STEEL MANUFACTURING SITE: AREA II – FORMER DONNER-HANNA COKE PLANT PARCEL

Site Assessment Report and Voluntary Cleanup Plan

November 9, 1998

PREPARED FOR:

LTV Steel Company/The Hanna Furnace Corporation

TURNKEY ENVIRONMENTAL RESTORATION, LLC

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SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEAN-UP PLAN FOR AREA II
FORMER DONNER-HANNA COKE PLANT PARCEL

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

1.1 South Buffalo Redevelopment Plan/Intended Use of Site 1
1.2 Background 1
1.3 Site History 2
1.4 Purpose and Scope 3

2.0 DEVELOPMENT OF SITE-SPECIFIC RISK-BASED SCREENING LEVELS 5

2.1 General 5
2.2.1 Parameters of Interest 5
2.3 Determination of Risk-Based Screening Levels for Site Soils 6
2.3.1 Organic Compounds 6
2.3.2 Inorganics 7
2.3.3 Cyanide 7
2.4 Groundwater 8

3.0 SOIL ASSESSMENT 10

3.1 General 10
3.2 Soil/Fill 11
3.3 Supplemental Soil Sampling 11

4.0 GROUNDWATER ASSESSMENT 13
4.1 General 13
4.2 Hydrologic Investigation Activities 14
4.3 Area II Groundwater Hydrodynamics 15
4.4 Groundwater Modeling 16
4.5 Groundwater Treatability Testing 19

5.0 VOLUNTARY CLEANUP PLAN 21
5.1 General 21
5.2 Soils 21
5.3 Groundwater Collection/Containment 23
5.4 Groundwater Pretreatment 25
5.5 Terminal Basin Decommissioning 26

5.6 Redevelopment Considerations 26

6.0 PROJECT SCHEDULE 27

7.0 REFERENCES 28

LIST OF PLATES

Plate No.	Title
1	Site Isopotential Map

LIST OF FIGURES

Figure No.	Title	Follows Page
1-1	Former Republic Steel Plant Area Regional Map	1
1-2	Steel Manufacturing Site - Vicinity Map	1
1-3	Steel Manufacturing Site - Site Map	3
3-1	Area II – Surface Soil Sample Locations	11
3-2	Area II – Subsurface Soil Sample Locations	11
5-1	Area II – Conceptual Containment System Site Plan	21
5-2	Area II – Conceptual Containment System Cross-Section	22
6-1	Steel Manufacturing Site Voluntary Cleanup Schedule	27

LIST OF TABLES

TABLE NO.	TITLE	FOLLOWS PAGE
2-1	Risk-Based Screening Levels for Organic Parameters-of-Interest	6
2-2	Risk-Based Screening Levels for Inorganic Parameters of Interest	7
3-1	Summary of Surface Soil Results – Organic Compounds	11
3-2	Summary of Surface Soil Results – Inorganic Compounds	11
3-3	Summary of Subsurface Soil Results – Organic Compounds	11
3-4	Summary of Surface Soil Results – Inorganic Compounds	11
4-1	Summary of Groundwater Sampling Results	14
4-2	Summary of Static Groundwater Levels	15
4-3	Summary of Slug Testing Results	15
5-1	Predicted Quality of Collected Groundwater	25

INTRODUCTION

1.1 South Buffalo Redevelopment Plan/Intended Use of Site

The City of Buffalo, in partnership with the City of Lackawanna, Erie County, and the Erie County Industrial Development Agency and other stakeholders, has developed a conceptual redevelopment plan for over 1,200 acres of currently inactive and largely vacant industrial properties ("brownfields") in South Buffalo, New York (see Appendix A and Figure 1-1 in Reference 1). The redevelopment plan conceptualizes a program for creating employment opportunities while allowing for open space conservation, habitat enhancement, parks and recreation.

The City of Buffalo has already claimed its first significant brownfields success story under the South Buffalo Redevelopment Plan. The Truscon Property, a former LTV property now owned by the City, was the subject of a fast-track remediation (petroleum spill cleanup) project jointly funded by LTV and the City of Buffalo and completed in late 1996 with the full cooperation of the New York State Department of Environmental Conservation (NYSDEC).

Successful completion of the fast-track remedial efforts allowed the City to close a deal with a developer for construction of a new hydroponics plant that reportedly created over 200 new jobs. The cornerstone of the South Buffalo Redevelopment Plan is the industrial/commercial corridor and Southtowns Connector Highway planned on the site of the former Republic Steel Plant and Donner-Hanna Coke Plant properties (Steel Manufacturing Site). The Redevelopment Plan envisions light manufacturing, warehousing, and distribution facilities on the former Steel Manufacturing Site based on its unique attributes of interstate highway, rail and shipping access and its proximity to the Canadian border crossing at the Peace Bridge. The Steel Manufacturing site consists of four parcels owned by LTV Steel Company (LTV) and The Hanna Furnace Corporation (HFC).

1.2 Background

LTV Steel Company owns, or co-owns with The Hanna Furnace Corporation, a vacant industrial property located on the Buffalo River in Buffalo, New York (Figure 1-1 and Figure 1-2). The

FIGURE 1-1 : FORMER REPUBLIC STEEL PLANT AREA REGIONAL MAP

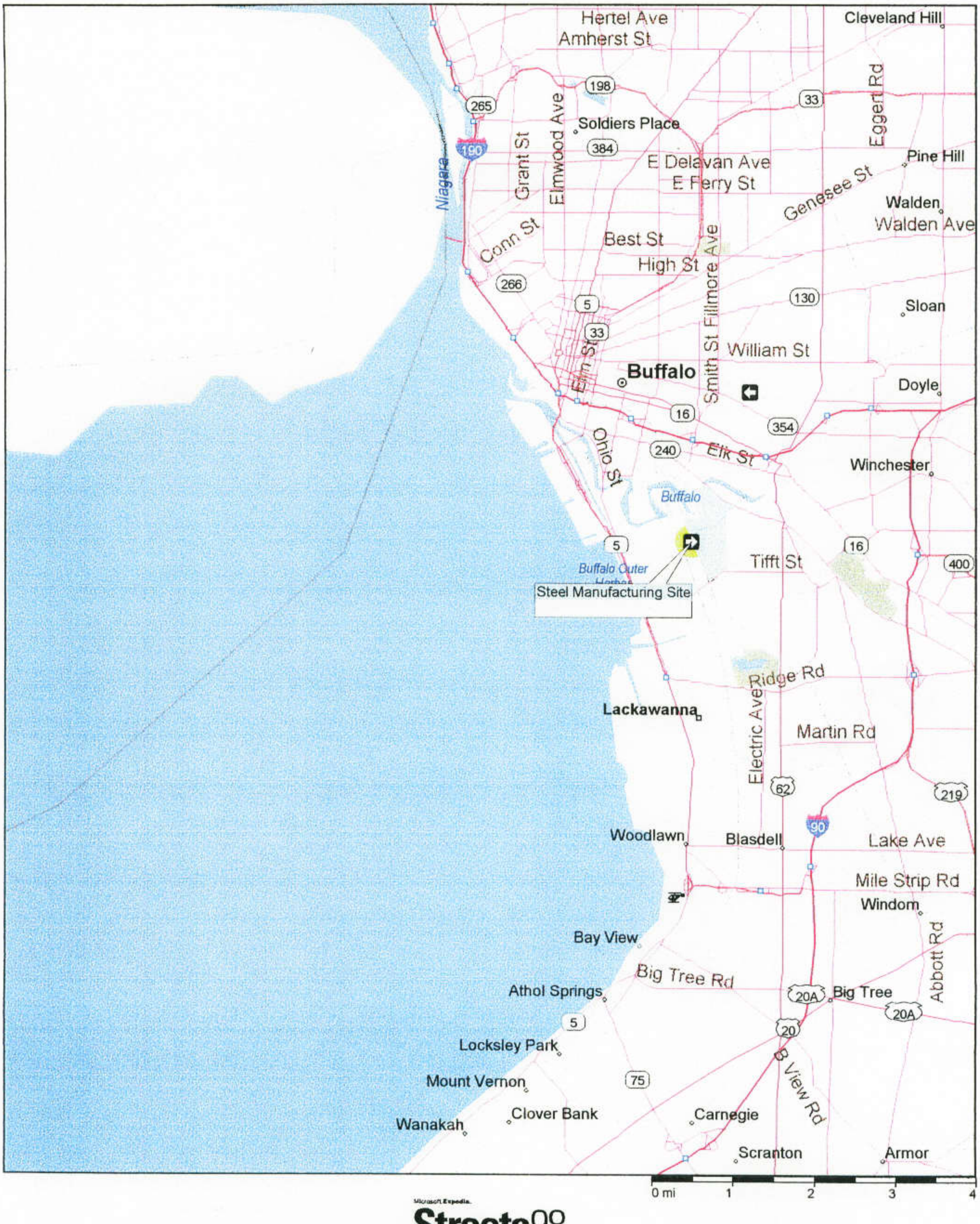


FIGURE 1-2 : STEEL MANUFACTURING SITE VICINITY MAP

vacant industrial property, hereinafter referred to as the Steel Manufacturing Site or Site, is subdivided into the following four parcels, shown on Figure 1-3, based on the operational and ownership history of each:

- Area I – Former Republic (LTV) Steel Plant
- Area II - Former Donner-Hanna Coke Plant
- Area III - Former Republic (LTV) Warehouse
- Area IV - Former Donner Hanna Coke Yard

