptcy Court on April 23, 2003.

The Site's first steel-making facilities were built along the lakeshore. During the time of integrated steel-making operations, the Site area was extended into Lake Erie by placing blast furnace iron-making slag as well as open hearth furnace and basic oxygen furnace steel-making slag along the shoreline. As a result, approximately 440 acres of man-made land were placed into Lake Erie; this area is referred to as the Slag Fill Area (SFA). This land filling activity was conducted in an area of the lake that included two Federal Dumping Grounds used for dredge spoils and other materials by the U.S. Army Corps of Engineers (USACE) and possibly others. The locations of the SFA and Federal Dumping Grounds are shown on Figure ES-3.

BSC records and aerial photographs from 1938 to the present indicate that the SFA was also used for the management of waste materials, including sludges from wastewater treatment plants; sludges, dusts, and liquids from iron-making, steel-making, steel-forming, steel-finishing, and coke-making operations; and dredge materials from Smokes Creek. The SFA has also been the location of management areas for various other types of debris resulting from BSC's operations at the Site.

As shown on Figure ES-4, five SFA reclamation areas (zones) have been designated. Slag in Zone 1 is presently being reclaimed by Buffalo Crushed Stone. Zones 3, 5 and portions of 4 are designated to be reclaimed while Zone 2 is predominately waste management areas.

ES1.2 Site Investigations

During the RFI, five phases of investigation, as well as four supplemental investigations, were conducted by BSC. Work plans for each phase were developed with input from and approval by the USEPA and NYSDEC. Draft final reports were submitted to the USEPA and NYSDEC for Phase I, Phase II-A, and Phase II-B. The results of some portions of the Phase II-C investigation were presented to the USEPA in two reports on January 20, 1995 and April 17, 1995. A full summary of the data collected in Phase II-C was submitted to the USEPA on October 21, 1997. The results of the Phase III investigation were submitted to the USEPA in summary form on March 5, 1996. A complete summary of the data from Phase III was submitted to the USEPA on October 31, 1997.

During the RFI and pre-RFI investigations, 149 wells and 86 piezometers were installed throughout the Site. In addition, numerous soil, sediment, groundwater and surface water samples collected from SWMUs, watercourses and land surface were analyzed for a list of parameters agreed upon by BSC, USEPA and NYSDEC. The locations of the wells and piezometers are shown on Figures ES-7 and ES-8. SWMU sample locations and results are provided in the individual SWMU reports presented in Parts V and VI of this RFI Report. Sediment and surface water sample locations and results for the watercourses (Lake Erie, Smokes Creek, Blasdell Creek, the Gateway Metroport Ship Canal, and the North and South Return Water Trenches) are provided in the Watercourse Assessment Reports in Part VII. Although an individual assessment report has not been prepared for Lake Erie, surface water and sediment were sampled and the results discussed in the RFI.

ES2.0 SITE DESCRIPTION

ES2.1 Location and Setting

The Site comprises approximately 1,600 acres and is zoned for medium-density industrial use. The property extends a distance of about 2-1/2 miles from Blasdell Creek on the south to the Buffalo Outer Harbor on the north, and extends about 1 mile east from Lake Erie (see Figure ES-1). The Site is bordered by the New York State Route 5 (Hamburg Turnpike) on the east-northeast, except for a small portion of the Site that lies to the east of the turnpike. A residential area (Woodlawn) is located to the south of the Site.

The portion of the Site west of Route 5 and currently owned by Tecumseh Redevelopment currently consists mostly of unused or vacant land (see Figure ES-5 and Figure ES-6). There are no manufacturing operations on the Tecumseh Property, only some outside lumber distribution and slag reclamation facilities south of Smokes Creek operated by others under short-term license agreements. Light manufacturing, warehousing, distribution and transportation facilities are located at the northern and southern ends of the Site on land owned by Gateway Trade Center, Inc.

The portion of the Site east of Route 5 consists of two parcels totaling approximately 229 acres that are owned and operated by ISG Lackawanna and Republic Engineered Products, Inc. The ISG Lackawanna parcel contains steel cold rolling and finishing facilities. The Republic parcel contains steel bar rolling facilities.

In general, the Site topography is relatively flat, with slopes of only a few feet per mile. Within the Site, the only slopes of any consequence are primarily "man-made" and occur in the SFA.

The Site area has a humid continental climate with warm summers and relatively long, cold winters. Precipitation is generally evenly distributed throughout the year, with slightly higher average precipitation rates from September through December. Normal annual total precipitation is approximately 36 inches, including normal annual snowfall of around 90 inches.

ES2.2 Ecological Setting

Including the SFA, approximately one-half of the Site is not vegetated due to the presence of buildings, foundations, concrete pads, coal piles, roads, railroad tracks and slag fill. The remainder of the Site is vegetated primarily by grasses, shrubs and small trees. Almost all of the vegetated areas are in a very early stage of succession, lack substantive diversity and are low quality habitats.

The Site is located within the Erie-Niagara River basin. Viable aquatic habitats in the vicinity of the Site include Smokes Creek, Blasdell Creek, and Lake Erie. Several State wetlands are located within 2 miles of the Site.

ES2.3 Demography and Land Use

Current ownership of the Site is identified on Figure ES-6. Land use surrounding the Site includes residential, light and heavy industrial-commercial properties, and several public use areas.

Nearby residential areas include the community of Woodlawn located south of the Site and adjacent to Blasdell Creek, and several areas east of Route 5 and north of the ISG Lackawanna operations (the "Galvanized Products Division"). Numerous small commercial businesses are located offsite along Route 5 east and south of the Site.

Public recreational areas include two beaches within 2 miles of the Site, and two marinas north and within 1 mile of the Site. Fishing and boating activities are also common offshore of the Site in Lake Erie.

ES2.4 Regional Geology and Hydrogeology

The Site is located in the Erie-Ontario Lake Plain Physiographic Province of Western New York. The geology of the Erie-Niagara basin is described as consisting of unconsolidated

deposits (predominantly of glacial origin) overlying Silurian- and Devonian-age sedimentary bedded or layered bedrock. The naturally occurring unconsolidated deposits in the area consist of the following three general types: (1) alluvial silt, sand, and gravel deposited during comparatively recent geologic time; (2) lacustrine sediments composed primarily of silt, sand, and clay deposited during the late Pleistocene Epoch; and (3) glacial till, a heterogeneous mixture of particles (i.e., clay, silt, sand, gravel, and cobbles) deposited directly from glacial ice during the Pleistocene Epoch. Relief in the area is generally flat and the result of pre-glacial erosion of bedrock and subsequent topographic modification by glaciation.

The bedrock formations in the region dip to the south at about 30 to 40 feet per mile and exhibit only very gentle folding. In the Erie-Niagara Basin, the major areas of groundwater are in glacial sand and gravel deposits and limestone and shale bedrock. The main sources of groundwater within the bedrock are fractures and solution cavities.

The quality of groundwater in the vicinity of the Site is generally fair with moderate levels of hardness (250-500 parts per million [ppm]), sulfate (100-500 ppm) and chloride (100-500 ppm). The entire area within 3 miles of the Site is served by municipal water companies that acquire their drinking water from Lake Erie.

ES2.5 Site Geology

As noted previously, slag fill deposits cover much of the Site, particularly near the lake. Below the fill, the natural surficial geology of the Site is composed principally of lake sediments consisting of silty sands that are underlain by lacustrine silts and clays and glacial till. Peat is also occasionally found between the sand and fill. Lying below the till is bedrock, which is composed mostly of dark gray and black fissile shale. A gray limestone has also been encountered in several of the borings drilled to bedrock.

The fill unit, which contains the SFA, covers the entire Site west of Route 5 and consists of iron-making and steel-making slag, dredge spoils, cinders, coke, ashes, and brick and steel construction debris generated from historic BSC activities combined with granular fill soils. The thickness of the fill is extremely variable; high ridges of fill more than 100 feet thick are present

along the Lake Erie shoreline at the northwest corner of the Site, thinning to a few feet near Route 5.

ES2.6 Site Groundwater Regime

The Site's hydrogeology is dominated by its lakeshore setting and the characteristics of the Site's subsurface materials. Slag and other fill placement on the Site has created an extensive man-made surficial fill unit. The fill is underlain by a natural sand unit ranging in thickness from approximately 0 to 20 feet. The lower, saturated part of the fill, along with the entire natural sand unit, comprises a low-yield, shallow, unconfined water table groundwater unit. Its saturated thickness ranges from 10 to 30 feet. The water table unit is underlain by an aquitard consisting of silt, clay and till units that together range in thickness from 2 feet to more than 50 feet. Below this aquitard is a confined and saturated groundwater unit within the uppermost part of the bedrock. This unit is assumed to discharge into Lake Erie.

In general, groundwater flow in the water table aquifer (fill and sand units) is generally east to west across the Site toward Lake Erie and also locally toward Smokes Creek, Blasdell Creek, the Gateway Metroport Ship Canal and the Union Ship Canal. Groundwater elevations, contour lines and flow paths as determined by the most recent round of Site-wide groundwater monitoring (November 20, 2001) are presented on Figure ES-7 and ES-8 for the fill and sand units, respectively.

ES2.7 Groundwater Recharge and Discharge

Recharge to the Site water table is from rainfall and snowmelt. Most of the Site precipitation evaporates or infiltrates to the subsurface. Site runoff is minimal and, if present, is eventually intercepted by one of the surrounding water bodies (Blasdell Creek, Smokes Creek, the Gateway Metroport Ship Canal, the Union Ship Canal, Lake Erie or the Buffalo Outer Harbor. Recharge for the Site is estimated at 1.25 feet/year. This value has been used for calculations of groundwater discharge and chemical loading to the surface water bodies.

Local flow patterns indicate discharge areas that provide groundwater flow into the following surface water bodies: Lake Erie, Blasdell Creek, Smokes Creek, Gateway Metroport Ship Canal and the Union Ship Canal. Several groundwater divides and flow boundaries exist within the Site, based on analysis of the piezometric surface. These create six distinct discharge areas, as shown on Figure ES-9. In addition, several offsite recharge areas that contribute flow to the Site have been identified.

Groundwater discharge rates into the surface water bodies were calculated by multiplying the area discharging into each water body by the annual recharge rate.

ES2.8 Horizontal and Vertical Hydraulic Gradients

The average westward horizontal hydraulic gradient calculated for the water table surface at selected locations along the western perimeter is about 0.0029 foot per foot (ft/ft), based on November 20, 2001 water level measurements in monitoring wells screened in the fill. Lower gradients are observed at the northern end of the Site; these values decrease to 0.0012 ft/ft and 0.00013 ft/ft in the vicinity of MWN-5A and MWN-6A, respectively. Hydraulic gradient calculations for wells screened in the sand unit average 0.0026 ft/ft but decrease to 0.0003 ft/ft near MWN-6A in the northwest corner of the Site.

Localized areas of anomalously high groundwater elevations that exist in the Coke Oven Area, the Acid Tar Pit (ATP) area, and near SWMU S-23 (see Figure ES-7) are at least in part due to reduced hydraulic conductivity associated with waste or fill materials in the subsurface. However, localized areas with higher horizontal hydraulic gradients were not used in estimating the Site-wide averages.

ES2.9 Hydraulic Conductivity and Flow Velocities

Pumping tests and/or slug tests of the majority of the monitoring wells provided data on the hydraulic conductivity of the various stratigraphic units present at the Site. Well testing results were critically reviewed and deemed acceptable only if they met the following criteria: (1)

the length of the test was greater than 0.5 minute and (2) the well screen penetrated only a single stratigraphic unit.

The arithmetic mean hydraulic conductivity value for the fill is 2.04×10^{-2} cm/sec. The arithmetic mean hydraulic conductivity of the sand is an order of magnitude lower at 2.02×10^{-3} cm/sec.

The arithmetic mean hydraulic conductivity of the clayey silt, peat and bedrock are 2.18×10^{-5} cm/sec, 2.49×10^{-5} cm/sec and 1.87×10^{-2} cm/sec, respectively.

The average westward (horizontal) hydraulic gradient for the fill and sand units is 0.0029 ft/ft and 0.0026 ft/ft, respectively. The average westward velocity in the fill portion of the water table is 1.97×10^{-4} cm/sec (0.6 ft/day). The average westward velocity in the sand is approximately 1.73×10^{-5} cm/sec (0.05 ft/day), which reflects its lower hydraulic conductivity.

ES2.10 Site Surface Water Regime.

The Site is bounded on three sides by surface waters: on the south by Blasdell Creek, on the west by Lake Erie, and on the north by the Buffalo Outer Harbor (see Figure ES-2). In addition, the Site is divided into north and south areas by Smokes Creek. The north area also contains three man-made watercourses: the Gateway Metroport Ship Canal, the North Return Water Trench (NRWT), and the South Return Water Trench (SRWT).

ES2.10.1 Lake Erie

The western boundary of the Site along Lake Erie is approximately 13,000 feet in length. The historic mean annual lake elevation is approximately 571 feet. Wind-driven circulation in Lake Erie results in a generally west-to-east near-surface flow along the shoreline of the Site. Discharges from groundwater and surface water to the lake generally are carried by coastal currents in an area generally limited to one quarter of a mile from the shoreline.

ES2.10.2 Smokes Creek

Smokes Creek, which flows east to west through the Site, discharges into Lake Erie (see Figure ES-2). Within the Site, the creek's average dimensions are 100 feet wide by 10 feet deep. Local topography is fairly flat, resulting in a low gradient. Periodic dredging of the creek has occurred to remove sediments that constricted flow. In the 1960s, BSC, in cooperation with the USACE, completed the Smokes Creek Flood Control Project, which included straightening the westernmost 2,500 feet of the creek. Nominal discharge of the creek averages 32 million gallons per day (mgd) at the Route 5 Bridge. Non-contact cooling water flows, treated process wastewater flows and dilution water pumped from the Gateway Metroport Ship Canal or the Buffalo Outer Harbor from State Pollution Discharge Elimination System (SPDES) outfalls and the SRWT increased flow in the creek to an average of 107 mgd, prior to the shut down of the coke ovens in 2001.

Smokes Creek continues to receive SPDES permitted discharges only from Galvanizing Mill and REP facility operations east of NY State Route 5 but they are diminished since the shutdown of the coke ovens. Pumping dilution water from the Gateway Metroport Ship Canal to the creek was discontinued after September 2002.

ES2.10.3 Blasdell Creek

Blasdell Creek flows through the south end of the Site and is from 15 to 35 feet wide and from 2.5 to 5 feet deep (see Figure ES-2). It has a low gradient and an average flow of about 32 mgd. Prior to 1970, the creek received discharges of process water, non-contact cooling water and other discharges from the Galvanizing Mill and BSC's 13-inch Bar Mill (now owned by REP). Recent discharges consist of non-contact cooling water and treated process water from the Galvanizing Mill and REP's 13-inch Bar Mill. The SPDES discharges to the creek related to steel making operations on the east side of Route 5 in 2000 averaged about 2.75 mgd.

ES2.10.4 Gateway Metroport Ship Canal

The Gateway Metroport Ship Canal is located at the northern end of the Site (Figure ES-2). Built in 1903, it is about 4,000 feet long and 200 feet wide and was used to load and unload cargo in support of facility operations. From the early 1920s until 1970, the canal received process wastewaters from the BSC's Coke Division operations. In addition, for a short period in the early and late 1970s, blast furnace wastewater was discharged into the south end of the canal. The canal also received discharges of steam condensate and non-contact cooling water through permitted SPDES outfalls. After the shutdown of the BSC coke ovens in 2001, all SPDES outfall discharges to the canal ceased.

Historically, water was pumped from the canal to supply the majority of the facilities "plant" water needs (up to 70 mgd). However, as of September 9, 2002, all pumping from the canal ceased.

ES2.10.5 North and South Return Water Trenches

The NRWT and SRWT are man-made channels that historically have received process wastewater and non-contact cooling water from plant operations (see Figure ES-2). After steel-making operations were discontinued in 1983, all process-related discharges to the SRWT also ceased. Discharges of some SPDES-permitted outfalls continued in the NRWT until 2001 when the BSC coke oven operations were shut down.

ES2.11 Groundwater-Surface Water Relationships.

All groundwater associated with the Site discharges into the surface water bodies located within the Site or along its boundaries (see Figure ES-9). The surface water runoff to Site surface water bodies is minimal because of the flat and permeable nature of the land surface.

ES2.11.1 Lake Erie

Direct groundwater discharge to Lake Erie from the Site is from onsite Discharge Areas 1, 2A, 4A, and 4B, and offsite recharge Area A located east of Route 5 (see Figure ES-9). Indirect groundwater discharge to the Lake is via Smokes and Blasdell Creeks and the Gateway Metroport Ship Canal. The total direct groundwater discharge to Lake Erie is approximately 1.32 cubic feet per second (cfs) or 593 gallons per minute (gpm), as estimated from recharged-based calculations.

ES2.11.2 Smokes Creek

Direct groundwater discharge to Smokes Creek from the Site is from Discharge Areas 2B, 3 and 3A (see Figure ES-9). The total groundwater discharge to Smokes Creek, approximately 263 gpm, as estimated from recharge-based calculations, is a small percentage (less than one percent) of the total flow in Smokes Creek.

ES2.11.3 Blasdell Creek

Groundwater discharge into Blasdell Creek comes from Discharge Area 1A west of Route 5 and Recharge Area C located within the former BSC facilities east of NY State Route 5. Groundwater discharge to Blasdell Creek was calculated to be approximately 0.42 cfs (approximately 189 gpm).

ES2.11.4 Gateway Metroport Ship Canal

Groundwater discharge into the Gateway Metroport Ship Canal from Discharge Areas 5 and 6 is estimated to average approximately 0.26 cfs (approximately 117 gpm). Most of this groundwater flows from the east side of the canal, which is recharged by a much larger area than the west side of the canal. Hence, only an average of about 0.04 cfs (19 gpm) is estimated to flow through the western canal sheet-pile wall.

In addition to onsite sources of recharge to Area 6, an offsite area of approximately 68 acres east of NY State Route 5, known as Recharge Area B, provides recharge to Area 6. Assuming an annual recharge of 1.25 foot, the estimated average recharge from this offsite area is approximately 0.117 cfs or 52.7 gpm. A significant portion of this recharge contribution and the recharge from the eastern portion of Discharge Area 6 would be expected to discharge into the NRWT and the northern-most portion of the SRWT.

Prior to the shut down of the coke ovens in September 2001, approximately 75 mgd were withdrawn from the Gateway Metroport Ship Canal primarily for use as non-contact cooling water. At that time, approximately 11 percent of this amount was returned to the canal via SPDES discharges; the resulting net withdrawal was primarily compensated for by inflow from the Buffalo Outer Harbor. For a period following the shut down of the BSC coke ovens, approximately 50 mgd was withdrawn from the canal and discharged to SPDES Outfall 223 to meet dilution agreements with Erie County Sewer District No. 6. Subsequent to September 2002, no water is withdrawn from or discharged to the Gateway Metroport ship Canal via SPDES permitted outfalls.

ES2.11.5 North Return Water Trench

The fluid level in the NRWT is consistently lower than the adjacent groundwater table (see the NRWT Watercourse Assessment Report in Part VII of this RFI Report). As a result, there is little likelihood of discharge from the trench to the surrounding groundwater. The trench is believed to intercept most of the flow of groundwater that enters the Site from the east of the trench (Discharge Area 6 and Offsite Recharge Area B). However, this cannot be verified because of the buried nature of the trench and the general absence of flow data related to the trench. Because of this uncertainty, all of the flow from Discharge Area 6 and Recharge Area B is assumed to flow to the Gateway Metroport Ship Canal and this total was used in calculating groundwater discharge to the eastern wall of the canal.

ES2.11.6 South Return Water Trench

Although the SRWT is not lined along its entire length, historic groundwater data from areas adjacent to the trench indicate that the flow level in the trench is consistently lower than that of the surrounding groundwater table. This suggests that groundwater from the area around the trench flows into the trench and then into Smokes Creek. For this reason, discharge from the trench into the groundwater is unlikely. As with the NRWT, this trench is believed to intercept most of the groundwater flow from areas east of the trench. The portion of the flow in the trench that is attributable to groundwater is uncertain. However, this uncertainty does not affect the recharge-based approach used to estimate groundwater discharge to surface water bodies, because groundwater flow through the trench ultimately ends up in Smokes Creek, along with the rest of the groundwater flow from Discharge Area 3.

ES3.0 GROUNDWATER, SURFACE WATER AND SEDIMENT QUALITY

ES3.1 Nature and Extent of Contamination

ES3.1.1 SWMU Materials

The source of chemical constituents found in groundwater, surface water and sediments at the Site may be attributed to waste materials historically discharged from or stored at the facility, and to the presence of contaminated dredge spoils imported to and placed beneath the western portion of the Site by the USACE. In the RFA, the USEPA identified 104 SWMUs and six watercourses at the Site that could have contributed contaminants to the environment. Of these, 59 SWMUs and one watercourse were granted "no further assessment" status based on assessment reports. Forty-five SWMUs and five watercourses were investigated during the phased RFI and the analytical results were subjected to a Tier 1 risk assessment. The Human Health Risk Assessment (HHRA) identified a number of Chemicals of Potential Concern (COPCs). These COPCs were subsequently evaluated to determine if they have the potential to impact groundwater and, eventually, surface water quality at the Site.

The COPCs identified in the Site's SWMU materials include metals, chlorinated volatile organic compounds (VOCs), petroleum VOCs, and volatile and semivolatile organic compounds

(SVOCs). Chlorinated VOCs are limited to SWMU material south of Smokes Creek in the area within and downgradient of the ATPs, while benzene, toluene, ethylbenzene and xylenes ("BTEX"), and volatile SVOCs are found concentrated in SWMU material associated with several ATPs (S-11, S-22 and S-24), the Benzol Yard (P-11) and the Tank Farm area (P-74 and P-75) (see Figure ES-2).

ES3.1.2 Groundwater

VOCs, predominately BTEX, are widely distributed in groundwater across the Site with the highest concentrations found in the ATPs and Benzol Yard. In both the ATPs and Benzol Yard, these same COPCs were identified at elevated concentrations in subsurface SWMU material. Benzene is typically the most common VOC chemical; it is usually found at 10 times the concentration of other BTEX compounds. The highest concentrations of benzene found in the groundwater at the ATPs and Benzol Yard area were 140,000 micrograms per liter (µg/L) and 570,000 µg/L respectively.

Concentrations of benzene in the groundwater decrease relatively quickly due to natural attenuation as the groundwater migrates from these SWMUs. In monitoring well pairs nearer the shoreline, total BTEX concentrations are typically less than 100 µg/L and tend to be higher in the sand unit than in the fill unit. Low levels of BTEX (nondetect to 12 µg/L) were also detected in bedrock wells near the shoreline.

Chlorinated VOCs in groundwater were detected at much lower concentrations and are present throughout Slag Fill Zone 2 and in the vicinity of SWMUs S-16 (HWM-1A/Lime Sludge Landfill) and S-23 (Sludge Tar Pit) within Slag Fill Zone 4. Elevated concentrations of chlorinated VOCs were detected in wells adjacent to the ATPs (S-11 and S-22), where they are also present at elevated concentrations in subsurface SWMU material. Fewer detections of chlorinated compounds were apparent in the deeper sand unit wells and no chlorinated compounds were detected in the bedrock wells.

SVOCs are primarily associated with coal tar generated from the processing of coke oven gases and petroleum products from steel-finishing and other manufacturing operations. These

compounds tend to be less soluble and therefore less mobile in groundwater than the volatile organic compounds discussed above. Specific SVOC constituents and groups of compounds detected in SWMU materials and Site groundwater include phenolic compounds, and polycyclic aromatic hydrocarbons (PAHs).

The occurrence of SVOCs in groundwater is widely distributed across the Site in both the fill and underlying sand unit, with naphthalene being the most commonly detected SVOC. Highest concentrations of SVOCs in groundwater were observed in the ATPs and Benzol Yard area with slightly lower concentrations associated with SWMUs nearer the lake shoreline and the Tank Farm area. Higher concentrations of SVOCs, particularly, phenolic compounds, were generally detected in the deeper (sand unit) groundwater samples.

Of the 11 heavy metals detected in groundwater collected during the comprehensive sampling event (1999-2000), six metals were also identified as COPCs in the Site's SWMU materials. Several of these metals, including arsenic (65% of samples), chromium (96% of samples) and lead (44% of samples), are groundwater COPCs and were found to be widely distributed in groundwater samples. Concentrations of these metals were also identified in upgradient monitoring wells (MW-07 and MW-08) located near NY State Route 5.

Free product and sheens in groundwater have generally been limited to certain discrete areas at the Site. These include the Benzol Plant, the ATPs, and several SWMUs in SFA Zone 4.

ES3.1.3 Distribution of Contaminants in Surface Water Bodies

Numerous surface water and sediment samples were collected throughout the RFI to characterize surface water and sediment quality. Based on the data collected and other factors, a HHRA and an Ecological Risk Assessment (ERA) were conducted on all of the surface water bodies. The HHRA identified COPCs and the ERA established Chemicals of Potential Ecological Concern (COPECs) by evaluating detected Chemicals of Potential Interest (COPIs) against appropriate screening criteria.

Background samples collected from Lake Erie locations south of the Site (upstream) show no VOCs detected in the surface water and sediments. Several SVOCs and metals were detected at low concentrations in these background samples. Samples collected from "off-site" sampling locations in the Buffalo Outer Harbor, north of the Site, showed several VOCs, SVOCs and metals at low concentrations. Samples collected from Lake Erie adjacent to the Site showed one VOC, in surface water near the mouth of Smokes Creek, and several SVOCs and metals with concentrations that were highest near the mouth of Smokes Creek. Most of the detected parameters were COPCs and/or COPECs.

Samples collected from Smokes Creek showed several VOCs detected in the surface water and sediment samples. Benzene was detected in most surface water samples and two sediment sample locations in Smokes Creek at low concentrations. SVOCs and metals were also detected in the surface water and sediment at most sampling locations in Smokes Creek. Concentrations of SVOCs in Smokes Creek surface water samples were generally less than 1 µg/L, but ranged from 70 micrograms per kilogram (µg/kg) to 190,000 µg/kg in the sediments. Heavy metals were detected in Smokes Creek surface water and sediment from all but one of the sampling locations. In general, the concentrations for all parameters detected in the upstream (i.e., background) sampling location were similar to those downstream except for one sampling location immediately downstream from the ATPs in Smokes Creek that had significantly elevated SVOC concentrations. Most of the parameters detected in Smokes Creek were COPCs and/or COPECs.

Only one VOC (1,1-dichloroethane), a COPEC, was detected in surface water at one sampling location in Blasdell Creek. No VOCs were detected in any of the sediment samples in Blasdell Creek.