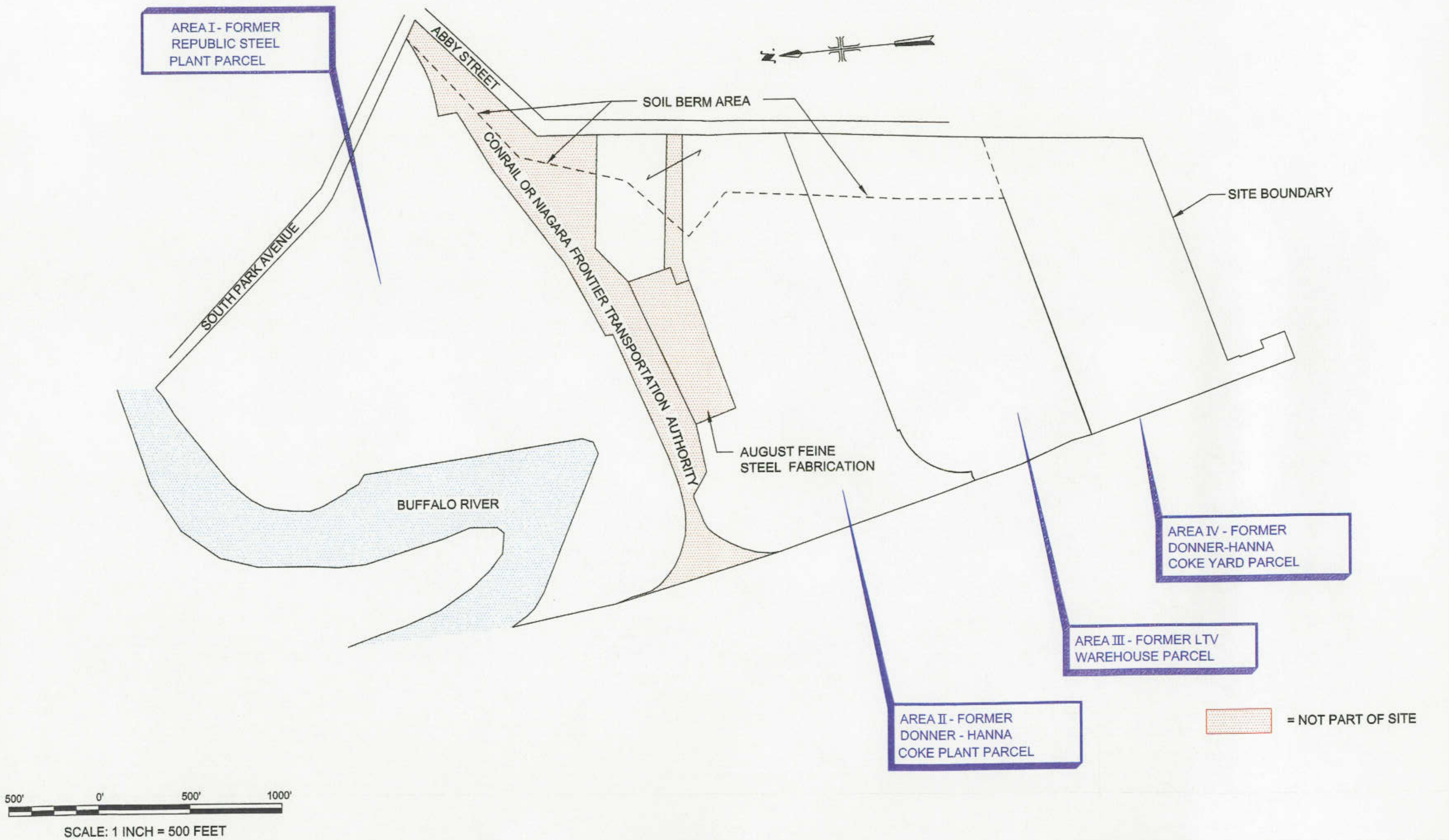
A Voluntary Cleanup Site Assessment Report (Reference 1) was prepared to assess the environmental condition of the Steel Manufacturing Site and to establish a voluntary remediation plan to support future redevelopment of the Site as a light industrial/corporate park. Based on its review of the Voluntary Cleanup Site Assessment Report, the New York State Department of Environmental Conservation (NYSDEC) requested that additional investigations be performed at the Site to characterize perimeter groundwater conditions and to serve as a basis for formalizing a voluntary cleanup application and remedial design plans.

1.3 Site History

The former Donner-Hanna Coke Plant (Area II) consisted of a manufactured gas plant that also produced coke and various by-products from coal. The coke production area included coal and coke handling equipment, coke batteries, coal and coke storage areas, and associated auxiliary equipment. The by-product area produced various by-products from coke oven gases generated during the coking process, including products such as coal tar, light oil, and ammonium sulfate. The by-product area consisted of process equipment, storage tanks and piping used to extract and purify the various by-products from the coke oven off-gases.

The facility also had a large gas holding tank used to store processed coke oven gas prior to its reuse as fuel in the coke batteries and other plant areas. In addition, there were various piping

FIGURE 1-3



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SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN
AREA II - FORMER DONNER-HANNA COKE PLANT PARCEL

STEEL MANUFACTURING SITE
SITE MAP

DATE NOVEMBER 1998
SHEET ___ OF ___
CAD REF. NO. TKTS02.DWG

and utility systems located both aboveground and belowground. There were also a large number of trenches, pits and sumps located throughout the former D-H plant.

In 1990 and 1991, the plant was decommissioned and demolished down to ground level. Aboveground buildings, structures, tanks, vessels, and piping were decommissioned and demolished, with the resulting demolition debris managed in accordance with applicable local, State and Federal regulations. The concrete trenches and pits were cleaned, fractured to prevent runoff water accumulation, and backfilled during the decommissioning and demolition process. Some of the underground piping systems and utilities were also removed in various areas as well. Upon completion of decommissioning activities, the site was graded and seeded to prevent erosion.

1.4 Purpose and Scope

The purpose of this report is to present a revised Voluntary Cleanup Plan for Area II based upon the results of the additional Area II investigations and site-specific risk-based cleanup levels proposed for the site.

A revised Voluntary Cleanup Plan for Area I was presented to the NYSDEC on October 16, 1998. Supplemental investigations are on-going in Areas III, and IV. Revised Voluntary Cleanup Plans for Areas III and IV will be prepared and presented to the NYSDEC upon completion, scheduled for mid-November 1998.

It is the intent of the Site owners to voluntarily cleanup the entire Steel Manufacturing Site. Area I was singled out for fast-track cleanup and redevelopment for the following reasons:

- The City of Buffalo and the Buffalo Economic Renaissance Corporation have urged the volunteers to make a major portion of the Site available for sale and redevelopment as soon as possible.
- Considerable interest has been expressed by prospective buyers/developers in the Steel Manufacturing Site.
- Based on site investigation results, Area I exhibits the fewest number of environmental conditions requiring cleanup.

- Cleanup of Area I can be completed and the Area made available for sale by the Summer of 1999 without delaying or interfering with cleanup of the remainder of the site.

- Area I is the natural choice for initial redevelopment based on existing infrastructure.

Area II is scheduled for the second phase of development immediately following remediation of Area I. A preliminary project schedule for Area II activities is included in Section 6.0.

2.0 DEVELOPMENT OF SITE-SPECIFIC RISK-BASED SCREENING LEVELS

2.1 General

The steel manufacturing Site is a Brownfields site intended for re-development for light industrial or corporate office uses under New York State's Voluntary Cleanup Program. Accordingly, the primary consideration in the determination of acceptable clean-up or screening levels for the site is the potential risk to human health posed by residual chemical constituents in the soils and groundwater. Specifically, the degree to which these analytes are likely to be directly or indirectly encountered, both during or following site development, and potentially impact human health due to their properties forms the basis for the development of acceptable risk-based screening levels (RBSLs). The site-specific RBSLs derived for this site will, in turn, provide a sound basis upon which decisions for voluntary cleanup and/or redevelopment can be made. As with all risk-based cleanup approaches, the calculated screening levels should be regarded as site-specific guidance values rather than definitive clean-up thresholds. Hence, the RBSLs should be regarded as screening values that, in combination with other site factors, will assist in determining of the suitability of the site parcels for commercial/light industrial redevelopment without further removal or clean-up actions. These RBSLs are intended to apply to all areas of the site.

2.2.1 Parameters of Interest

A comprehensive discussion of the nature and extent of contamination in Area II is presented in Sections 3 and 4. In general, analytes detected across the Site at elevated concentrations are the common byproducts of manufactured gas plant and coke processing, coal handling, and steel manufacturing operations. These analytes or parameters are:

- **Volatile Organic Compounds (VOCs)** – VOCs present in elevated concentrations in site soils and groundwater are limited to benzene, toluene, ethylbenzene and xylene (*i.e.*, BTEX).

- **Polynuclear Aromatic Hydrocarbons (PAHs)** - PAHs are byproducts of incomplete combustion and impurities in petroleum products. As such, they are commonly found in urban soil environments. They are present in site soils with elevated concentrations in certain areas of the LTV/Donner-Hanna property. Specific PAH compounds that are known to represent a human health risk and/or are present in elevated concentration are almost exclusively limited to benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h,)andthracene.

- **Inorganics** – or heavy metals are present in site soils and to a lesser extent in groundwater (primarily due to adsorption on particulates) in certain areas of the property. Most of these levels are commonly found in soils at trace levels. Inorganics present in site soils at elevated concentrations relative to "background" or typical concentrations include lead, arsenic, chromium, zinc, and copper. Mercury is also present in isolated instances.

- **Cyanide** – is present in stable form in certain areas of the site soils and in lower concentrations in corresponding site groundwater. Cyanide is believed to be complexed with iron and other inorganics.

Soil and groundwater test results within Area II indicate that contaminants are present in many locations within Area II. Heavy metals, SVOCs, VOCs, BTEX and PAH compounds were detected throughout the majority of the former coke plant area (the northern portion of Area II) which exceed proposed RBSL screening levels for soils. New York State groundwater quality standards have also been exceeded in the majority of the coke plant area.