SVOCs were not detected in any of the Blasdell Creek surface water samples. From 7 to 16 SVOCs were, however, detected in all but one of the Blasdell Creek sediment sampling locations, with concentrations ranging from 44 to 46,000 µg/kg. The highest concentrations were at a sampling location near the BSC Cold Mill and former 13-inch Bar Mill. All of the detected SVOCs were COPECs and about one-half were COPCs.

Only a limited number of COPC and COPEC metals (i.e., arsenic, barium, lead and mercury) were detected in surface water samples in Blasdell Creek. A greater number of metals were detected at all sediment sampling locations, including a location upstream of BSC plant operations. Upstream concentrations of metals were similar to those found in downstream locations.

Only one VOC, benzene, was detected in Gateway Metroport Ship Canal surface water samples and only in two sampling locations; the maximum concentration was 1.0 µg/L. No VOCs were detected in Gateway Metroport Ship Canal sediments. Two SVOCs were detected in surface water at several of the sampling locations and 17 to 20 SVOCs were found in every sediment sampling location. Concentrations of the SVOCs in sediment ranged from 44 µg/kg to 46,000 µg/kg with the highest concentrations found about midpoint in the canal. Heavy metals found in the Gateway Metroport Ship Canal surface water and sediments include arsenic, barium, chromium and lead. Metals concentrations were highest at the south end of the canal, with lead having the highest detected concentration at 842 mg/kg. All of the VOCs, SVOCs and some of the metals were COPCs. There were no COPECs identified for the Gateway Metroport Ship Canal surface water or sediment as there are no complete exposure pathways due to a recent dredging of the canal.

Sampling results for the North and South Return Water Trenches showed two VOCs present in the surface water of the NRWT and one in the surface water of the SRWT. No SVOCs were found in either trench in the surface water, but three metals were present. Sampling results for the sediment in the trenches detected one VOC, 10 to 16 SVOCs and up to eight heavy metals. Most of the analytes detected were COPECs. There were no COPCs identified for surface water in either trench, and none for SVOCs in sediment in the SRWT.

ES3.2 Contaminant Fate and Transport

This RFI has identified 38 SWMUs that are recommended for further evaluation, several of which represent major sources of past and on-going release of contaminants to on-site groundwater and to on-site and adjacent water bodies. The predominant types of contaminants found in groundwater and SWMU materials at the Site are BTEX, PAHs and several metals (i.e.,

lead, arsenic, thallium, barium, iron and chromium). An additional potential source of these contaminants is the dredge spoils dumped by the USACE.

The total mass of contamination present at the Site is divided mainly between the mass contained within the major source areas (i.e., SWMUs in sludges, wastes, or residual product within the soil/fill) and the mass that migrated from the sources into the saturated and unsaturated subsurface zones. The contaminant mass within the source areas is predominantly a function of the disposal practices and is likely to be significant. The mass present in the subsurface strata is divided into mass adsorbed within the soil, mass dissolved in the ground water and mass present in the soil gas. The contaminant mass within the soil gas is generally considered negligible in comparison with the other two. The Site conditions of relatively high organic carbon content and very high pH are likely to result in the subsurface contaminant mass being predominantly contained within the soil and fill, as an adsorbed phase.

Contamination has migrated from the source areas through a variety of mechanisms. Contamination associated with surface soils and fill travels as fugitive dust and surface runoff. The surface runoff flows into the local surface water bodies, such as Lake Erie and Smokes Creek. The fugitive dust is also carried into the surface water, in addition to being dispersed on land. Volatile organic contaminants in the subsurface unsaturated soils move as a gas-phase, following volatilization into the soil gas, and eventually reach the atmosphere. Water soluble organic and inorganic contaminants in the unsaturated zone migrate downward towards the water table, carried by the infiltrating rainwater. Once it is within the saturated zone, the contaminants migrate as a dissolved-phase plume within the water-bearing zone, and eventually reaches the surface water bodies, where it is mixed and dispersed.

Contaminants from the Site flow into Lake Erie and the other surface water bodies surrounding the Site. However, because the Site is located in an old industrial region which used to contain numerous industries, it is not clear what part of the surface water contamination is directly attributable to the Site, and what part is the result of other sites or the general anthropogenic background levels.

Organic contaminants within the water-bearing zone at the Site undergo biodegradation. However, it is not clear whether this process is viable enough to significantly affect contaminant levels. Metals contamination can be considered to be essentially non-degradable but is also naturally attenuated in soil by various processes.

ES3.3 Constituent Loadings to Surface Waters

Estimates of groundwater loadings to surface water bodies were calculated using recharge-based groundwater discharge rates and concentrations of constituents detected during the most recent, comprehensive groundwater sampling event (1999-2000).

Groundwater constituent loadings to Lake Erie are dominated by metals, especially along the shoreline north of Smokes Creek. Estimated loadings of heavy metals are 1,331 lbs/yr and are primarily composed of barium (1,244 lbs/yr). Organics loading consists of 210 lbs/yr of SVOCs (primarily naphthalene) and 43 lbs/yr of VOCs (primarily BTEX compounds). Total phenolics and total cyanide are also estimated to be discharged to the lake at an average rate 43 and 21 lbs/yr, respectively.

Estimated average annual loadings to Blasdell Creek consist of approximately 15 lbs/yr of heavy metals (mostly barium). Estimated loadings for VOCs, SVOCs and cyanide are insignificant because none were detected in any samples taken in Blasdell Creek.

Constituent loadings to Smokes Creek along the south bank consist primarily of VOCs (mainly BTEX) whereas loadings along the north bank consist mainly of SVOCs, dominated by naphthalene. Total VOC loadings to the creek are estimated at 1,508 lbs/yr and SVOCs are estimated at 202 lbs/yr. Heavy metals, consisting mostly of barium, are discharged at an estimated rate of 31 lbs/yr. Loadings of total cyanide are approximately 2 lbs/yr.

Constituent loadings to the Gateway Metroport Ship Canal consist mainly of VOCs (81 lbs/yr) dominated by benzene (75 lbs/yr). SVOCs loadings are estimated to be 8 lbs/yr and

consist primarily of naphthalene. Heavy metals and cyanide are estimated at 18 and 12 lbs/yr, respectively.

ES4.0 ECOLOGICAL RISK ASSESSMENT

A Tier 1 and Tier 2 Ecological Risk Assessment (ERA) was conducted for the Site as part of the RFI. The ERA was conducted to determine the potential for adverse effects posed to wildlife and community receptors from Site-related constituents in soil, sediment, and surface water.

The ERA discussed the ecological investigation that was conducted as part of the RFI. It focused on the potential impacts to the terrestrial ecosystem within the SFA and the aquatic ecosystem of the six water bodies that may have been impacted by BSC operations: Lake Erie, the Gateway Metroport Ship Canal, Smokes Creek, Blasdell Creek, and the North and South Return Water Trenches. The process area of the Site was not evaluated in the ERA because that portion of the plant includes industrial or former industrial areas with limited habitat.

ES4.1 Terrestrial Habitat

A habitat characterization of the SFA was performed that identified onsite fauna and flora and evaluated the viability of habitats at the Site. The results of this characterization indicated that recent and ongoing physical disturbances in Zones 1 and 5 preclude vegetative growth within those areas. However, many areas in Zones 2, 3, and 4 have been substantially undisturbed since the cessation of steel making operations in 1983. Soil formation and the slow rate of plant community development in the SFA is somewhat characteristic of primary succession, though at a slower pace. The slow vegetative development at the Site is attributable to the slag substrate, which is devoid of nutrients and lacked an existing seed reservoir at the time of its placement in the SFA. Only a thin veneer of soil has developed since slag deposition, ranging from 1 to more than 4 inches deep.

Large areas in Zones 3 and 4 appear to have been colonized by just a few plant species, which do not provide sufficient cover for most wildlife taxa. The relative scarcity of trees and shrubs indicates a lack of vertical complexity in community structure over most of the SFA,

limiting biological diversity. A developed canopy and understory are present in the northwest section of Zone 2 and the western portion of Zone 3, where the greatest abundance and diversity of wildlife have been observed.

Based on field observations, over half of the SWMUs investigated in the SFA have fewer than 50% vegetative cover. Overt effects of SWMU-related wastes on vegetation are obvious in those SWMUs (such as SWMU S-1 and SWMU S-22) where oil and/or tar-like substances are present at the SWMU surface. Plants in physical contact and at least partially covered with these substances are chlorotic and withered, while plants just beyond the edge of these materials appear healthy. Forbs and small saplings growing outside SWMU perimeters are without apparent stress.

In order to characterize potential adverse effects from SWMU-related materials to the terrestrial ecosystem, soil samples were collected from the surface horizon (generally to 6 inches below ground surface). Analytical results of these samples were screened against ecotoxicological benchmarks to develop a list of COPECs. Average daily doses (ADDs) of COPECs were estimated for selected wildlife receptors (representing species observed or potentially dwelling on the Site) by applying receptor-specific exposure factors to maximum and average concentrations of COPECs in soils. Terrestrial wildlife receptors evaluated in the ERA were as follows:

Deer mouse;
Short-tailed shrew;
American robin; and
Red-tailed hawk.

Complete exposure pathways quantitatively evaluated for the wildlife receptors included ingestion of potentially impacted soil and ingestion of potentially impacted food. The results indicate that, with the exception of the deer mouse in SWMU S-5, terrestrial receptor hazard indices (HIs) based on maximum concentrations of detected compounds exceed 1.0 in every SWMU and background location. An HI in excess of 1.0 indicates the potential for an ecological risk. In all cases, SWMU S-5 had the lowest HI and SWMU S-6 had the highest HI. The COPECs contributing to the terrestrial wildlife risks were antimony, arsenic, chromium, lead, selenium, thallium and polycyclic aromatic hydrocarbons (PAHs).

In conclusion, the terrestrial ecosystem at the Site (*e.g.,* areas other than obviously impacted SWMUs such as S-1, S-22 and S-24) is influenced primarily by the physical characteristics of the habitat subjected to recent disturbances from industrial operations and traffic associated with the slag reclamation operations. The plant community in the SFA is one of low diversity and comprised of pioneering species because of physical factors such as the man-made substrate (slag and other non-native fill), which essentially precludes the development of a mature terrestrial community. Despite the elevated HIs for many SWMUs, toxicological effects from Site COPECs are not overt, as the fauna and flora observed at the Site generally appear healthy. However, the potential for adverse effects to all four receptors is likely at the obviously contaminated SWMUs (*i.e.*, S-1, S-6, S-22, S-24), where the physical presence of tars and oils may result in acute physical effects, as well as, toxicological effects. Therefore, nearly all the vegetation and trees on the SFA are those that have seeds that are easily windborne.

Poor substrate quality is another reason for slow plant community progression. Only a thin veneer of soil has developed since slag deposition, ranging from one to more than four inches deep. The absence of organic compounds in the soils limits the presence of earthworms or other soil invertebrates as well as the soil's ability to retain moisture during drier periods, resulting in limited vegetation growth and diversity in the slag areas. Large slag aggregations are present under the soil, which preclude larger vegetation species requiring deeper roots.

ES4.2 Aquatic Risk Habitat

Water bodies potentially affected by the Site include Smokes Creek, Blasdell Creek, Lake Erie, the SRWT, the NRWT and the Gateway Metroport Ship Canal. However, the Gateway Metroport Ship Canal area was eliminated from consideration in the ERA because sediments from the entire length of the Canal were dredged by the USACE in October 2001, effectively removing all contaminants.

Analytical results from surface water and sediment samples collected during the RFI were used to characterize potential effects from Site COPECs to selected semi-aquatic receptors. The analytical results of the upstream and downstream surface water and sediment sampling effort were used to estimate exposure and risks for five receptors:

Mallard;
Great blue heron;
Raccoon;
Spotted sandpiper; and
Red-tailed hawk.

Complete exposure pathways quantitatively evaluated for the semi-aquatic wildlife receptors included ingestion of potentially impacted sediment and surface water and ingestion of potentially impacted food.

For Blasdell Creek, quantitative risks to the mallard, great blue heron, raccoon and red-tailed hawk indicate that the potential for adverse effects to these receptors is insignificant for all exposure pathways evaluated. The HI for the spotted sandpiper suggests the potential for adverse ecotoxicological effects from sediment ingestion exposure and benthic invertebrate ingestion exposure to metals, including arsenic, antimony, chromium and lead.

For Smokes Creek, the analytical results of the upstream and downstream surface water and sediment sampling effort were used to estimate doses and risks for the five semi-aquatic receptors. Food web modeling results indicate no unacceptable risks from the ingestion route to mallards (benthic invertebrates), raccoons (fish and benthic invertebrates), and red-tailed hawks (raccoons). Although the upstream and downstream HIs for the great blue heron are approximately equivalent, the individual chemical hazard quotients (HQs) for cadmium and selenium are greater downstream than upstream. The HI for mallards is only slightly greater than one for ingestion of benthic invertebrates.

For the NRWT, the analytical results of surface water sampling from the NRWT were used to calculate doses and risks for mallards from direct ingestion of NRWT surface water. The resulting HI was at least seven orders of magnitude less than one, indicating that there are no significant risks to the mallard as a consequence of exposure to COPECs in NRWT surface water.

For the SRWT, hazard indices for the mallard, raccoon and red-tailed hawk were less than one, indicating no unacceptable risks are posed to these receptors from exposure to SRWT

media. The spotted sandpiper HI was 504, based on exposure to antimony, arsenic, chromium, lead, selenium, and cyanide.

For Lake Erie, the resulting surface water HIs were at least four orders of magnitude less than one, indicating that 1) no ecotoxicological effects are predicted for the mallard from exposure to Lake Erie surface water, and 2) discharges from other BSC-related water bodies (Smokes Creek, Blasdell Creek, and both water return trenches) are not adversely affecting Lake Erie.

ES4.3 Recommendations and Conclusions of ERA

Based on the conclusions of the ERA, a Tier 3 ecological risk assessment is not recommended. The information provided in the ERA in this RFI report, in conjunction with other information provided in the RFI, is adequate for risk management decision making to determine which SWMUs should be evaluated for remediation. The calculated risk estimates suggest the potential for ecological hazards as indicated by hazard indices above 1 in several of the SWMUs evaluated in the SFA; however, habitat quality on a SWMU-by-SWMU basis must be taken into account, as well as constituent bioavailability and attenuation when considering the necessity for and extent of remediation to be performed at the SWMUs.

ES5.0 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment was performed for the BSC Lackawanna site to evaluate potential human health risks due to chemical releases from the identified SWMUs to soil, air, groundwater, sediment, and surface water. Thirty-three SWMUs, SWMU groups and watercourses at the Site were quantitatively evaluated as part of the RFI to determine whether or not the releases warrant further action to protect human health. Both current and future land uses were considered in the risk evaluation.

Fifty-three chemicals detected in environmental media across the facility were selected as COPCs using a conservative screening method. The selected screening criteria included:

- USEPA Region III risk-based concentrations (RBCs) for surficial SWMU material, subsurface SWMU material (nonvolatile chemicals), and sediment;

- USEPA Soil Screening Levels based on inhalation for volatile chemicals in subsurface SWMU material;

- For water (groundwater, surface water, pit water), the lower of the New York State Ambient Water Quality Standard or Guidance Value or the USEPA Region III residential tap water RBC.

The twelve receptor scenarios evaluated in the HHRA are associated with current use patterns and unrestricted future commercial/industrial development of all areas of the site, as well as recreational development in the area of SFA Zone 1. These populations and a description of their activity patterns that could result in exposure are:

- Current Non-BSC Commercial/Industrial Workers: These workers in general are not located in areas where SWMUs are located. Limited exposures to releases to ambient air from nearby sources (i.e., uncovered SWMUs, subsurface SWMU material or from groundwater/pit water) are assumed.

- Future Commercial/Industrial Workers: These workers are a future population that could come in direct contact with SWMU material, if those areas are redeveloped for some industrial or commercial land use. Inhalation of both ambient and indoor air affected by SWMU releases are also considered relevant exposures.

- Future Construction Workers: This population is possible under future development of the site. Because of excavation-type activities, this population could come in direct contact with both surface and subsurface SWMU material, as well as vapors or particulates released to ambient air from these SWMUs. In some areas of the site, groundwater is sufficiently shallow, resulting in potential direct contact exposures by this population. Similar exposures could occur in site areas where pits are located.

- Future Utility/Maintenance Workers: Once the Lackawanna site is redeveloped, there may be potential for contact with SWMU material by this type of population, either directly or through inhalation of releases from the SWMUs, groundwater or pit water.

- Future Ship Canal Maintenance Worker: Although the historical activity patterns for workers at this site location represent minimal exposures, this population is included. This population could be exposed to both surface water and sediment in the Ship Canal.

- Current and Future Trespassers: This adolescent-aged population could bypass site security and freely wander around the site. This population could come in limited contact with surficial SWMU material, as well as vapors and particulates emanating from either the SWMU material, or groundwater and pitwater affected by SWMU releases.

- Future Marina Workers: This population could be relevant depending on recreational development within SFA Zone 1. Although direct contact with SWMU material is not relevant for this population, inhalation of releases from other SWMUs (including groundwater and standing water in pits) are potential exposures.

- Future Greenway Users: Greenway users are assumed to be adults and children residing in the area who would regularly use a proposed greenway area for recreational purposes. As with the marina workers, direct contact with SWMU material is not relevant, but inhalation of releases is a potential exposure.

- Current and Future Recreational Bathers: Recreational bathers are adults and children who reside in the area and regularly wade or swim in Blasdell Creek, Smokes Creek, and along nearshore Lake Erie in the vicinity of the Lackawanna site. Exposures could occur through direct contact with surface water and sediment in these waterbodies affected by site releases.

- Current and Future Fish Consumers: This population consists of adults and children residing in the area who regularly catch and eat fish from Smokes Creek and nearshore Lake Erie.

- Current and Future Off-Site Residents: These populations consist of adults and children living on the fenceline of the Lackawanna boundary who could be exposed to particulate or vapor releases from SWMU material, including groundwater and pit water affected by releases.

- Present and Future Off-Site Water Consumer: The off-site water consumer population includes adults and children whose drinking water supply is surface water from intakes downstream of the mouth of the Niagara River.

Risk characterization was accomplished in two steps. In the first step, risk-based screening levels (RBSLs) were calculated for each exposure medium–receptor population combination and compared to the representative chemical concentrations calculated for that medium. In the second step, RBSL exceedances were further evaluated with regard to Tier 1 cancer and noncancer benchmarks.

Risk-based screening levels are chemical concentrations that are not expected to produce adverse health effects under the assumed exposure conditions. Inputs to the RBSL calculations include exposure factors that describe human receptor physiology and human activity patterns, chemical-specific toxicity values and intermedia modeling factors (e.g., the volatilization factors for quantifying releases from groundwater or subsurface SWMU material). In addition, RBSL calculations require a target hazard index (assumed to be 1.0) and a target cancer risk level (assumed to be 1×10^{-6}).

The comparison of the representative COPC concentration to the RBSL for each receptor population provided a preliminary screening of potential risk. If there were no exceedances of RBSLs, then the conclusion was that further evaluation with regard to risk is not warranted. If there were exceedances of RBSLs, a further evaluation was done to address multiple chemicals, multiple pathways, and total risk estimates.

This further characterization, or a Tier 1 HHRA, was accomplished by calculating either (or both) a total screening-level hazard index ($SLHI_{total}$) or a total screening-level cancer risk ($SLCR_{total}$). These values were then compared with the Tier 1 noncancer benchmark (1.0) or the Tier 1 cancer benchmark of 1×10^{-4}. For those chemicals that exceed RBSLs based on noncancer effects, an $SLHI_{total}$ was calculated by first deriving the ratio of the representative concentration to the RBSL, and then adding these ratios for all chemicals and pathways that contribute to a given receptor scenario.

For those chemicals that exceed RBSLs based on cancer, an SLCR was calculated by first deriving the ratio of the representative concentration to the RBSL, multiplying it by the target risk level assumed in the RBSL derivation and adding these ratios for all chemicals and pathways that contribute to a given receptor scenario. Based on USEPA guidance, total cancer risks for a given population equal to or less than the target risk level of 1×10^{-4} are considered negligible and further actions to reduce risk are not warranted.

The results of the SLCR and SLHI values determined for each SWMU, SWMU group, or watercourse are summarized in Table ES-1 and ES-2. The Tier 1 HHRAs conducted for SWMUs, SWMU groups, watercourses and site-wide groundwater at the Lackawanna Facility indicate that levels of benzene, naphthalene, pyridine, carcinogenic polycyclic aromatic hydrocarbons (PAHs) and some metals (notably lead, arsenic, chromium, and thallium) exceed either (or both) noncarcinogenic RBSLs and carcinogenic RBSLs, resulting in risk and hazard levels above the Tier 1 benchmarks of 1.0 (for hazard) and 1×10^{-4} (for excess cancer risk).

Table ES-1 summarizes the Tier 1 HHRA results for SWMUs and SWMU groups. Risks and hazards are highest for the future commercial/industrial receptor scenario, which is the population that represents the greatest potential exposure, via multiple pathways, to the COPCs. Since this worker cannot be exposed to ambient air and indoor air simultaneously, risk and hazard estimates were developed separately for ambient air exposures and indoor air exposures. The $SLCR_{totals}$ above the Tier 1 cancer benchmark range from 2×10^{-4} to 8×10^{-3}. These exceedances are generally attributable to indoor air exposures; benzene is the primary chemical contributor, although the PAHs contribute to the exceedance at some SWMUs (i.e., SFA-1, SFA-2, PA-2, the Tank Farm). The $SLHI_{totals}$ for the future commercial/industrial worker that exceed the Tier 1 noncancer benchmark range from 1.1 to 1,859. Again, the indoor air pathway is the significant pathway contributor, with benzene and naphthalene the primary chemical contributors. At five SWMUs (SFA-1, S-3, S-8, S-18, and S-21), the lead RBSL is exceeded, indicating an unacceptable hazard attributable to this chemical.

For the other occupational scenarios, exceedances of the risk or hazard benchmarks were not as frequent nor as great. For the future construction workers, $SLCR_{totals}$ exceed the Tier 1 benchmark at five SWMUs (SFA-1, SFA-2, S-23, S-24, the Tank Farm). Risk estimates range

from 2×10^{-4} to 5×10^{-4}. The $SLHI_{totals}$ for this population range from 2.5 to 964, with benzene as the primary contributor. The lead RBSL is exceeded at five SWMUs (SFA-1, S-3, S-8, S-18, and S-21) for this population as well as the utility/maintenance worker and the trespasser populations, indicating an unacceptable hazard attributable to this chemical.

For the future utility/maintenance worker, the risk benchmark is met at all SWMUs, but not the hazard benchmark. The $SLHI_{totals}$ for this population range from 2.6 to 119 (benzene). Exceedances of the hazard benchmark for the non-BSC commercial/industrial worker are limited to five SWMUs (SFA-2, PA-1, P-11, P-12, and P-18). The $SLHI_{totals}$ range from 1.1 to 5.1 (benzene). Risk benchmarks are not exceeded at any SWMU for this receptor scenario.

For the trespasser receptor scenario, all risk and hazard benchmarks are met, except for lead at five SWMUs (SFA-1, S-3, S-8, S-18, and S-21). For the future marina worker, the only benchmark exceedance occurs at SFA-2, where the $SLHI_{total}$ is 4.9 (benzene).

There are no exceedances of either risk or hazard benchmarks at any SWMU location for either the future greenway user or present/future fenceline resident population.

Table ES-2 summarizes the SLHI and SLCR values for populations evaluated for the watercourses and site-wide groundwater exposures. Benchmark exceedances occur only at Smokes Creek and the South Return Water Trench. The only exceedance of the risk benchmark (5×10^{-4}) is associated with the indoor air pathway for a future commercial/industrial worker at the Smokes Creek groundwater area. This exceedance is attributable to benzene in the groundwater in this area. The $SLHI_{total}$ for this population at this location ranges from 10 (ambient air) to 218 (indoor air). Both benzene and pyridine contribute to these exceedances. Other hazard exceedances are noted for the utility/maintenance worker at the South Return Water Trench (1.1, attributable to arsenic). For the future construction worker at Smokes Creek, a SLHI of 4.0 was calculated. This exceedance is attributable to pyridine.

For all other receptor scenarios at the other watercourses, and for site-wide groundwater, there are no exceedances of risk or hazard benchmarks. In some locations and for some populations, not even RBSLs are exceeded, indicating that a Tier 1 HHRA (i.e., the calculation of

SLCR and SLHI values) was not needed. Tables ES-1 and ES-2 show these receptor/location combinations.

Based on the above information, most SWMUs require some evaluation as part of the Corrective Measures Study. The risk assessment concludes, however, that three SWMUs (S-15, S-16, and S-25), as well as Blasdell Creek, the Ship Canal, the North Return Water Trench, and Lake Erie do not warrant evaluation of remedial activities for the protection of human health.

ES6.0 RESULTS OF SWMU AND WATERCOURSE ASSESSMENTS

A total 104 SWMUs and six watercourses were investigated as required in the AOC. Between 1988 and 1992, 59 SWMUs and one watercourse were determined to require "No Further Assessment" by the USEPA and are no longer a regulatory concern (Figure ES-10). Documentation of the BSC submittal letters to the USEPA regarding each of these 60 reports and the respective letters from the USEPA granting "No Further Assessment" designation are provided in Part V of this RFI Report. A summary of the remaining 45 SWMUs and five watercourses that were evaluated in the phased RFI investigations is provided below.

All SWMUs at the Site were designated as either "P" or "S" SWMUs. "P" SWMUs are located within former process areas of the plant. "S" SWMUs are located within the SFA. Figure ES-10 shows the location of the 45 SWMUs summarized in this section. Each SWMU was investigated as required by the AOC. In some instances, where locations and waste types were similar, multiple SWMUs were evaluated as part of a SWMU group. For each SWMU or SWMU group, chemical analysis of SWMU material (when available) was evaluated and compared to local groundwater conditions. The material was often evaluated for hazardous waste characteristics and its potential to leach (synthetic precipitation leaching procedure [SPLP] extraction analysis). Five watercourses currently exist on the Site and they were investigated as required by the AOC. Both sediment and surface water was evaluated for each watercourse. Total constituent results from both the SWMUs and watercourses, where available, were also evaluated in a Tier I Human Health Risk Assessment.

Conclusions for the SWMUs and Watercourses that are presented in the individual SWMU assessment reports were further evaluated with the results of the Ecological Risk

Assessment. The summary of the SWMU and Watercourse status based on this combined evaluation is presented in Section ES 7.1. Individual SWMU assessment reports are provided in Parts V, VI, and VII of this RFI Report.

ES7.0 CONCLUSIONS

The Site has been used for the making of steel and related products for almost a century. As a result of these activities, environmental impacts to the Site's soil and groundwater and the sediment and surface water of adjacent surface water bodies have occurred.

The source of chemical constituents found in groundwater, soil, surface water and sediments at Site may be attributed to by-products and waste materials spilled, discharged or stored at the facility (primarily in SWMUs), and to the presence of contaminated dredge spoils imported and placed beneath the western portion of the Site.