2.3 Determination of Risk-Based Screening Levels for Site Soils

2.3.1 Organic Compounds

Risk-based screening levels are dependent on the nature of the contamination and the potential routes of exposure, both during and following site development. For organic compounds in soil media, potential routes of exposure to site workers would be through:

- incidental ingestion of contaminated soils
- direct skin contact with the contamination or contaminated soil
- inhalation of volatilized contaminants/airborne dust resulting from site redevelopment activity
- inhalation of contaminant vapors accumulating in buildings

Site-specific RBSLs for organic parameters of interest are shown in Table 2-1. For a detailed discussion regarding how site-specific organic compound RBSL values were

TABLE 2-1
SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN FOR AREAS II - FORMER DONNER-HANNA COKE PLANT PARCEL

RISK-BASED SCREENING LEVELS FOR ORGANIC PARAMETERS-OF-INTEREST

Parameter-of-Interest	Soil Ingestion, Inhalation, Skin Contact RBSL[1] (mg/kg)		Indoor Soil Vapor Inhalation RBSL[1,3] (mg/kg)		Risk-Based Screening Level (mg/kg)
	Carcinogenic Effects[2]	Toxic Effects	Carcinogenic Effects[2]	Toxic Effects	
Volatile Organics					
Benzene	1,000	N/A	1.09	N/A	1.09
Toluene	N/A	18,700	N/A	55	55
Ethylbenzene	N/A	11,500	N/A	1,100	1,100
Xylene	N/A	208,000	N/A	>S	208,000
Poly-Aromatic Hydrocarbons					
Benzo(a)anthracene	304	23,800	>S	>S	304
Benzo(a)pyrene	30.4	23,800	>S	>S	30.4
Benzo(b)fluoranthene	304	23,800	>S	>S	304
Benzo(k)fluoranthene	3,040	23,800	>S	>S	3,040
Chrysene	3,040	23,800	>S	>S	3,040
Dibenzo(a,h)anthracene	30.4	23,800	>S	>S	30.4

1. RBSL = Risk-Based Screening Level, determined for commercial/industrial exposure scenario in accordance with ASTM E 1739 - 95.

2. Carcinogenic effects for 1 in Ten Thousand Risk (TR = 1.00 E-04).

3. >S = Selected risk level is not exceeded for pure compound present at any concentration.

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calculated, refer to Section 2 of the Area I Site Assessment Report and Voluntary Cleanup Plan.

2.3.2 Inorganics

The primary routes of worker exposure to inorganic contamination in site soils at the Site essentially involve the same pathways as for organic contaminants, discounting significant exposure from inhalation of volatilized contaminant vapors. Thus, the major routes of exposure for inorganics in soils include:

- Incidental ingestion of contaminated soils
- Direct skin contact with the contamination or contaminated soils
- Inhalation of wind-blown contaminated surface soils (*i.e.*, dust)

Site-specific RBSLs for inorganic parameters of interest are shown in Table 2-2. For a detailed discussion regarding how site-specific inorganic RBSL values were calculated, refer to Section 2 of the Area I Site Assessment Report and Voluntary Cleanup Plan.

2.3.3 Cyanide

Potential exposure pathways for cyanide in the site soils are identical to those for the inorganic parameters of interest. In general, the toxicity of cyanide complexes is dependent on its availability to organisms, which is a function of the susceptibility of the compounds to chlorination, acidification and hydrolysis. Measurement of the susceptibility of cyanide complexes to these phenomena is accomplished through comparison of the total cyanide concentrations in the site soils relative to amenable cyanide concentrations in the same material. The difference between the total and amenable cyanide concentrations reflects the amount of cyanide present as highly stable metal complexes, which are typically unavailable to living organisms (Ref. 2).

An additional indicator of the health hazard associated with cyanide complexes is the amount of the total matrix that is available to react with hydrogen (*i.e.*, at low pH) to form hydrogen cyanide (HCN) gas. They cyanide reactivity test provides a measurement

TABLE 2-2
SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN FOR AREAS II FORMER DONNER-HANNA COKE PLANT PARCEL
RISK-BASED SCREENING LEVELS
FOR INORGANIC PARAMETERS OF INTEREST[1]

Parameter	RfD (mg/kg-d)	RBSL (mg/kg)	Max. Background Conc.[2] (mg/kg)	Screening Level (mg/kg)
Aluminum	N/A	N/A	33000	33000
Arsenic	3.00E-04	613.2	12	613
Barium	N/A	N/A	600	600
Beryllium	2.00E-03	4088	1.75	4088
Cadmium	N/A	N/A	1	1
Calcium	N/A	N/A	44400*	44,400
Chromium (trivalent)	1.5	3066000	40	Note 3
Cobalt	N/A	N/A	60	60
Copper	N/A	N/A	55.7*	55.7
Iron	N/A	N/A	550,000	550000
Lead	N/A	N/A	500	500
Magnesium	N/A	N/A	7920*	7920
Manganese	0.14	286160	5000	286160
Mercury	N/A	N/A	0.211*	0.211
Nickel	2.00E-02	40880	25	40880
Potassium	N/A	N/A	43000	43000
Selenium	5.00E-03	10220	12.7	10220
Silver	5.00E-03	10220	1.27	10220
Sodium	N/A	N/A	8000	8000
Vanadium	N/A	N/A	300	300
Zinc	0.3	613200	138	613200

1 - RBSL calculated based on ingestion risk in accordance with the following formula (derived from ASTM E 1739-95):

$$RBSL = \frac{THQ \times BW \times AT_N \times 365 days/yr \times RfD}{EF \times ED \times 10^{-6} kg/mg \times IR_{soil} \times RAF_o}$$

Where: THQ = Toxic Hazard Quotient = 1
BW = Body Weight = 70 KG
ATN = Averaging Time for Non-Carcinogens = 25 yrs
RfD = Oral Reference Dose (chemical-specific, from IRIS)
EF = Exposure Frequency = 250 days/year
ED = Exposure Duration = 25 years
IR_{soil} = Soil ingestion rate = 50 mg/day
RAF_o = Oral relative absorption factor = 1

2 - Based on highest values of Eastern U.S./NY State background concentration data (per TAGM 4046) or site-specific background (from Truscon site). Values flagged with an asterisk represent Truscon site data.

3 - Not Applicable - greater than 100%

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of the amount of hydrogen cyanide liberated by the soil or waste material as it is subjected to acidic conditions. A comparison of the mass of HCN liberated relative to the sample mass provides a cyanide reactivity value, which is used under the Federal RCRA program in support of determining whether the material is characteristically hazardous.

Several soil samples from Area II that exhibited elevated total cyanide concentrations were also analyzed for amenable and reactive cyanide. In all instances, amenable cyanide was present at very low on non-detectable levels, and reactive cyanide was not detected. Thus, cyanide present in soils at the Site appears to be in highly stable form, and poses negligible health threat.

TAGM 4046 acknowledges that toxicity of cyanide varies according to the stability of the complex, and that background cyanide concentrations are not considered an applicable factor in the determination of cleanup goals. Hence, the TAGM does not provide a generic cleanup goal for this material. In absence of any other NY State guidance for cyanide cleanup goals, pertinent USEPA guidance was reviewed. USEPA Region III and Region IX preliminary remediation levels for free cyanide in industrial soils are 41,00mg/kg and 21,400 mg/kg, respectively, where free cyanide is essentially synonymous with amenable cyanide. Alternatively, USEPA's Soil Screening Guidance Technical manual cites a generic screening level of 1,600 mg/kg for amenable cyanide. For purpose of conservatism, 1,600 mg/kg amenable cyanide is proposed as the cyanide Site Specific Screening Level for the soils at the Site.

2.4 Groundwater

A detailed assessment of groundwater quality in Area II of the site is presented in Section 4. In general, the primary area of high groundwater contamination is the former coke plant process area located on the northern portion of the parcel. That area of the site will not be redeveloped for industrial/commercial use as discussed in Section 5.0. Contaminated groundwater migration from the process area will be controlled by constructing a combined groundwater collection and containment system around the perimeter of the area (refer to Section 5 for a detailed discussion of the voluntary cleanup plan approach). Direct contact with groundwater outside of the collection and containment system is not significant.

Groundwater contamination at the Site poses little potential health impact for site workers. Since municipal potable water will be used for consumption, sanitary and process purposes, the only potential for significant intake of contamination present in the groundwater would be through direct contact with and/or inhalation of volatile organic contaminants during active groundwater management (*viz.*, during dewatering activities, such as by utility or foundation workers).

Although direct contact with and/or volatilization from groundwater during active management may pose a short-term exposure scenario, this is generally controllable with appropriate personal protection, and will by no means represent a chronic occurrence. In fact, health-based groundwater remediation guidance values for acute exposure scenarios of this nature are generally not available, nor does ASTM E 1739-95 provide a method for deriving such values. It is therefore proposed that groundwater screening levels be based strictly upon potential impact to sensitive off-site receptors as addressed in Section 4 of this document.

3.0 SOIL ASSESSMENT

3.1 General

ICF Kaiser Engineers performed a Phase II Environmental Site Assessment for Area II to identify potential environmental conditions on the property through the collection of site-specific data on soil, subsurface materials, groundwater and other media. The results are summarized in the 1997 Voluntary Cleanup Site Assessment Report (Reference 1). The NYSDEC reviewed and provided technical comments on the Report. A Supplemental Field Investigation was undertaken in March, 1998 in accordance with a Work Plan (Reference 3) to address these comments. The scope of the Work Plan focused on conducting a perimeter groundwater investigation to assess the potential for migration of on-site groundwater contamination and its potential impact on sensitive downgradient receptors. In addition, the ability of natural attenuation processes to degrade and dissipate site contaminants was to be assessed. The Work Plan also:

- Outlined a boring program designed to assess remedial requirements for certain subareas of Area I (refer to the November, 1998 Area I Site Assessment Report & Voluntary Cleanup Plan for details).

- Described the installation and testing of additional groundwater monitoring wells within Area II to estimate the quality and quantity of groundwater to be collected; predict the area of influence with alternative groundwater collection and containment system configurations and serve (at least in part) as a long-term environmental monitoring system..

- Specified a procedure to conduct solidification/treatability testing of the blue stained soils.

3.2 Soil/Fill

Area II soil and fill was characterized during the initial ESA by approximately 50 borings located in the northern portion of Area II related to historical coke plant byproducts and manufactured gas plant operations.

The surface soil analytical results identified one PAH compound, (*i.e.*, Benzo(a)pyrene) and several heavy metals (cadmium, calcium, copper, lead, mercury) exceeding RBSL concentrations in Area II. The analytical results also identified eleven subareas with subsurface contamination. These subareas include:

- The light oil area
- Underground piping area
- Old tar tanks
- Benzol washers and final coolers area
- Tar decanters
- Gas Holder and iron oxide (gas purifier) boxes
- Possible tar unit
- Primary cooler area
- Northeast soil gas plume (the area in the vicinity of former Koppers Tar Works).

The subsurface soils were contaminated with aromatic hydrocarbons (BTEX) and PAHs. Two of the PAH compound concentrations (*i.e.*,. Benzo(a)pyrene and naphthalene) exceeded RBSL concentrations. Black-stained soils, elevated PID readings, and olfactory evidence of elevated parameter concentrations were apparent at these subareas.

Laboratory analytical results for surface and subsurface samples from the Phase II ESA investigation are summarized in Tables 3-1 through 3-4. Sample locations are shown on Figures 3-1 and 3-2.

3.3 Supplemental Soil Sampling

During the Phase II Environmental Site Assessment, no samples were collected in the southern portion of Area II because of its historical site use. The southern portion of Area II had been

TABLE 3-1

AREA II

SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF SURFACE SOIL RESULTS - ORGANIC COMPOUNDS(1)

Parameter	Risk Based Screening Level (2)	A2-SS-5	A2-SS-6	A2-SS-7	A2-SS-8	A2-SS-8 Duplicate	A2-SS-9
Volatile Organic Compounds (mg/kg)							
Methylene Chloride	93		0.007	0.011			0.0098
1,1,1-Trichloroethane	7,000						0.19
Semivolatile Organic Compounds (mg/kg)							
Acenaphthene	5,000	6.1				5.6	
Acenaphthylene	-	5.7	0.44	6.4	18	12	1
Anthracene	20,000	34	0.58	4.7	30	26	0.85
Benzo(a)anthracene	304*	58	1.9	8.2	56	43	2.2
Benzo(a)pyrene	30.4*	47	1.7	9.1	45	37	2.3
Benzo(b)fluoranthene	304*	64	2.8	11	52	44	3.8
Benzo(k)fluoranthene	3,040*	38	1.3	5.9	26	26	1.7
Benzo(g,h,i)perylene	-	22	0.87	6	17	18	1.3
Carbazole	-	11			6.4	10	0.42
Chrysene	3,040*	51	1.9	7.7	46	36	1.9
Dibenzo(a,h)anthracene	30.4*	9.5			7.2	6.7	0.41
Dibenzofuran	-	6.2	0.4		11	20	
Fluoranthene	3,000	89	3.1	21	91	91	3.9
Fluorene	3,000	9.2			24	35	0.4
Indeno(1,2,3-cd)pyrene	-	23	0.86	5.5	18	17	1.2
2-Methylnaphthalene	-					11	
Naphthalene	300		0.59	11	15	24	0.98
Phenanthrene	-	56	1.8	18	82	100	2.5
Pyrene	2,000	84	3	16	78	69	3.3

Notes

1. Source: Analytical summary report (March 10, 1997) prepared by Columbia Analytical Services for Malcolm Pirnie, Inc.
2. Levels flagged by an * represent risk based screening levels from ASTM E1739-95. Non-flagged levels represent TAGM 4046 health-based cleanup levels.
3. Blank space indicates that the parameter was analysed for but not detected.
4. Shading denotes that concentration exceeds risk based screening level.

- No ASTM risk based screening level or TAGM 4046 health-based cleanup level has been developed.

TABLE 3-2

AREA II

SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF SURFACE SOIL RESULTS - INORGANIC COMPOUNDS(1)

Parameter	Background(2)	Risk Based Screening Level(3)	A2-SS-5	A2-SS-6	A2-SS-7	A2-SS-8	A2-SS-8 Duplicate	A2-SS-9
Aluminum	33,000	-	4,960	5,170	23,200	19,700	30,100	3,260
Antimony	-	-						
Arsenic	-	613	10.2	14	6.9	4.74	3.69	5.58
Barium	600	-	66.4	74.4	271	203	332	41
Beryllium	-	4,088	0.885	0.81	6.23	3.21	4.66	0.681
Cadmium	1	-		1.48		0.715		
Calcium	44,400	-	47,800	27,300	163,000	124,000	163,000	18,700
Chromium	-	NA	23	31.8	27.8	223	194	77.4
Cobalt	60	-		6.97				
Copper	55.7	-	28.2	54.8	21	64.3	32.8	24.3
Iron	550,000	-	18,600	65,200	15,600	88,900	65,700	13,100
Lead	500	-	46.7	83.7	15.1	60.5	3,260	31.8
Magnesium	7920	-	18,600	4,370	40,500	23,400	25,400	4,190
Manganese	-	286,160	794	1,320	2,970	11,700	7,350	1,360
Mercury	0.211	-		4.62	0.683			0.351
Nickel	-	40,880	11.4	27.9	13.3	25.8	14.1	14.8
Potassium	43,000	-	492	595	884	1,270	1,980	326
Selenium	-	10,220	3.85	10.4	7.5	31	27.5	4.64
Silver	-	10,220				2.17	1.94	
Sodium	8,000	-			747	623	776	
Vanadium	300	-	12.7	18.5	14	124	86.7	19.1
Zinc	-	613,200	84	349	25.3	105	115	78.9
Cyanide	-	1,600	25.1	2.88	2.7	28.9	28.5	

Notes

1. Source: Analytical summary report (March 10, 1997) prepared by Columbia Analytical Services for Malcolm Pirnie, Inc.
2. Background inorganic soil concentrations from Truscon Property or TAGM (Eastern US/NYS).
3. Levels derived from ASTM E1739-95.
4. Blank space indicates that the parameter was analyzed for but not detected.
5. Shading denotes concentration exceeds risk based screening level or background TAGM 4046 values.

TABLE 3-3

AREA II

SUPPLEMENTAL SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF SURFACE SOIL RESULTS - ORGANIC COMPOUNDS[1]

Parameter	Risk Based Screening Level	A2-P-1	A2-P-1	A2-B-2	A2-B-2	A2-B-3 to A2-B-5[2]	A2-B-5	A2-B-6 to A2-B-9[2]	A2-B-10	A2-B-10	A2-P-11 A2-B-12 to A2-B-14[2]	A2-P-11	A2-B-15 to A2-B-17[2]	A2-B-19 to A2-B-21[2]
Sample Depth (ft)		2-4	11-13	2-4	9-11	2-4	10-12	2-4	2-4	9-11	2-6	9-11	2-4	2-4
Volatile Organic Compounds (mg/kg)														
Benzene	1.09*	3.1			0.14		0.02				13			
Ethylbenzene	1,100*									0.03	9.3			
Toluene	55*	0.99		1.8	0.14									
Total Xylenes	208,000*	8		2.6	0.03					0.06	4.3			
Semivolatile Organic Compounds (mg/kg)														
Acenaphthene	5,000		1.1	3.3		4.5					61			49
Acenaphthylene	-		2.3	5.5		13			54		48	0.98		90
Anthracene	20,000		4.3	2.9		16			53		39			110
Benzo(a)anthracene	304*	7.9	4.3	2.9		33			150		48	0.58		110
Benzo(a)pyrene	30.4*	6.7	3.4	2.4		33			100		36	0.53	6.3	110
Benzo(b)fluoranthene	304*	8.4	3.8	2.6		37			130	0.48	40	0.62	7.9	110
Benzo(k)fluoranthene	3,040*	5	2.2	1.6		21			83					61
Benzo(g,h,i)perylene	-	3.1	1.2	1.1		16			71				5.6	48
Chrysene	3,040*	6.1	3.4	2.2		26			130		43			100
Dibenzo(a,h)anthracene	30.4*		0.59			5.4			22					
Dibenzofuran	-													
Fluoranthene	3,000	11	9.6	11		55			330	1.2	81	1.6	7	310
Fluorene	3,000		5.3	3.9		11			34		46			110
Indeno(1,2,3-cd)pyrene	-	3.5	1.2	1		16			70				5.3	48
2-Methylnaphthalene	-													
Naphthalene	300		14	2.9		3.6			63	1.2	460	13		110
Phenanthrene	-	2.9	12	13		38			210	1.2	120	1.4		280
Pyrene	2,000	11	7	3.1		49			250	0.85	60	1.1	5.4	220

TABLE 3-3 (CONT.)

AREA II

SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF SURFACE SOIL RESULTS - ORGANIC COMPOUNDS(1)

	Risk Based Screening Level	A2-B-22 to A2-B-24(2)	A2-B-25	A2-B-25	A2-B-26 to A2-B-28(2)	A2-B-29 to A2-B-31(2)	A2-B-31	A2-B-32	A2-B-33 to A2-B-35(2)	A2-B-85
Sample Depth (ft)		2-4	6-8	10-12	7-9	2-4	10-12	16-18	2-4	4-6
Volatile Organic Compounds (mg/kg)										
Benzene	1.09*		1.8	0.042	54		15	0.014	0.009	
Ethylbenzene	1,100*				22		2.9			11
Toluene	55*				200		4.2	0.008		20
Total Xylenes	208,000*				429		24.4			178
Semivolatile Organic Compounds (mg/kg)										
Acenaphthene	5,000		6.3							8.2
Acenaphthylene	-	13	25				2.4		55	29
Anthracene	20,000	9.8	42				2.1		41	57
Benzo(a)anthracene	304*	22	67				1.4		39	170
Benzo(a)pyrene	30.4*	24	56				1.1		39	94
Benzo(b)fluoranthene	304*	31	82				1.4		41	150
Benzo(k)fluoranthene	3,040*	13	30				0.7		19	93
Benzo(g,h,i)perylene	-	7.6	23						21	43
Chrysene	3,040*	24	63				1.4		34	140
Dibenzo(a,h)anthracene	30.4*		10						5.3	18
Dibenzofuran	-									
Fluoranthene	3,000	55	120	1			2.9		100	500
Fluorene	3,000	8.3	33				2.6		31	86
Indeno(1,2,3-cd)pyrene	-	9.1	26						19	50
2-Methylnapthalene	-									
Napthalene	300	6.4	58		48		52		7.9	150
Phenanthrene	-	47	110	0.91			5.4		81	370
Pyrene	2,000	40	110	0.67			2.4		83	300

Notes:

1. Source: "Final Report for the Phase II Environmental Site Assessment of the Donner-Hanna Coke Plant - Buffalo, New York," ICF Kaiser Engineers, Inc., July, 9, 1997.
2. Composite soil samples.
3. Levels flagged by an * represent risk based screening levels from ASTM E1739-95. Non-flagged levels represent TAGM 4046 health-based cleanup levels.
4. Blank space indicates that the parameter was analysed for but not detected.
5. Shading denotes concentration exceeds risk based screening level.