ES7.1 SWMUs and Watercourses

Of the 45 SWMUs and six watercourses investigated in this report, 38 SWMUs and 3 watercourses are recommended for further evaluation with a Corrective Measures Study. The remaining five (5) SWMUs and three (3) watercourses require no further assessment as they do not pose a potential risk to human health and do not appear to have an effect on concentrations of COPCs present in the groundwater. Table ES-3 and Figure ES-10 presents the SWMUs and watercourses and their status with respect to the need for further assessment.

Table ES-1
Risk Assessment Results for SWMUs and SWMU Groups
Bethlehem Steel Corporation, Lackawanna, New York

SWMU or SWMU Group	SWMU Description	Future Commercial/Industrial Worker		Future Construction Worker		Future Utility/Maintenance Worker		Current Non-BSC Commercial/Industrial Worker		Trespasser		Future Marina Worker		Future Greenway User		Present/Future Fenceline Resident	
		Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI
Slag Fill Areas																	
SFA-1	Zone 2 SWMUs: S-1,S-2,S-4,S-5,S-6,S-7, S-20,S-27	3×10^{-3} - ambient 3×10^{-3} - indoor	8 - ambient 20 - indoor lead	2×10^{-4}	10, lead	✓	3, lead	∞	∞	✓	∞, lead	∞	∞	∞	∞	∞	∞
SFA-2	SWMU S-11 and S-22: Landfill K and Acid Tar Pit North	4×10^{-4} - ambient 8×10^{-3} - indoor	70 - ambient 2,000 - indoor	5×10^{-4}	700	✓	100	✓	2	✓	∞	✓	5	✓	∞	✓	∞
S-3	Surface Impoundment C	✓ - ambient/indoor	✓ -ambient/indoor lead	∞	✓, lead	∞	∞, lead	∞	∞	∞	∞, lead	∞	∞	∞	∞	∞	∞
S-8	Surface Impoundment H	✓-ambient/indoor	5 - ambient/indoor lead	✓	2, lead	✓	∞, lead	∞	∞	∞	∞, lead	∞	∞	∞	∞	∞	∞
S-10	Slag Quench Area J	✓-ambient ∞-indoor	6-ambient ∞-indoor	∞	3	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-14	General Rubble Landfill N	✓-ambient/indoor	10 -ambient/indoor	✓	4	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-15	General Rubble Landfill O	∞ -ambient/indoor	∞, ✓-ambient/indoor	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-16	Lime Stabilized SPL Sludge/Slag Landfill	∞ -ambient/indoor	∞ - ambient/indoor	∞	∞	∞	∞	NE	NE	∞	∞	NE	NE	NE	NE	NE	NE
S-17	Vacuum Carbonate Blowdown - Landfill Q	✓-ambient/indoor	6 - ambient/indoor	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-18	Lime/Kish Landfill	✓-ambient/indoor	8 -ambient/indoor lead	✓	2, lead	✓	∞, lead	∞	∞	∞	∞, lead	∞	∞	∞	∞	∞	∞
S-19	Murphy's Mountain Landfill	✓-ambient/indoor	✓-ambient/indoor	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-21	Sludge Storage Area	✓-ambient/indoor	3 - ambient/indoor lead	✓	∞, lead	∞	∞, lead	∞	∞	∞	∞, lead	∞	∞	∞	∞	∞	∞
S-23	Tar Pit Adjacent to Lime Stabilized SPL Sludge Landfill	✓ - ambient 3×10^{-4} - indoor	2 - ambient 70 - indoor	3×10^{-4}	30	✓	7	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-24	Tar Pit North of Lime Plant	✓ - ambient 8×10^{-3} - indoor	20 - ambient 2,000 - indoor	5×10^{-4}	1000	✓	200	✓	∞	∞	∞	∞	∞	∞	∞	✓	∞
S-25	Landfill/Impoundment Under North End of Coal Pile	NE	NE	∞	∞	∞	∞	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
S-26	Fill Area Near Coke Battery 8	✓-ambient/indoor	4 - ambient 30 - indoor	✓	60	∞	4	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
S-28	Drum Landfill	✓-ambient/indoor	2 - ambient/indoor	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

Table ES-1
Risk Assessment Results for SWMUs and SWMU Groups
Bethlehem Steel Corporation, Lackawanna, New York

SWMU or SWMU Group	SWMU Description	Future Commercial/Industrial Worker		Future Construction Worker		Future Utility/Maintenance Worker		Current Non-BSC Commercial/Industrial Worker		Trespasser		Future Marina Worker		Future Greenway User		Present/Future Fenceline Resident	
		Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI	Cancer - SLCR	Noncancer-SLHI
Process Area SWMUs																	
PA-1	SWMUs P-1, P-2, P-3, P-4, P-5	✓ - ambient 1 x10^{-3} - indoor	✓ - ambient 300 - indoor	✓	600, lead[(1)]	✓	50, lead[(1)]	✓	✓	∞	∞	∞	∞	∞	∞	∞	∞
PA-2	SWMUs P-6 and P-7	2 x 10^{-4} - ambient 1 x 10^{-3} - indoor	∞ - ambient 300 - indoor	✓	600	✓	50	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞
PA-3	SWMUs P-9 and P-10	✓ - ambient 1 x 10^{-3} - indoor	∞ - ambient 300 - indoor	✓	600	✓	50	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞
P-11	Benzol Plant Tank Storage Area	✓ - ambient 2 x 10^{-3} - indoor	10 - ambient 500 - indoor	✓	600	✓	60	✓	3	∞	∞	∞	∞	∞	∞	✓	∞
P-12	Spill Cleanup Storage Area	✓ - ambient 2 x 10^{-3} - indoor	2 - ambient 500 - indoor	✓	600	✓	60	✓	3	∞	∞	∞	∞	∞	∞	✓	∞
P-18	Blast Furnace Cooling Tower and Hot & Cold Wells	✓ - ambient 1 x 10^{-3} - indoor	5 - ambient 300 - indoor	✓	600, lead[(1)]	✓	50, lead[(1)]	✓	5	∞	∞	NE	NE	NE	NE	NE	NE
Tank Farm	SWMUs P-8, P-74, P-75	3 x 10^{-3} - ambient/indoor	30 - ambient 90 - indoor	5 x 10^{-4}	100	✓	20	✓	∞	✓	∞	∞	∞	∞	∞	∞	∞
P-63	Former Mill Scale Storage Area No. 2	✓-ambient/indoor	✓ - ambient/indoor	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
P-73	Drum Storage Area East of Cold Strip Mill	✓-ambient/indoor	2 - ambient/indoor	✓	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

SLCR Screening-Level Cancer Risk
SLHI Screening-Level Hazard Index
Lead Lead is not evaluated in either the SCR or the SLHI. Exceedances of the lead RBSL for surface or subsurface SWMU material noted as "Lead" in the SLHI column.
✓ Benchmarks not exceeded. (Cancer risk: 1 x 10^{-4}; Hazard Index of 1)
∞ No RBSLs exceeded.
NE Receptor scenario not evaluated for this SWMU/SWMU group
(1) No RBSL for lead in pit water calculated. Lead concentrations at these locations exceed the drinking water action level.

NOTE: Risk estimates presented in this table have been rounded to one significant figure from the risk estimates presented in the SWMU or Watercourse Reports in accordance with USEPA (1989).

Table ES-2
Risk Assessment Results for Watercourses and Groundwater
Bethlehem Steel Corporation, Lackawanna, New York

Watercourse or Groundwater Evaluation	Future Commercial/Industrial Worker		Future Utility/Maintenance Worker		Trespasser		Future Construction Worker		Current Ship Canal Maintenance Worker		Future Ship Canal Maintenance Worker		Present/Future Recreational Bather		Present/Future Fish Consumer		Present/Future Off-Site Water Consumer		Future Marina Worker		Future Greenway User		Curren Non-BSC Commercial/Industrial Worker		Present/Future Fencelina Resident	
	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI	Cancer-SLCR	Noncancer - SLHI
Blasdell Creek	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	✓	▪▪	✓	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Ship Canal	NE	NE	NE	NE	NE	NE	NE	NE	▪▪	▪▪	▪▪	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Smokes Creek	✓ - ambient[1] 5 x10^{-4} - indoor[1]	10 - ambient[1] 200 - indoor[1]	▪▪	▪▪	▪▪	▪▪	✓	4	NE	NE	NE	NE	✓, lead	▪▪, lead	✓, lead	▪▪, lead	▪▪	▪▪	NE	NE	NE	NE	NE	NE	NE	NE
North Return Water Trench	NE	NE	✓	▪▪	NE	NE	✓	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
South Return Water Trench	NE	NE	✓	✓	NE	NE	✓	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Lake Erie	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	▪▪	▪▪	✓	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪
Site-Wide Groundwater	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	▪▪	▪▪	▪▪	▪▪
Zone 1 Groundwater	▪▪ - ambient/indoor	▪▪ - ambient/indoor	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	▪▪	▪▪	▪▪	▪▪	NE	NE	NE	NE
Zone 5 Groundwater	▪▪ - ambient/indoor	▪▪ - ambient/indoor	▪▪	▪▪	▪▪	▪▪	▪▪	▪▪	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

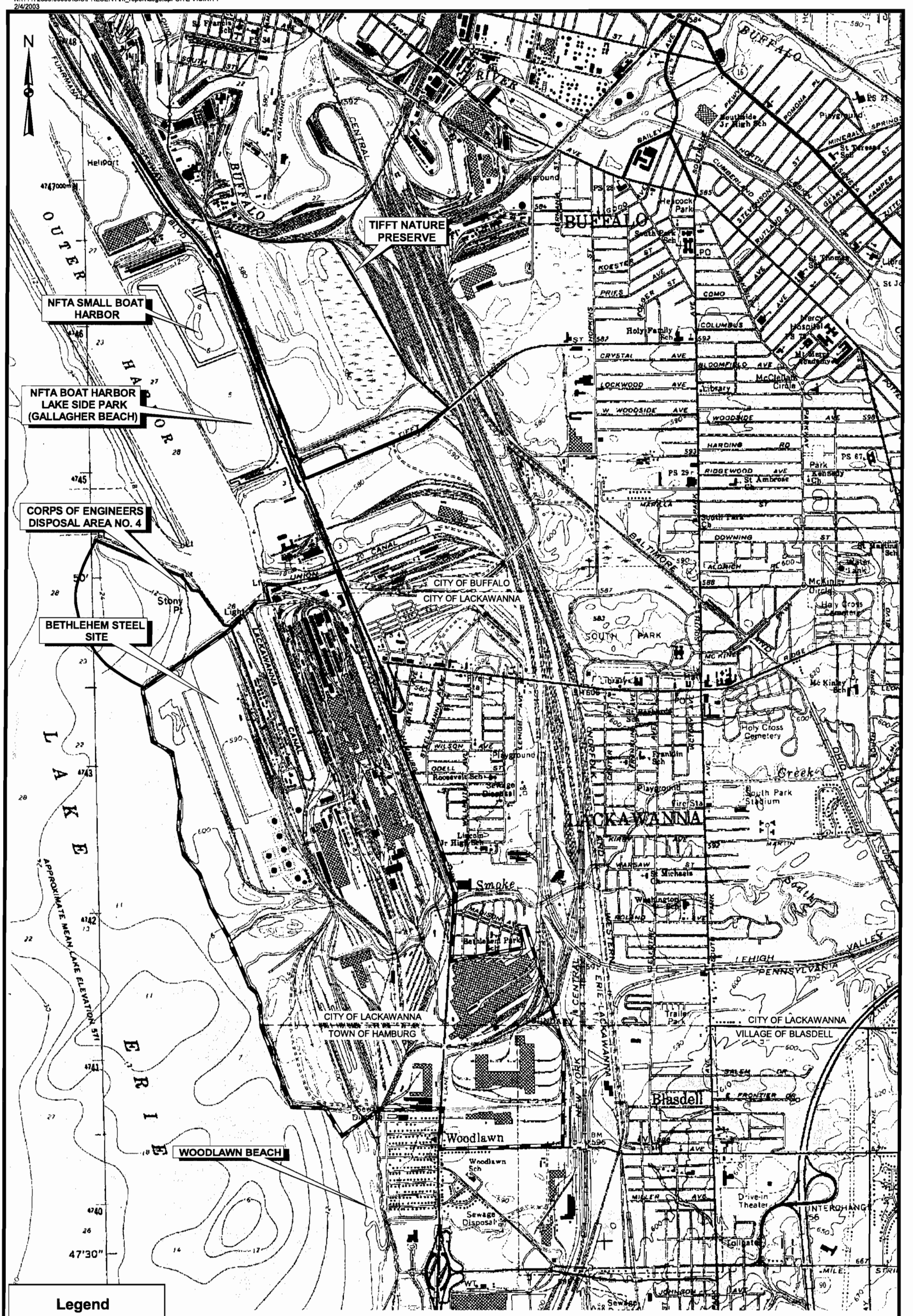
SLCR	Screening-Level Cancer Risk
SLHI	Screening-Level Hazard Index
Lead	Lead is not evaluated via the SLCR or the SLHI. RBSLs were not calculated for lead in surface water. Exceedance of drinking water action level noted.
✓	Benchmarks not exceeded. (Cancer risk: 1 x 10^{-4}; Hazard Index of 1)
▪▪	No RBSLs exceeded.
NE	Receptor scenario not evaluated for this watercourse.
(1)	Risks for this receptor population are attributed to inhalation of groundwater vapors from the Smokes Creek groundwater discharge area.
NOTE:	Risk estimates presented in this table have been rounded to one significant figure from the risk estimates presented in the SWMU or Watercourse Reports in accordance with USEPA (1989).