TABLE 3-4

AREA II

SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF SUBSURFACE SOIL RESULTS - INORGANIC CONSTITUENTS[1]

Parameter	Background[2]	Risk Based Screening Level[3]	A2-P-I	A2-P-1	A2-B-2	A2-B-2	A2-B-3 to A2-B-5[4]	A2-B-5	A2-B-6 to A2-B-9[4]	A2-B-10	A2-B-10	A2-P-II A2-B-12 to A2-B-14[4]	A2-P-II	A2-B-15 to A2-B-17[4]
Sample Depth (ft)			2-4	11-13	2-4	9-11	2-4	10-12	2-4	2-4	9-11	2-6	9-11	2-4
Inorganic Constituents (mg/kg)														
Aluminum	33,000	-	4,970	12,100	52,100	23,600	27,600	19,800	29,200	13,800	25,100	38,600	24,600	17,600
Antimony	-	-								16.9				
Arsenic	-	613		1.96		3.36	8.3	4.19	7.56	61.8	4.71	7.55		6.23
Barium	600	-	91.3	86.5	435	118	435	153	411	238	142	1,140	441	295
Beryllium	-	4,088		0.63	6.11	1.16	3.18	1.22	3.49	1.98	1.08	4.41	1.89	1.92
Cadmium	1	-	1.47				1.01			1.04				
Calcium	44,400	-	136,000	1,910	315,000	2,510	139,000	3,570	146,000	69,000	2,100			94,700
Chromium	-	NA	1,050	16.5	4.31	31.5	40.2	27.6	9.92	51.7	35.3	11	26.4	19.4
Cobalt	60	-		8.68		11.7		14.3			41.6		10.3	
Copper	55.7	-	88.3	14.9		26.9	142	32.8	17	164	31.6	11.4	26.6	42.3
Iron	550,000	-	157,000	22,800	4,900	48,700	45,600	45,100	36,200	76,700	47,300	11,500	31,600	36,700
Lead	500	-	172	10.4		19.5	236	15.3	10.8	2,800	17.2	93.4	28.2	121
Magnesium	7,920	-	34,200	2,460	4,570	4,420	5,340	4,910	7,610	5,360	4,870	17,300	9,490	8,220
Manganese	-	286,160	35,700	183	5,170	304	3,430	693	4,700	2,660	499	5,260	2,360	2,570
Mercury	0.211	-											0.65	
Nickel	-	40,880	23.1	23.3		31.4	17.8	41.7	8.68	30.7	44.5		24.9	12.5
Potassium	43,000	-	343	1,070	1,950	4,030	2,370	1,240	1,860	951	2,600	1,220	1,840	1,880
Selenium	-	10,220	7.45											2.44
Sodium	8,000	-	453	227	1,080	502	822	431	747	418	149	707	731	830
Vanadium	300	-	484	24.5		40.4	18.7	29.5	13.2	40.1	40.9	8.31	27.5	14.8
Zinc	-	613,200	565	57.1	14.8	116	187	99.2	124	325	146	118	90	181
Cyanide	-	1,600 (3)	2.58		95.2		50.8		228	169		209	43.4	191

TABLE 3-4 (CONTINUED)

AREA II

SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

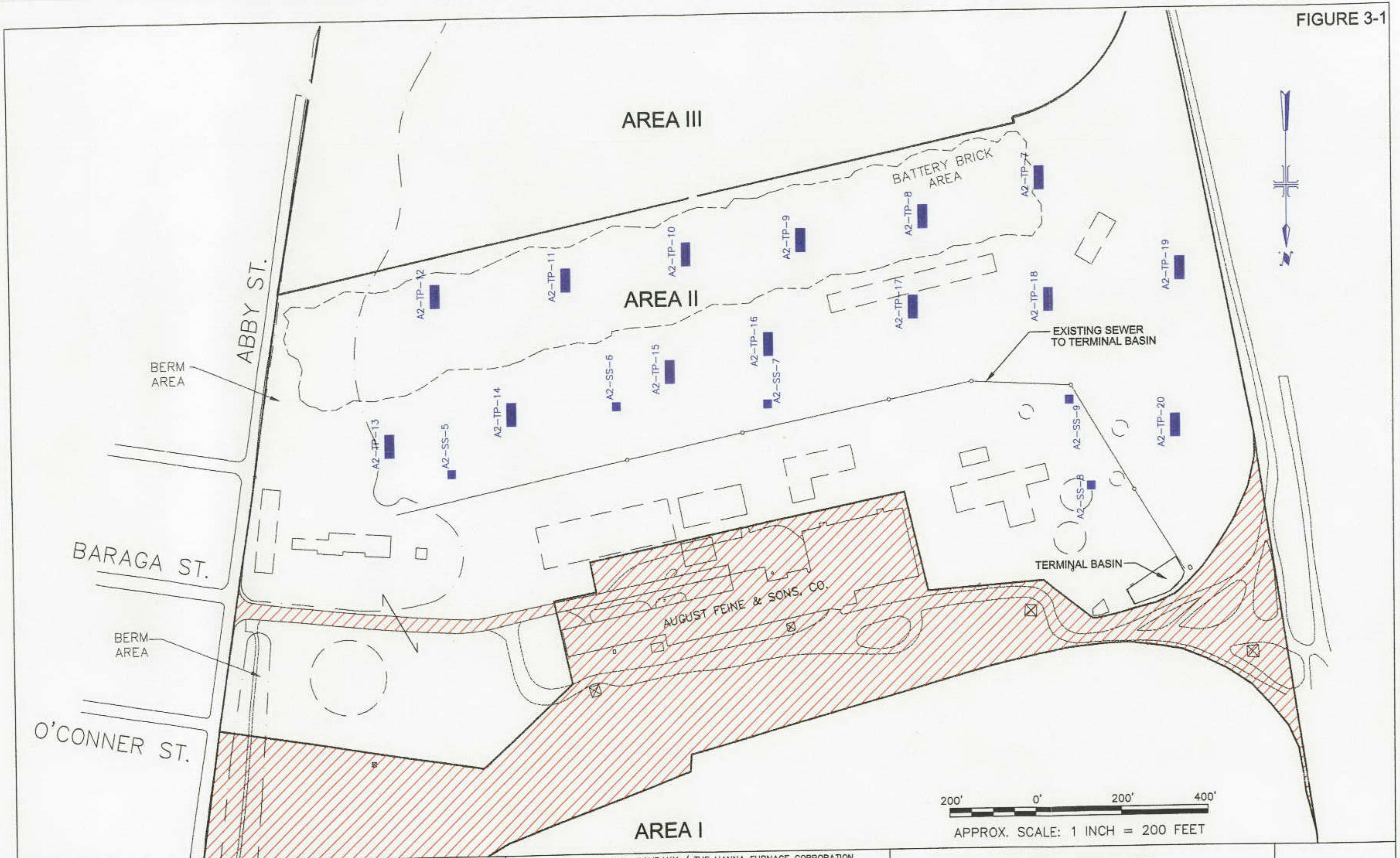
SUMMARY OF SUBSURFACE SOIL RESULTS - INORGANIC CONSTITUENTS(1)

	Background(2)	Risk Based Screening Level(3)	A2-B-19 to A2-B-21(4)	A2-B-22 to A2-B-24(4)	A2-B-25	A2-B-25	A2-B-26 to A2-B-28(4)	A2-B-29 to A2-B-31(4)	A2-B-31	A2-B-32	A2-B-33 to A2-B-35(4)	A2-B-85
Sample Depth (ft)			2-4	2-4	6-8	10-12	7-9	2-4	10-12	16-18	2-4	4-6
Inorganic Constituents (mg/kg)												
Aluminum	33,000	-	35,200	(5)	35,300	15,400	17,100	2,090	24,300	11,800	44,700	(5)
Antimony	-	-		(5)								(5)
Arsenic	-	613	28.8	(5)	2.14	3.36	13.7	2.56		1.91	3.44	(5)
Barium	600	-	510	(5)	232	104	208	54.2	184	53.7	541	(5)
Beryllium	-	4,088	3.69	(5)	4.39	1.21	1.31		1		4.76	(5)
Cadmium	1	-	2.58	(5)	3.61	1.78	2.88		0.94	0.81		(5)
Calcium	44,400	-	187,000	(5)	117,000	14,600	95,700	4,180	4,910	41,700	246,000	(5)
Chromium	-	NA	153	(5)	282	48.2	19.8	5.67	28.4	16.6	14	(5)
Cobalt	60	-		(5)	11.6				9.2	8.92		(5)
Copper	55.7	-	99.9	(5)	138	65.8	42	20.8	24.5	28.1	22.9	(5)
Iron	550,000	-	68,100	(5)	58,100	48,000	81,500	7,180	32,500	26,800	41,200	(5)
Lead	500	-	432	(5)	54.7	76.6	55.1	11.3	51.7	12.1		(5)
Magnesium	7920	-	26,700	(5)	27,700	3,490	4,350	474	4,320	15,000	20,300	(5)
Manganese	-	286,160	6,600	(5)	2,370	376	1,620	94	313	471	7,360	(5)
Mercury	0.211	-		(5)	15.2	0.98	0.77	2.78				(5)
Nickel	-	40,880	26.1	(5)	319	36	21.7	6.44	31.8	26.3	8.49	(5)
Potassium	43,000	-	1,950	(5)	2,470	1,110	1,780		2,220	2,080	2,460	(5)
Selenium	-	10,220		(5)	5.67		4.12					(5)
Sodium	8,000	-	688	(5)	702	182	1190	121	142	252	763	(5)
Vanadium	300	-	26.1	(5)	32.1	21	20.8		26.8	18.8	12	(5)
Zinc	-	613,200	1750	(5)	504	143	657	21.9	232	70.9	26.1	(5)
Cyanide	-	1,600 (3)	97.3	(5)	800	290	1.97	24.5			106	198

Notes:

1. Source: "Final Report for the Phase II Environmental Site Assessment of the Donner-Hanna Coke Plant - Buffalo, New York," ICF Kaiser Engineers, Inc., July, 9, 1997.
2. Background inorganic soil concentrations from Truscon Property or TAGM (Eastern US/NYS).
3. Levels derived from ASTM E1739-95.
4. Composite soil samples.
5. Analysis not performed.
6. Blank indicates that the parameter was analyzed for but not detected.

FIGURE 3-1



TURNKEY ENVIRONMENTAL RESTORATION, LLC

LTV STEEL COMPANY / THE HANNA FURNACE CORPORATION

SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN FOR AREA II – FORMER DONNER-HANNA COKE PLANT PARCEL

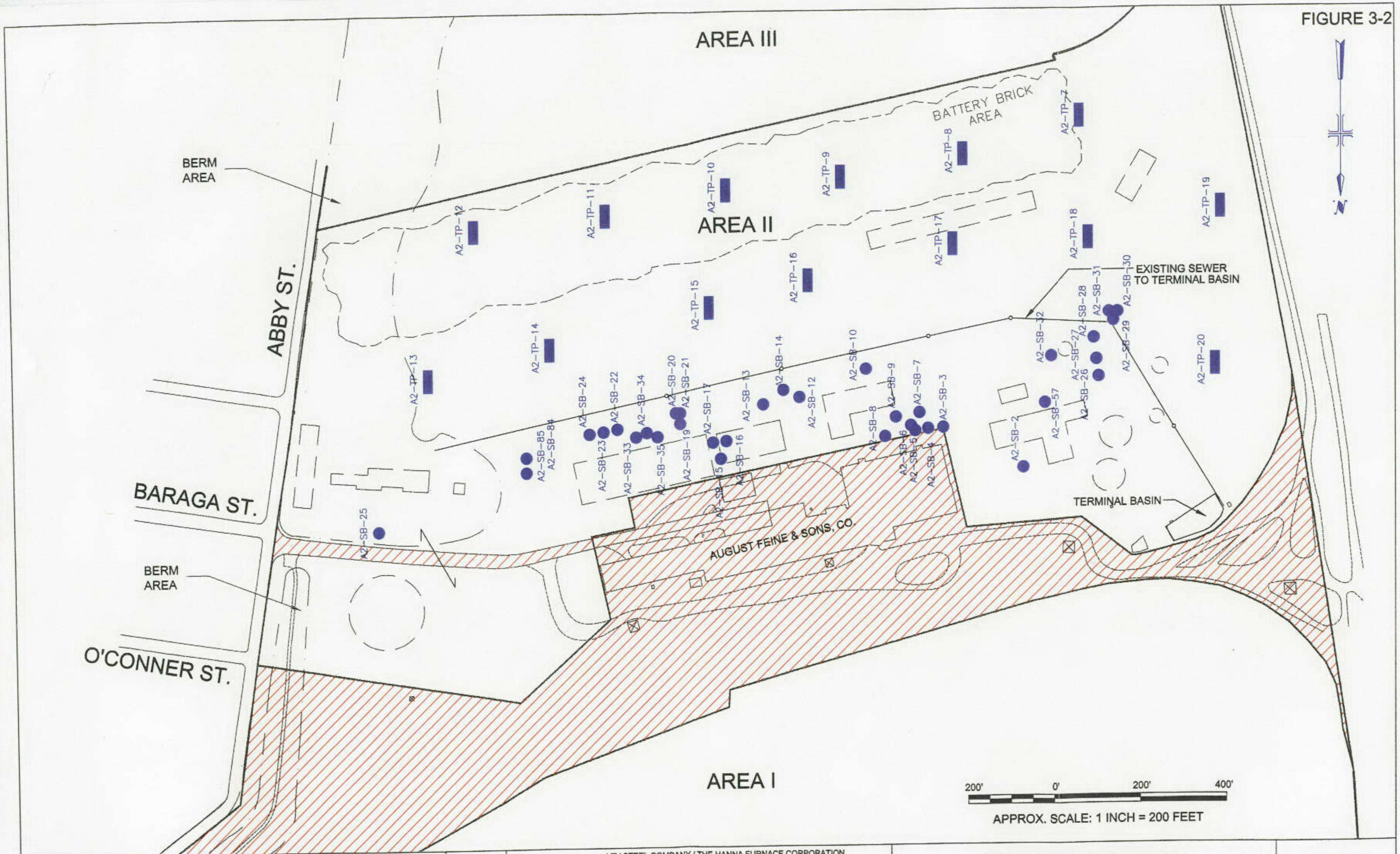
SURFACE SOIL SAMPLE LOCATIONS

DATE NOVEMBER 1998

SHEET ___ OF ___

CAD REF. NO. TKTS05.DWG

FIGURE 3-2



TURNKEY ENVIRONMENTAL RESTORATION, LLC

REVISIONS

NO.	BY	DATE	REMARKS

DES ______
DWN ______
CKD ______

LTV STEEL COMPANY / THE HANNA FURNACE CORPORATION

SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN
FOR AREA II - FORMER DONNER-HANNA COKE PLANT PARCEL

SUBSURFACE SOIL SAMPLE LOCATIONS

DATE NOVEMBER 1998
SHEET ____ OF ____
CAD REF. NO. TSTK04.DWG

used for coal storage and handling and was filled with bricks and debris during plant demolition activities. While beyond the scope of the Supplemental Field Investigation Work Plan, additional soil/fill sampling was performed in that portion of the site in October 1998 to determine its potential for redevelopment.

A total of fourteen test pits were excavated (See Figure 3-1 and 3-2 for locations). Seven test pits were performed at approximately 300 foot intervals along an East-West line within the former railroad track hub area and at seven parallel locations within the battery brick subarea (*i.e.*, former coal storage subarea). Two additional test pits were dug to the west of the light oil subarea to determine the western edge of the Area II containment system. At each test pit location, the excavation was completed to the top of the water table or four feet below grade whichever was encountered first. Soils and fill was field-logged and photo-documented by a Project Hydrogeologist. Test pit locations will be surveyed by a licensed land surveyor and accurately mapped at a later date.

At each location, surface and subsurface soil was screened for organics with a photoionization detector (PID). At each of the fourteen test pit locations, a representative surface soil sample was collected from the surface to one foot below the surface, and a representative subsurface sample was collected from one to four feet deep. Within the former railroad track area, two composite samples were formulated from three proximate test pits for surface soil testing, and two composite samples for subsurface soil testing. A similar sampling plan was followed for the line of test pits within the battery brick area. The two test pits to the west were formulated into one composite of surface soil and one for subsurface soil for the testing outlined below. The five composite soil samples collected from the surface will be analyzed for PAHs, TAL metals and cyanide. The five composite subsurface samples will be analyzed for BTEX, PAHs, TAL metals, and cyanide.

The results of the analytical testing will be submitted to the NYSDEC for review as an addendum to this report as soon as the data becomes available. Although not expected to materially change the site cleanup plan, the plan will be modified accordingly if determined to be necessary.

4.0 GROUNDWATER ASSESSMENT

4.1 General

Groundwater samples collected from two piezometers located within the former benzol washers and light oil/tar storage tank subareas were analyzed during the Phase 1/2 ESA to evaluate groundwater conditions. The analytical results showed slightly elevated levels of total cyanide; moderately elevated levels of SVOCs (with napthalene above the standard) and BTEX compounds (especially benzene) above GW standards in the tar storage tank area and high levels of total cyanide; slightly elevated levels of SVOCs, primarily PAH compounds; and slightly elevated levels of BTEX compounds in the benzol washer area (for details, refer to Appendix G of Reference 1).

As a result of the wide-spread soil contamination described in Section 3.0 and the preliminary groundwater analytical data, remediation of the former coke plant area was determined to be necessary. The remedial plan that was developed involved physical containment in-place accomplished by waste/fill consolidation and grading, and capping (with a low permeability soil/synthetic cover system) of the contaminated portions of Area II to reduce the amount of surface infiltration. The remedial plan also included the installation of a groundwater collection system and potentially a groundwater barrier wall along with an on-site groundwater pretreatment system (refer to Section 5.0 for detailed information).

The nature and extent of contaminated groundwater, however, had not been full characterized to the degree necessary in order to determine the "best" remedial approach (*i.e.*, location and extent of the collection system and/or the barrier wall) in this area. Therefore, in order to assess hydraulic containment remedial alternatives for the contaminated portions of Area II and to address the NYSDEC's concerns regarding off-site migration and potential impacts on sensitive downgradient receptors, additional information was required to better understand groundwater flow directions and hydraulic properties of the uppermost saturated fill.

A Supplemental Field Work Investigation Work Plan was prepared (Reference 3) which described how hydraulic information would be collected from the installation and acquifer testing of several additional monitoring wells to be installed to better define the hydraulic properties of the saturated fill. The information collected will be used as input into the three-dimensional groundwater flow model discussed in Section 4.4 and the treatability testing discussed in Section 4.5 to better predict the hydrologic effects and the quantity and quality of collected groundwater under the alternative collection and containment configurations.