TABLE ES-3
RESULTS OF RFI
STATUS OF SWMUS AND WATERCOURSES
[BETHLEHEM STEEL CORPORATION. LACKAWANNA, NEW YORK

SWMUS/WATERCOURSES REQUIRING CORRECTIVE MEASURES STUDY
SWMU GROUP PA-1: COKE OVEN QUENCH WATER PITS: NORTH STATION (P-1), ARCTIC STATION (P-2), CENTRAL STATION (P-3), "A" STATION (P-4), AND "B" STATION (P-5)
SWMU GROUP PA-2: LIME SLUDGE SETTLING BASIN (P-6), ABANDONED LIME SLUDGE SETTLING BASIN (P-7)
SWMU GROUP PA-3: ABANDONED TAR DECANTER SLUDGE PIT (P-9) CONTAMINATED SOIL AREA NEAR THE BALL MILL (P-10).
SWMU P-11: BENZOL PLANT TANK STORAGE AREA
SWMU P-12: SPILL CLEANUP SOIL STORAGE AREA
SWMU P-18: HOT AND COLD WELLS (BLAST FURNACE)
SWMU P-73: FORMER DRUM STORAGE AREA AND FLANDER'S FIELD,
SWMUs P-74, P-75, P8: TANK FARM SWMUs
SWMU GROUP SFA-1: SURFACE IMPOUNDMENTS, SWMUS S-1, S-2, S-4, S-5, S-6, S-7/S-20, AND S-27
SWMU S-3: AMMONIA STILL LIME SLUDGE IMPOUNDMENT
SWMU S-8: SURFACE IMPOUNDMENT H
SWMU S-10: SLAG QUENCH AREA J
SWMU S-11: LANDFILL K (ACID TAR PIT SOUTH)
SWMU S-14: GENERAL RUBBLE LANDFILL N
SWMU S-15: GENERAL RUBBLE LANDFILL O
SWMU S-17: VACUUM CARBONATE BLOWDOWN LANDFILL Q
SWMU S-18: LIME DUST AND KISH LANDFILL R
SWMU S-21: SCRAP MELTER DUST STORAGE AREA
SWMU S-22: VACUUM CARBONATE BLOWDOWN IMPOUNDMENT (ACID TAR PIT NORTH)
SWMU S-23: SLUDGE LANDFILL
SWMU S-24: TAR PIT NORTH OF THE LIME PLANT
SWMU S-26: FILL AREA NEAR COKE BATTERY NUMBER 8
SWMU S-28: DRUM LANDFILL
BLASDELL CREEK
SOUTH RETURN WATER TRENCH
SMOKES CREEK
SWMUS/WATERCOURSES REQUIRING NO FURTHER ASSESSMENT
SWMU S-12: ASBESTOS LANDFILL L
SWMU S-13: TAR SLUDGE SURFACE IMPOUNDMENT
SWMU S-16: LIME STABILIZED PICKLE LIQUOR SLUDGE LANDFILL
SWMU S-19: LANDFILL AA (MURPHY'S MOUNTAIN)
SWMU S-25: LANDFILL/IMPOUNDMENT UNDER NORTH END OF COAL PILE
SWMU S-29: DRUM LANDFILL
SWMU P-63: MILL SCALE STORAGE AREA NO. 2
NORTH RETURN WATER TRENCH
GATEWAY METROPORT SHIP CANAL
LAKE ERIE

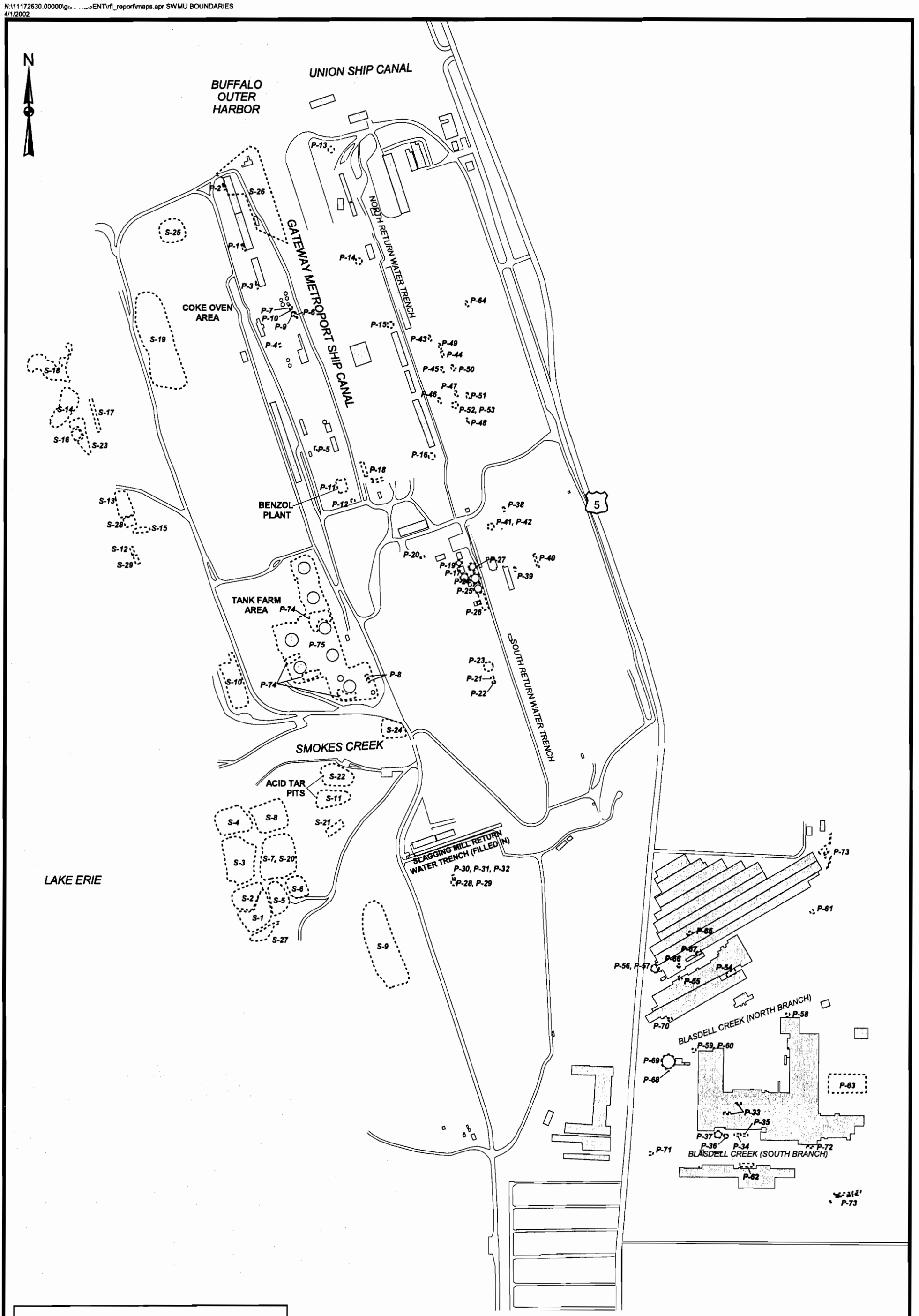
0000\GIS\PRESENT\rfi_report\usgs.apr SITE VICINITY

N:\11172630.00000\GIS\PRESENT\rfi_report\usgs.apr SITE VICINITY
2/4/2003



URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK SITE VICINITY MAP	FIGURE ES-1

N:\11172630.00000\gi... ...ENT\rfi_report\maps.apr SWMU BOUNDARIES
4/1/2002

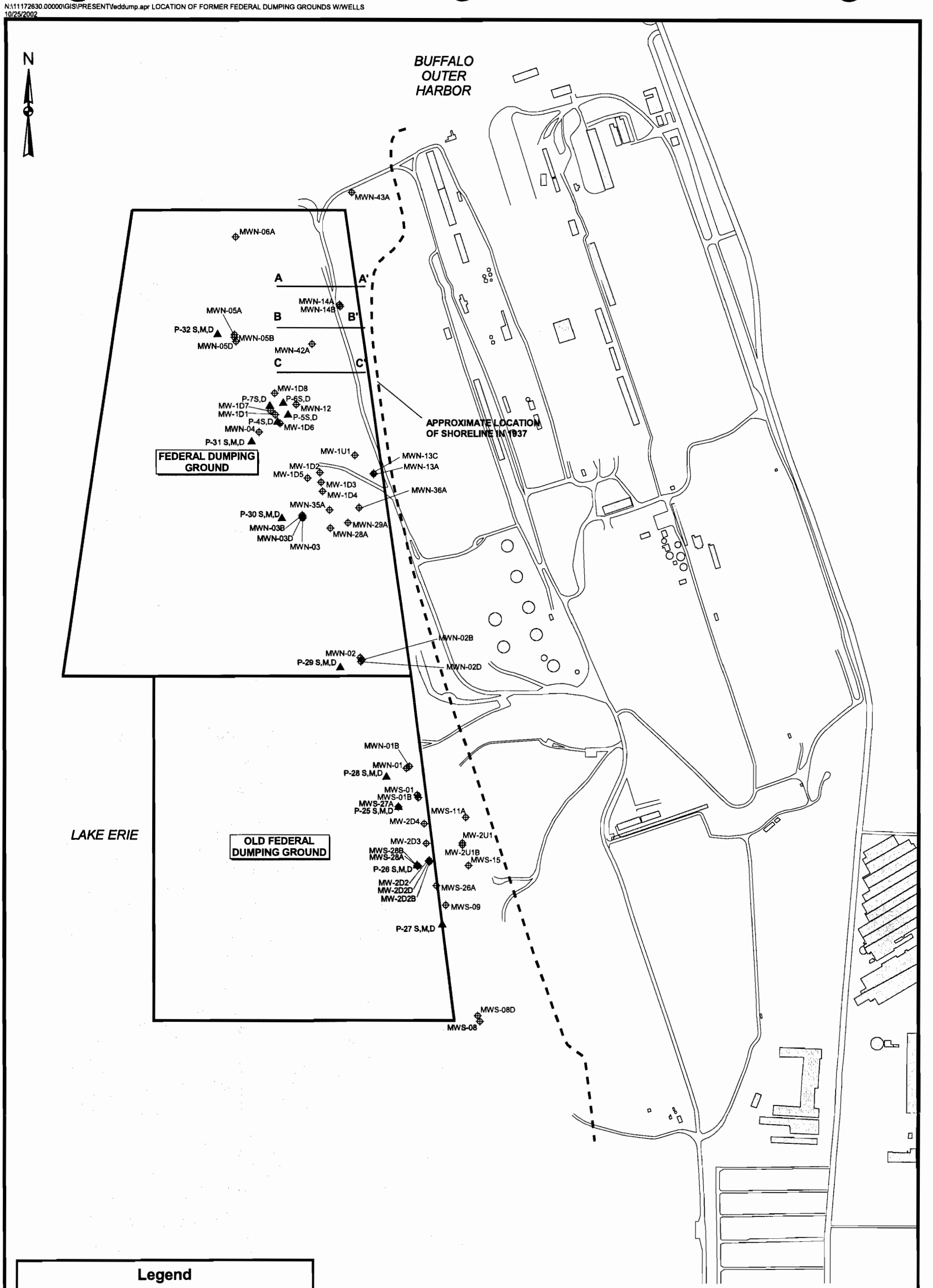


Legend

S-13 Solid Waste Management Unit

URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK SOLID WASTE MANAGEMENT UNITS (SWMUs) AND SURFACE WATER BODY LOCATIONS	FIGURE ES-2