4.2 Hydrogeologic Investigation Activities

The required additional hydraulic information was collected from the installation of eleven new monitoring wells (A2-MW-3, A2-MW-4, A2-MW-5, A2-ME-6 A2-MW-7, A2-MW-8, A2-MW-9, A2-MW-10, A2-MW-11, A2-MW-12, and A2-MW-13) supplementing the two existing piezometers (A2-P-I and A2-P-II) installed during the ESA. Refer to Plate 1 for the well locations.

Once the wells were installed, they were developed and sampled for the parameters outlined in the Work Plan to characterize the containment distribution within the process area of Area II. Existing piezometer A2-P-II was also sampled (see Table 4-1). In addition, slug testing was performed on the newly installed wells and two piezometers to estimate hydraulic conductivity values and evaluate the heterogeneity of the fill material.

Three new wells (A2-PW-1, A2-PW-2 and A2-PW-3) were also installed where shown on Plate 1 to collect the hydraulic information on the saturated fill. Shallow acquifer testing, using short-term (*i.e.*, 24 hours) "mini-rate" pump test methods was performed to develop a greater area of hydraulic influence and produce more reliable estimate of transmissivity compared to slug testing in heterogeous media.

TABLE 4-1
SUPPLEMENTAL SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF GROUNDWATER SAMPLING RESULTS[2]

Parameter	NYS Class GA Groundwater Quality Stds[1]	A2-P-I	A2-P-II	A2-MW-3	A2-MW-4	A2-MW-5	A2-MW-6	A2-MW-7	A2-MW-8	A2-MW-9	A2-MW-10	A2-MW-11	A2-MW-12	A2-MW-13
				Western Perimeter Wells				Interior			Interior Wells			Berm Area
Volatile Organic Compounds (µg/L)														
Benzene	0.7	12000	110	5 U	5 U	5 U	240	5 U	170	69	3 J	5 U	41	5 U
Ethylbenzene	5	250	2 J	5 U	5 U	5 U	11	5 U	5 U	3 J	5 U	5 U	42	1 J
Toluene	5	120	62	5 U	5 U	5 U	38	5 U	5 U	35	5 U	5 U	86	2 J
Xylene (Total)	5	880	8 J	15 U	15 U	15 U	36	15 U	15 U	7 J	15 U	15 U	140	2 J
Semivolatile Organic Compounds (µg/L)														
Acenaphthene	20	40	3 J	10 U	10 U	10 U	400	10 U	29	6 J	10 U	10 U	300	10 U
Acenaphthylene	-	12	54	10 U	10 U	10 U	170	10 U	10 U	8 J	10 U	10 U	190	10 U
Anthracene	50	12	5 J	10 U	10 U	10 U	270	10 U	10 U	10 U	10 U	10 U	73	10 U
Benzo(a)anthracene	0.002	3 J	10 U	10 U	10 U	10 U	240	10 U	10 U	10 U	10 U	10 U	38	10 U
Benzo(b)fluoranthene	0.002	3 J	3 J	10 U	10 U	10 U	320	10 U	10 U	10 U	10 U	10 U	46	10 U
Benzo(k)fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	160	10 U	10 U	10 U	10 U	10 U	20 U	10 U
Benzo(ghi)perylene	-	10 U	10 U	10 U	10 U	10 U	130	10 U	10 U	10 U	10 U	10 U	20 U	10 U
Benzo(a)pyrene	-	10 U	10 U	10 U	10 U	10 U	280	10 U	10 U	10 U	10 U	10 U	26	10 U
Chrysene	0.002	2 J	10 U	10 U	10 U	10 U	260	10 U	10 U	10 U	10 U	10 U	31	10 U
Dibenzo(a,h)anthracene	-	10 U	10 U	10 U	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 U	20 U	10 U
Fluoranthene	50	13	7 J	10 U	10 U	10 U	660	10 U	10 U	10 U	10 U	10 U	150	11
Fluorene	50	58	15	10 U	10 U	10 U	340	10 U	10 U	5 J	10 U	10 U	210	10 U
Indeno(1,2,3-cd)pyrene	0.002	10 U	10 U	10 U	10 U	10 U	140	10 U	10 U	10 U	10 U	10 U	20 U	10 U
2-Methylnaphthalene	-	280	36	10 U	10 U	10 U	82	10 U	10 U	11	10 U	10 U	370	10 U
Naphthalene	10	3900	1000	10 U	10 U	10 U	1300	10 U	22	270	10 U	10 U	3200	10 U
Phenanthrene	50	68	19	10 U	10 U	10 U	680	10 U	10	4 J	10 U	10 U	320	10 U
Pyrene	50	9 J	5 J	10 U	10 U	10 U	460	10 U	10 U	10 U	10 U	10 U	93	10 U
Phenol	1	45	9 J	10 U	10 U	10 U	20 U	10 U	10 U	NA	10 U	10 U	20 U	10 U
Inorganic Compounds (mg/L)														
Arsenic	0.025	NA	NA	NA	NA	NA	0.11	0.016	0.01	NA	0.013	0.021	0.005	0.038
Chromium	0.05	NA	NA	NA	NA	NA	0.017	0.01	0.013	NA	0.051	0.039	0.003	0.016
Copper	0.2	NA	NA	NA	NA	NA	0.039	0.021	0.020	NA	0.063	0.11	0.007	0.032
Lead	0.025	NA	NA	NA	NA	NA	0.059	0.046	0.024	NA	0.03	0.24	0.011	0.23
Zinc	0.3	NA	NA	NA	NA	NA	0.12	0.11	0.12	NA	0.25	0.28	0.089	0.35
Cyanide	0.1	0.069	1	0.037	0.035	0.033	0.120	0.071	0.11	1.0	0.05	0.25	1.40	9.90

Notes:
(1) Value represents either a Groundwater Standard or a Guidance Value.
NA - Parameter was not on analysis list.
(2) Data collected and analyzed by Malcolm Pirnie, Inc during Supplemental Field Investigation performed in March & April, 1998
- NYS Guidance Value or Standard not available.
Concentration above NYS Groundwater Standard or Guidance Value
J - Analyte was positively identified; the associated numerical value is the approx. concentration of the analyte in the sample.

TABLE 4-1 (continued)
SUPPLEMENTAL SITE ASSESSMENT REPORT AND VOLUNTARY CLEANUP PLAN

SUMMARY OF GROUNDWATER SAMPLING RESULTS [2]

Parameter	NYS Class GA Groundwater Quality Stds[1]	A2-MW-6	A2-MW-7	A2-MW-10	A2-MW-11
Semivolatile Organic Compounds (µg/L)					
Benzoic Acid	-	50 U	50 U	50 U	50 U
Benzyl Alcohol	-	40 U	20 U	20 U	20 U
Bis(2-chloroethoxy)methane	-	40 U	10 U	10 U	10 U
Bis(2-chloroethyl)ether	1	20 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	-	20 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	50	20 U	2 J	10 U	2 J
4-Bromophenyl phenyl ether	-	38 U	10 U	10 U	10 U
Butyl benzyl phthalate	50	20 U	10 U	10 U	10 U
4-chloroaniline	-	20 U	10 U	10 U	10 U
4-chloro-3-methylphenol	-	40 U	10 U	10 U	10 U
2-Chloronaphthalene	10	20 U	10 U	10 U	10 U
2-Chlorophenol	-	40 U	10 U	10 U	10 U
4-Chlorodiphenylether	-	40 U	4 U	4 U	4 U
Dibenzofuran	-	290	10 U	10 U	10 U
Di-n-butyl phthalate	50	20 U	10 U	10 U	10 U
1,2-Dichlorobenzene	4.7	20 U	10 U	10 U	10 U
1,3-Dichlorobenzene	5	20 U	10 U	10 U	10 U
1,4-Dichlorobenzene	4.7	20 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	-	20 U	20 U	20 U	20 U
2,4-Dichlorophenol	1	40 U	10 U	10 U	10 U
Diethyl phthalate	50	20 U	10 U	10 U	10 U
2,4-Dimethylphenol	-	150	4 U	4 U	4 U
Dimethyl phthalate	50	20 U	10 U	10 U	10 U
4,6-Dinitro-2-methylphenol	-	50 U	50 U	50 U	50 U

Parameter	NYS Class GA Groundwater Quality Stds	A2-MW-6	A2-MW-7	A2-MW-10	A2-MW-11
Semivolatile Organic Compounds (µg/L), continued					
2,4-Dinitrophenol	-	50 U	50 U	50 U	50 U
2,4-Dinitrotoluene	-	20 U	10 U	10 U	10 U
2,6-Dinitrotoluene	5	20 U	10 U	10 U	10 U
Di-n-octyl phthalate	50	20 U	10 U	10 U	10 U
Hexachlorobenzene	0.35	20 U	10 U	10 U	10 U
Hexachlorobutadiene	5	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	5	20 U	10 U	10 U	10 U
Hexachloroethane	-	20 U	10 U	10 U	10 U
Isophorone	50	20 U	10 U	10 U	10 U
2-Methylphenol	-	77	10 U	10 U	10 U
4-Methylphenol	-	30 J	10 U	10 U	10 U
2-Nitroaniline	-	50 U	50 U	50 U	50 U
3-Nitroaniline	-	50 U	50 U	50 U	50 U
4-Nitroaniline	-	50 U	50 U	50 U	50 U
Nitrobenzene	5	20 U	10 U	10 U	10 U
2-Nitrophenol	-	40 U	10 U	10 U	10 U
4-Nitrophenol	-	50 U	50 U	50 U	50 U
N-nitrosodiphenylamine	50	20 U	10 U	10 U	10 U
N-nitroso-Di-n-propylamine	-	20 U	10 U	10 U	10 U
Pentachlorophenol	1	50 U	50 U	50 U	50 U
1,2,4-Trichlorobenzene	5	20 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	-	40 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	-	40 U	10 U	10 U	10 U

Notes:

(1) Value represents either a Groundwater Standard or a Guidance Value.

(2) Data collected and analyzed by Malcolm Pirnie, Inc during Supplemental Field Investigation performed in March & April, 1998

- NYS Guidance Value or Standard not available.