N:\11172630.00000\GIS\PRESENT\eddump.apr LOCATION OF FORMER FEDERAL DUMPING GROUNDS W/WELLS
10/25/2002



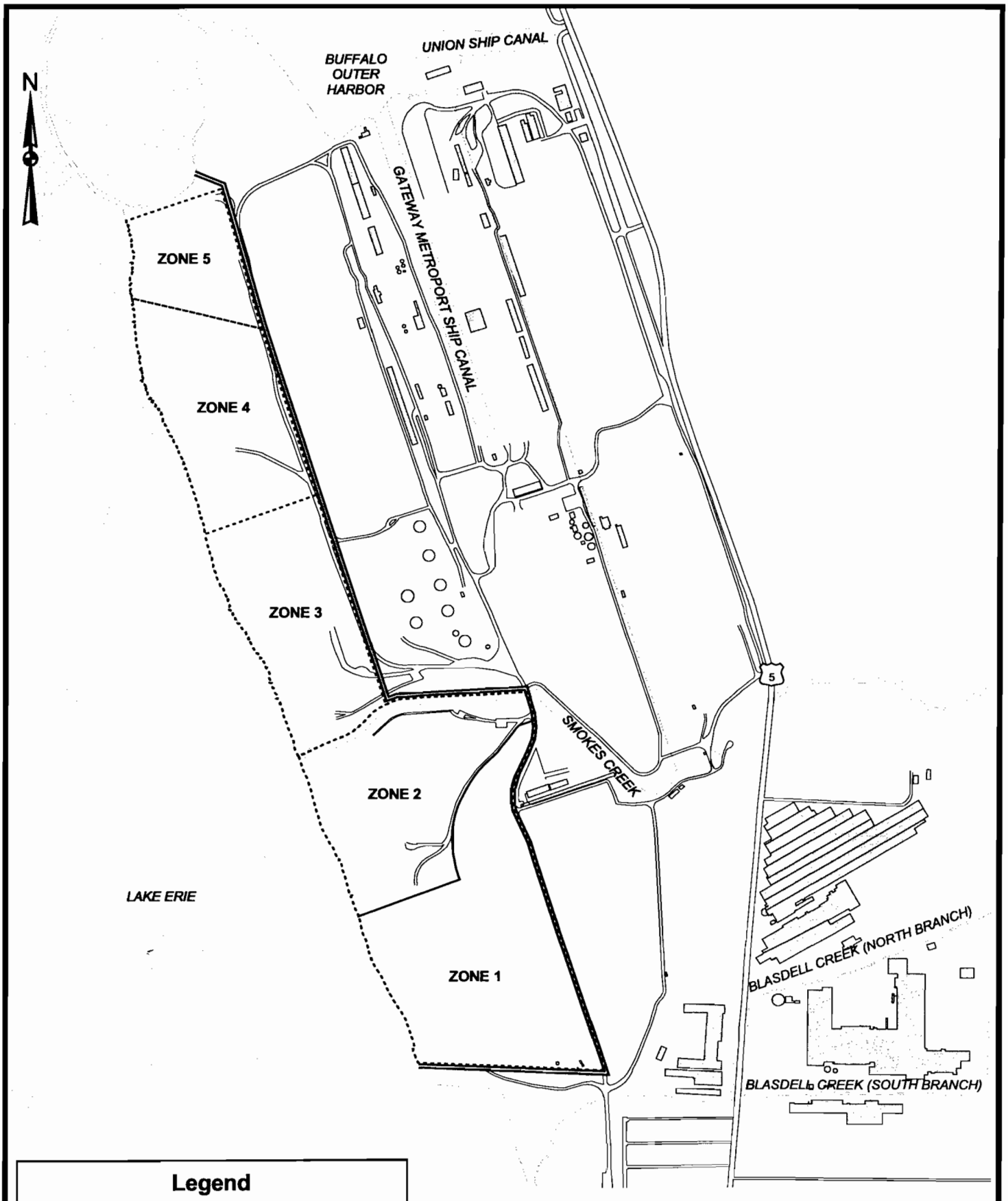
Legend

- Shoreline Area Monitoring Well
- Shoreline Investigation Piezometer
- A ___ A' Dump Ground Cross Section (See Figure 2 for Cross Sectional View)

SOURCE FEDERAL DUMPING GROUNDS:
Buffalo Harbor Dumping Ground Drawing,
U.S. Army Corps of Engineers, April 24, 1937

1000 0 1000 Feet

URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK LOCATION OF FORMER FEDERAL DUMPING GROUNDS AND OTHER SITE FEATURES	FIGURE ES-3



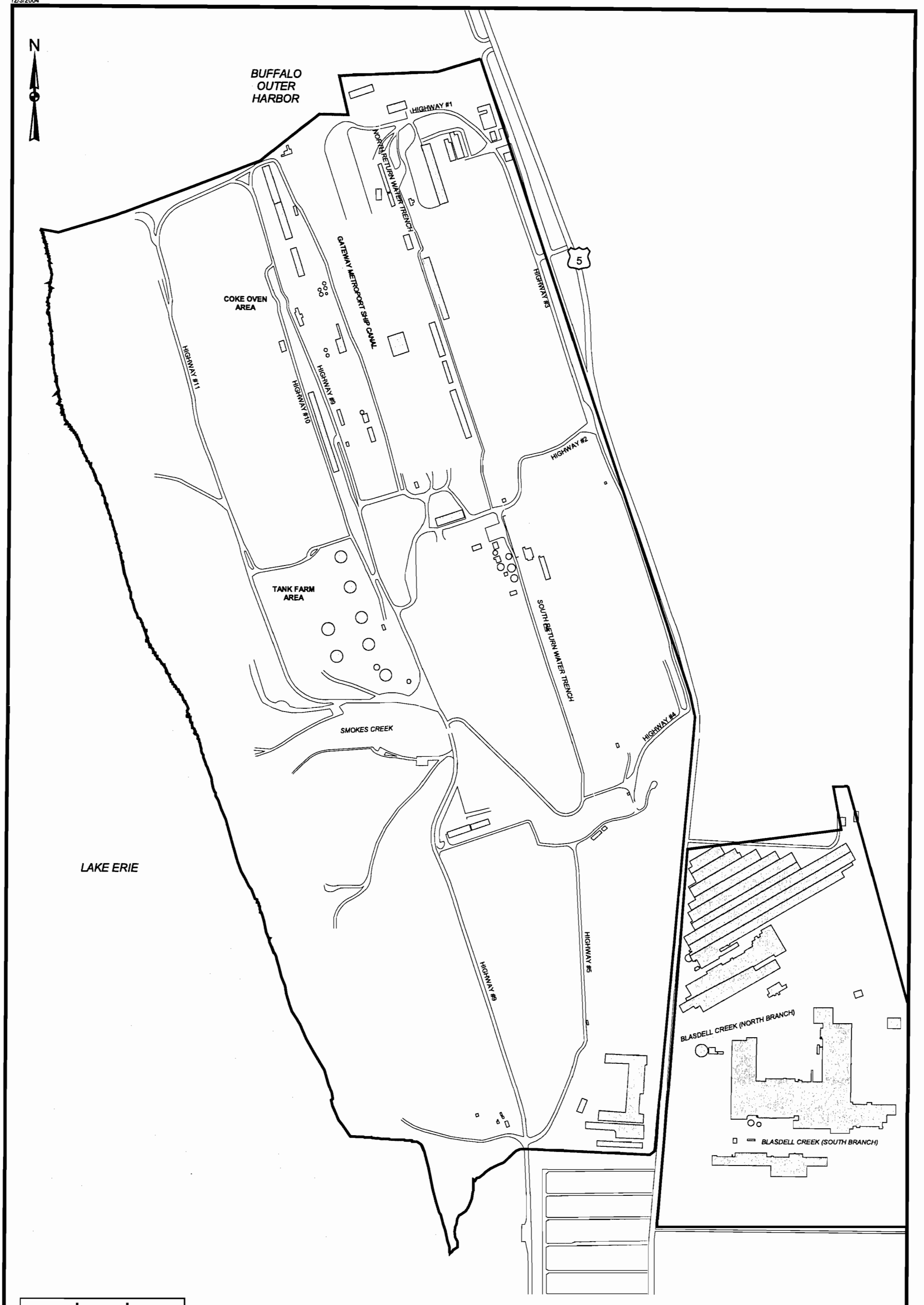
URS

BETHLEHEM STEEL CORPORATION
LACKAWANNA, NEW YORK
SLAG FILL AREA (SFA) BOUNDARY

FIGURE ES-4

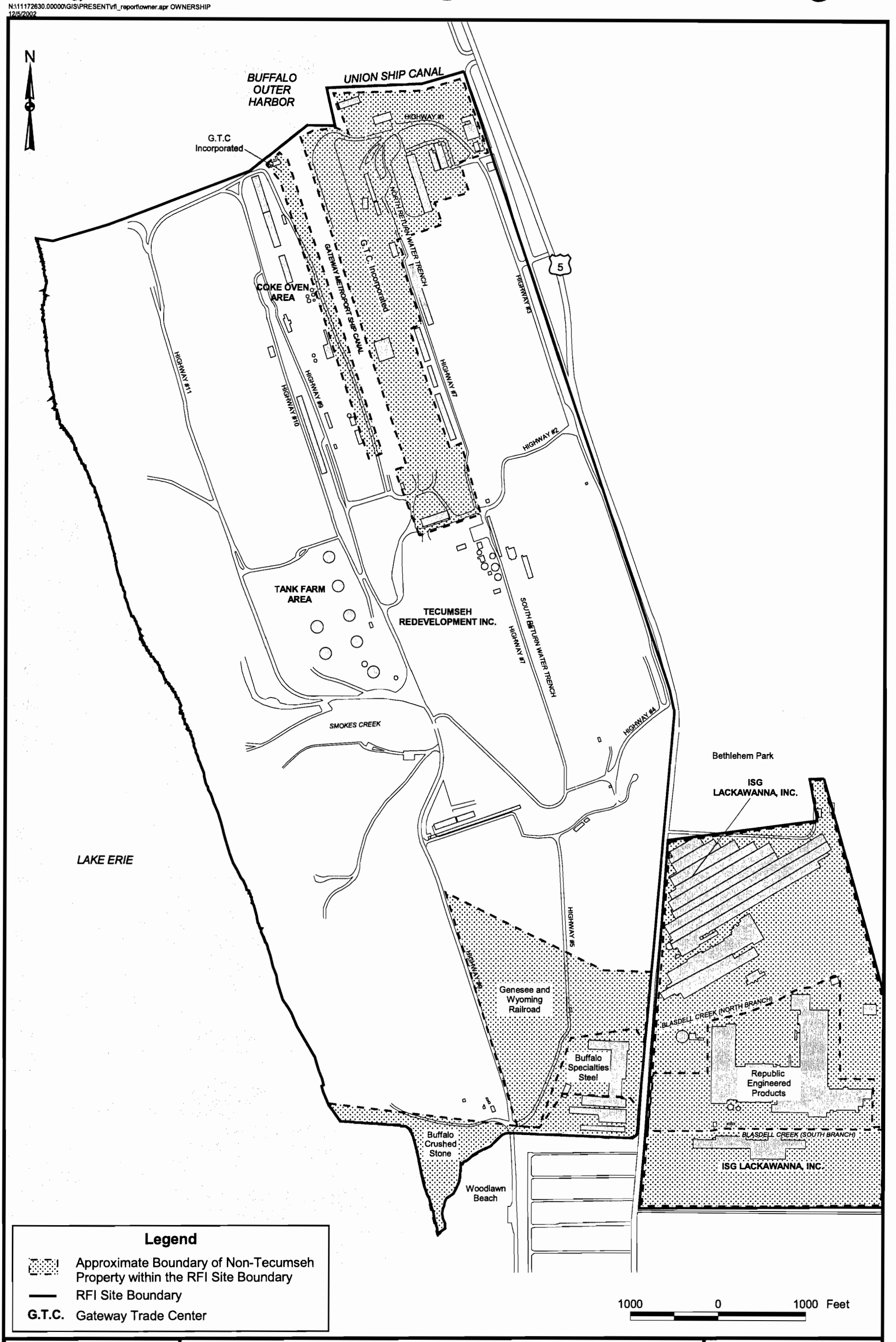
N:\11172630.00000\GIS\PI...\NTvfl_report\mapa.apr SLAG FILL AREA (SFA) BOUNDARY
12/2/2002

N:\11172630.00000\GIS\PRESENT\rfi_report\maps.apr SITE BOUNDARY
12/3/2004



URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK LACKAWANNA SITE BOUNDARY	FIGURE ES-5

N:\11172630.00000\GIS\PRESENT\rfi_report\owner.apr OWNERSHIP
12/5/2002



URS	THE FORMER BETHLEHEM STEEL CORPORATION LACKAWANNA, NEW YORK CURRENT OWNERSHIP OF SITE	FIGURE ES-6

N:\11172630.00000\GIS\PRESENT\welev_1117.apr (FILL) 11/20/01 GROUNDWATER ELEVATIONS
12/6/2002

N

BUFFALO OUTER HARBOR

LAKE ERIE 570.47

SEE INSET

INSET

TBM-11, 570.81
P-43 S, 574.61
P-42 S, 571.00
ES1-1, 572.18
P-35 S, 571.48
MWN-07, 570.94
MWN-18A, 572.52
P-3A-S, 571.98
MWN-43A, 570.65
P-44 S, 573.94
MW-08A, 583.14
ES1-2, 578.32
MWN-52A, 574.67
MWN-52B, 574.94
TBM-2006, DRY
MWN-50A, 573.73
P-34 S, 575.58
TBM-10, 571.97
TBM-09, 572.51
TBM-08, DRY
MWN-06A, 570.59
P-33 S, 577.80
MWN-25A, 575.36
MWN-49A, 572.86
MWN-08, 572.93
P-45 S, 578.46
P-2B-S, 569.01
MWN-14A, 572.53
P-2A-S, 578.32
B-3, 578.56
TBM-07, 574.94
MWN-51A, 574.65
MWN-05A, 570.38
MWN-34A, 572.77
TBM-06, 576.46
MWN-42A, 570.72
P-13 S, 580.51
MWN-28C, 576.67
MWN-28A, 578.14
B-2, 577.34
TBM-05, 577.21
MW-1D8, 573.56
P-6S, 570.01
P-7S, 570.94
MW-1D7, 572.94
MWN-12, 570.360
P-15 S, 579.22
B-1, 576.330
MW-1D1, 575.44
P-4S, 570.84
P-5S, 570.78
P-9S, 573.80
MWN-04, 570.27
MW-1D6, 571.51
P-31 S, 570.58
MW-1D1, 571.71
MW-1D2, 570.66
P-8S, 572.62
MW-1D5, 570.84
MWN-13A, 572.30
MW-1D3, 570.58
TBM-04, 575.40
MW-1D4, 569.80
MWN-35A, 571.30
MWN-36A, 572.14
MWN-03, 570.61
MWN-29A, 571.28
MWN-28A, 571.31
MWN-20A, 573.16
MWN-39A, 574.92
P-47 S, 576.860
P-49 S, 576.59
P-46 S, 577.02
P-48 S, 576.13
MWN-10, 577.50
MWN-38A, 574.25
MWN-40A, 578.31
TBM-03, 575.28
MWN-02, 571.25
MWN-16A, 573.27
MWN-37A, 574.47
MW-07A, 577.64
MWN-41A, 572.57
MWN-17A, 574.92
P-37 S, 575.23
MWN-44A, 574.31
MWN-24A, 576.03
MWN-11, 573.74
P-36 S, 572.97
MWS-03, 574.23
SC-01, 572.37
MWS-19A, 573.99
MWS-18A, 574.07
MWS-02, 574.23
MWS-26A, 576.65
P-38 S, 577.07
P-41 S, 575.89
P-39 S, 577.35
P-40 S, 575.69
MWS-22B, 583.00
MWS-22A, 582.04
MWN-01, 571.24
SC-03, 572.05
MW-11, 583.44
MWS-28A, 581.58
TBM-02, 574.99
MWS-01, 572.05
MWS-21B, 575.30
MWS-10, 579.280
TBM-01, 572.38
MWS-14, 574.84
MWS-21A, 576.37
MWS-24A, 575.67
P-25 S, 572.43
MWS-27A, 571.91
MWS-11A, 573.38
MWS-29A, 577.39
MW-2D4, 573.28
MWS-25A, 575.54
MWS-04, 578.07
MW-2D3, 573.26
MWS-13, 574.19
MWS-12B, 574.76
MW-2D2, 571.75
MWS-12A, 574.77
MWS-15, 673.58
MWS-26A, 571.24
MWS-09, 570.91
MWS-05, 575.98
MWS-08, 572.27
MW-06A, 576.26
MWS-06, 575.79

INSET:
P-1B-S, 571.80
MWN-09, 571.42
P-1A-S, 571.92
MWN-15A, 574.91
BPP-03, 578.014
BPP-02, 578.710
MWN-21C, 576.41
MWN-47A, 571.14
MWN-21A, 576.63
MWN-48A, 574.55
BPP-07, 577.51
BPP-10, 577.68
BPP-11, 577.69
MWN-45A, 571.40
BPP-06, 577.77
BPP-12, 577.66
MWN-46A, 577.58
BPP-08, 576.87
BPP-05, 577.12
MWN-27A, 577.16
BPP-16, 578.32
MWN-27C, 577.25
BPP-17, 576.71
MWN-31A, 577.37
MWN-32A, 576.42
P-18 S, 577.48
BPP-04, 577.440
BPP-14, 577.530
P-19 S, 577.31
MWN-30A, 577.52
BPP-15, 577.718
BPP-13, 577.556
MWN-19A, 577.33
P-20 S, 575.87
0 400 Feet

Legend

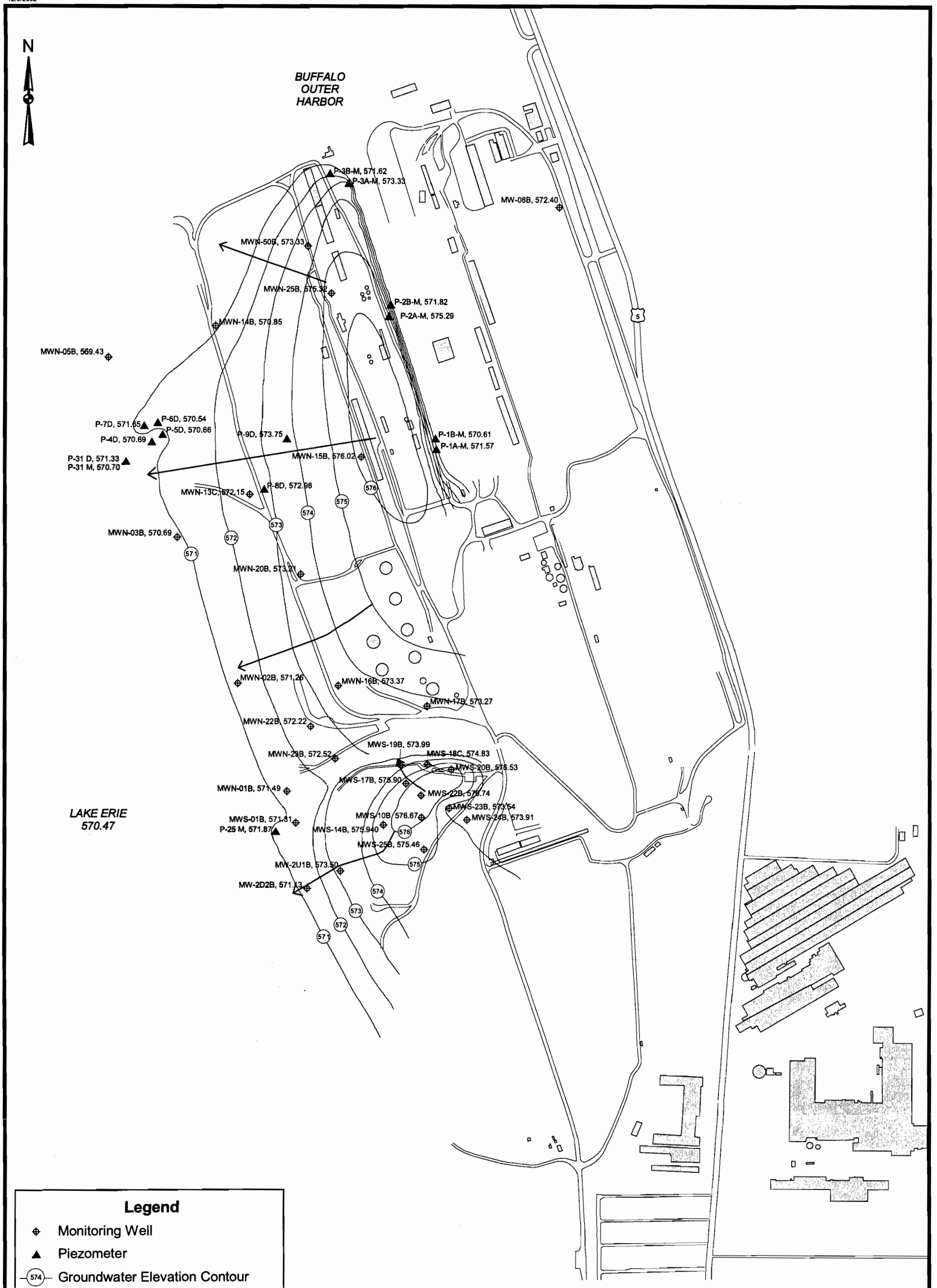
- Monitoring Well
- Piezometer
- Staff Gauge Location
- 574 Groundwater Elevation Contour
- Groundwater Flow Line

MWS-06, 575.79
Location ID
Groundwater Elevation (in feet MSL)

1000 0 1000 Feet

URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK GROUNDWATER ELEVATION CONTOUR MAP (FILL UNIT - NOVEMBER 20, 2001)	FIGURE ES-7

N:\11172630.00000\GIS\PRESENT\welev_sand.apr (SAND) 11/20/01 GROUNDWATER ELEVATIONS
12/6/2002



URS

BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK
GROUNDWATER ELEVATION CONTOUR MAP
(SAND UNIT - NOVEMBER 20, 2001)

FIGURE ES-8

N:\11172630.00000\...ENT\welev_1117.apr (FILL) 11/20/01 DISCHARGE AREAS
2/19/2003

N

BUFFALO OUTER HARBOR

6A

B

4B

6

5

4A

3

3A

2B

2A

1

1A

A

C

GATEWAY METROPORT SHIP CANAL

NORTH RETURN WATER TRENCH

SOUTH RETURN WATER TRENCH

SMOKES CREEK

BLASDELL CREEK (NORTH BRANCH)

BLASDELL CREEK (SOUTH BRANCH)

LAKE ERIE
570.47

S-1 S-2 S-3 S-4 S-5 S-6 S-7, S-20 S-8 S-9 S-10 S-11 S-12 S-13 S-14 S-15 S-16 S-17 S-18 S-19 S-21 S-22 S-23 S-24 S-25 S-26 S-27 S-28 S-29

P-1 P-2 P-3 P-4 P-5 P-7 P-8 P-9 P-10 P-11 P-12 P-13 P-14 P-15 P-16 P-17 P-18 P-19 P-20 P-21 P-22 P-23 P-24 P-25 P-26 P-27 P-28, P-29 P-30, P-31, P-32 P-33 P-34 P-35 P-36 P-37 P-38 P-39 P-40 P-41, P-42 P-43 P-44 P-45 P-46 P-47 P-48 P-49 P-50 P-51 P-52, P-53 P-54 P-55 P-56, P-57 P-58 P-59, P-60 P-61 P-62 P-63 P-64 P-66 P-67 P-68 P-69 P-70 P-71 P-72 P-73 P-74 P-75

Legend

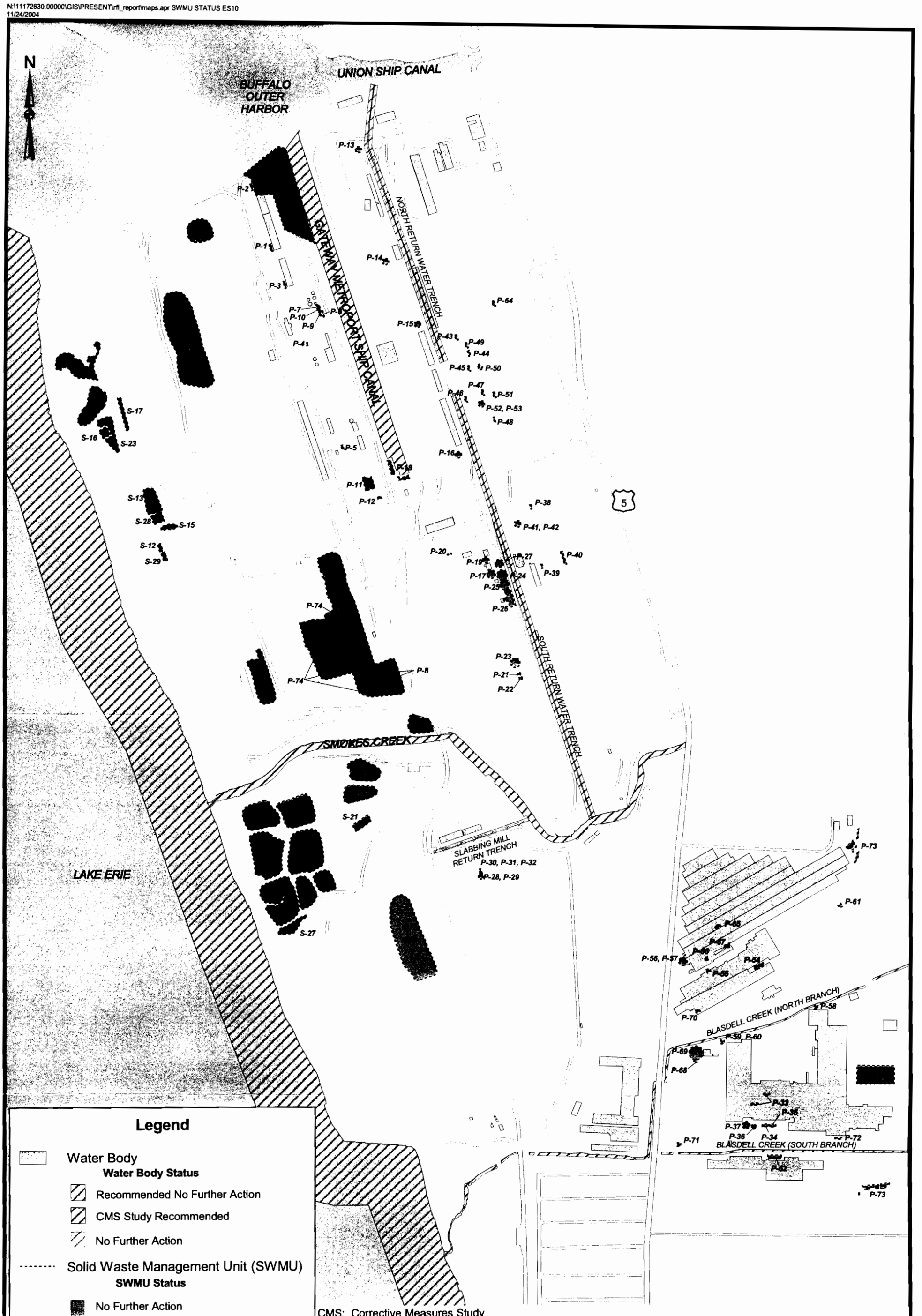
- 574 — Ground Water Elevation Contour (ft. amsl)
- ← Ground Water Flow Direction
- S-13 Solid Waste Management Unit
- 1A Discharge Area Boundary and Number
- A Offsite Recharge Area Boundary and Letter

NOTE:
- See Table 2-34 for discharge/recharge Area square footage

1000 0 1000 Feet

URS	BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK DISCHARGE AREA MAP (FILL UNIT - NOVEMBER 20,2001)	FIGURE ES-9

N:\11172630.00000\GIS\PRESENT\rfi_report\maps.apr SWMU STATUS ES10
11/24/2004



Legend

- Water Body
  - **Water Body Status**
  - Recommended No Further Action
  - CMS Study Recommended
  - No Further Action
- Solid Waste Management Unit (SWMU)
  - **SWMU Status**
  - No Further Action
  - Recommended No Further Action
  - CMS Study Recommended

CMS: Corrective Measures Study

Note:
- Status based on results of SWMU/Watercourse Assessments, Human Health Risk Assessments, and Ecological Risk Assessments

1000 0 1000 Feet

URS	BETHLEHEM STEEL CORPORATION SWMU STATUS	FIGURE ES-10