J - Analyte was positively identified; the associated numerical value is the approx. concentration of the analyte in the sample.

U - Parameter was analyzed for, but not detected

4.3 Area II Groundwater Hydrodynamics

Groundwater evaluation data collected from existing and newly installed wells was used to provide groundwater flow directions and hydraulic gradient information for Area II. Static groundwater level measurements are presented in Table 4-2 and Area II groundwater isopotential contours are shown on Plate 1. Groundwater occurs at varying depths within Area II at approximate depths of 3.6 to 11.1 feet below grade. A groundwater divide exists in the central portion of Area II along the northern perimeter in the general vicinity of August Feine & Sons Company at an approximate depth of four feet below grade. Plate 1 shows groundwater elevations and inferred flow directions based on depth-to-groundwater measurements collected on June 8, 1998. As shown, shallow groundwater migrates both to the southwest and northwest corners of Area II with a varying hydraulic conductivity as calculated and presented in Table 4-3. Hydraulic conductivity measurements for Area II are presented in Table 4-3. Hydraulic conductivity results for the monitoring wells in Area II range from 4.8 ft/day in A2-MW-12 to 1,077 ft/day in A2-MW-6. This variablilty in data indicates that the fill in Area II has a highly variable grain size distribution.

The groundwater low area in the northwest corner of Area II is a result of the pumping of the terminal basin. The basin has sheet piling walls which likely leak. It was originally believed that the 48-inch pipe leading into the basin from the middle of Area II was the major source of water entering it. However, this now does not appear to be the case. Inflow to the basin from that pipe was measured with a bucket and watch to be only about 3,600 gallons per day in October 1998. Previous flow monitoring on the pipe which enters the basin from the Feine facility determined that approximately four percent of the overall basin flow was contributed by Feine. Since the 48-inch pipe and pipe from Feine are the only solid connections to the basin, the remainder of the water being discharged to the BSA collection system has to be groundwater entering the basin through leaks or possibly the underdrain system beneath it. This conclusion is supported by the isopotential lines shown in the area of the basin on Plate 1.

Table 4-2
LTV STEEL COMPANY/DONNER-HANNA
Supplemental Site Assessment and Voluntary Cleanup Plan for Area II-Former Donner Hanna Coke Plant

Summary of Static Groundwater Levels [1]

Location of Well	*Well Designation*	*Water Level ft below reference*	*Reference Elevation famsl*	*Water Table Elevation* [2] *famsl*
Area II	A2-P-I	7.91	590.0	582.1
	A2-P-II	6.02	590.9	584.9
	A2-MW-3	6.96	588.95	582.0
	A2-MW-4	6.85	588.59	581.7
	A2-MW-5	6.85	587.25	580.4
	A2-MW-6	8.28	589.23	581.0
	A2-MW-7	9.33	591.46	582.1
	A2-MW-8	5.67	591.34	585.7
	A2-MW-9	6.52	591.12	584.6
	A2-MW-10	10.16	593.28	583.1
	A2-MW-11	**	590.11	-
	A2-MW-12	5.64	590.95	585.3
	A2-MW-13	13.1	597.9	584.8

NOTES:
(1) Water levels recorded on June 8, 1998
(2) Water levels recorded by Malcolm Pirnie, Inc. during Supplemental Field Investigation performed March-June, 1998
** - Water level was inadvertently not recorded during June event.

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TABLE 4-3
LTV STEEL COMPANY/DONNER-HANNA
Supplemental Site Assessment and Voluntary Cleanup Plan for Area II- Former Donner-Hanna Coke Plant

Summary of Hydraulic Conductivity Results [1]

Location of Well	*Well Designation*	*Hydraulic Conductivity* ft/d
Area II	A2-P-1	15.9
	A2-P-II	119
	A2-MW-3	964
	A2-MW-4	90.7
	A2-MW-5	312
	A2-MW-6	1077
	A2-MW-7	-
	A2-MW-8	42.5
	A2-MW-9	142
	A2-MW-10	266
	A2-MW-11	167
	A2-MW-12	4.8
	A2-MW-13	73.7

Notes:

- Water column in the well too small to perform slug testing.

(1) Slug tests were performed by Malcolm Pirnie, Inc. during supplemental investigations performed in April, 1998

TurnKey Environmental Restoration, LLC

4.4 Groundwater Modeling

Groundwater flow modeling is currently being conducted to evaluate the effectiveness and serve as the basis of design for alternative groundwater containment and collection scenarios for the portion of Area II where groundwater impacts have occurred. The main objectives of the modeling are to:

1. Establish predicted areas of hydraulic influence from groundwater collection.

2. Determine estimated flow rates from groundwater collection for use in the groundwater pre-treatment system design.

3. Evaluate the reduction in the collected groundwater flows resulting from installation of barrier walls.

4. Predict influent groundwater quality concentrations for pre-treatment system design.

The modeling efforts are being performed by Geomatrix Consultants, Inc. under subcontract to TurnKey. A groundwater modeling report describing the methodology used, the analytical data and model results will be prepared. The model will be developed, calibrated and verified to simulate groundwater collection and barrier walls to satisfy the described objectives. The primary work efforts will include:

Task 1. Data Compilation

Geologic, hydrogeologic and water chemistry data collected to-date will be reviewed and compiled for input into the groundwater flow model. These data will include: pump test data; slug test analyses; D_{10} grain size testing results to establish the variability of hydraulic conductivity of the shallow water-bearing zone (saturated zone in the fill); existing water level data to assess potential changes in groundwater flow directions during seasonally wet and dry recharge conditions; borehole logs and stratigraphic tables to determine bottom elevations of the shallow water-bearing zone; approximate groundwater recharge rates using meteorological data for the City of Buffalo; and analytical data for existing groundwater sampling events.

Task 2. Conceptual Hydrogeologic Model

Data compiled Task 1 will be evaluated to develop a conceptual hydrogeologic model that establishes the recharge/discharge relationship of site groundwater in the shallow water-bearing zone.

Task 3. Model Development

The USGS groundwater flow model MODFLOW will be used to simulate steady-state two-dimensional groundwater flow in the saturated fill. A grid will be established across the site map that extends laterally to hydraulic boundaries or a sufficient distance from the site to minimize the potential for the "boundary effects" during groundwater collection simulations. Hydraulic properties of the shall water-bearing zone compiled in Task 1 will be used as model input parameters to simulate the hydrogeologic conditions established in the development of the conceptual hydrogeologic model (Task 2). Hydrogeologically important groundwater discharge areas such as the Buffalo River, the Terminal Basin and wetland areas south of the site will be incorporated into the model.

Task 4. Calibration/Verification/Sensitivity Analysis

The groundwater flow model will be calibrated to verify the conceptual hydrogeologic model established for the site. Model input parameters such as hydraulic conductivity, transmissivity, storage coefficients, and recharge/discharge rates will be varied within a geologically reasonable range of values to achieve model convergence. Model boundary effects will also be tested during the calibration process. The calibrated model will be verified by simulating the transient hydraulic stresses developed during the short term pump tests. Model responses to simulated pumping will be compared with actual field data to determine the accuracy of the calibrated model. If necessary, model re-calibration steps will be taken to obtain better agreement between the model predicted hydraulic responses to actual field responses. The sensitivity of the model to changing model input parameters will be evaluated to assess primary controlling hydrogeologic properties in the model. Sensitivity analysis serves as a quality assurance step to determine the parameter(s) that have the greatest impact on the model and to assess model limitation based on the amount of supporting data.

Task 5. Model Simulations

The groundwater flow model will be used to simulate three steady-state groundwater collection alternatives in Area II. Each groundwater collection alternative will be simulated with a low permeability cap (*i.e.*, 1×10^{-7} cm/sec) covering the northern portion of Area II. The first simulations will involve groundwater collection from a continuous trench approximately 2,000 feet in length with a barrier wall constructed immediately south of the impacted soils and groundwater of Area II. The second simulation will involve groundwater collection from a continuous trench with several laterals to collect impacted groundwater near several source areas, an infiltration gallery located in the former light oil production/storage area with a barrier wall to the south. The third simulation will involve groundwater collection surrounded by a continuous barrier wall. Using particle tracking methods or flow indicator arrows, groundwater flow paths will be simulated to demonstrate areas of hydraulic capture from groundwater collection.

Task 6. Reporting

A report will be prepared that describes the hydrogeologic conceptual model, documents model development, verification, and sensitivity analyses, presents colorized maps showing area of hydraulic influence from each simulation, summarizes flow rates from groundwater collection simulations, and presents estimated organic compound loadings to the collection trench for each simulation. The limitation of the mode results based on the data available for input will be discussed in the report. The report will be submitted to the NYSDEC for review as an addendum to this document.

4.5 GROUNDWATER PRE-TREATABILITY TESTING

Collection and pre-treatment of groundwater to meet BSA requirements to discharge to the City collection system will be a component of the voluntary cleanup plan for Area II due to the elevated concentrations of organics in this parcel. Treatability testing is being performed to aid in the design of the groundwater treatment system.

Based on the constituents of concern in the groundwater, both air stripping with emissions controls and advanced oxidation process (AOP) are being evaluated as pretreatment alternatives for the groundwater. AOP combines high intensity ultraviolet light and hydrogen peroxide to form hydroxyl radicals, which are powerful oxidizers that destroy organic compounds to carbon dioxide and water. AOP is capable of destroying cyanides, including complexed cyanide, PAHs, and BTEX. The size and operating cost of an AOP system, however, is highly dependent on the water matrix. Inorganics may affect the maintenance costs and treatment system efficiency. . Treatability testing is being performed to:

- Provide a more definitive basis against which performance/cost of other treatment trains can be evaluated;
- Ensure adequate system sizing, and
- Determine the need for supplemental pre-treatment needs (*viz.*, metals precipitation).

A desk top evaluation of air stripping will also be performed based on the chemical properties of the constituents of concern. Metals precipitation will also be evaluated to determine the feasibility of reducing target inorganic loadings to the BSA and as a means of reducing scaling and related operating and maintenance impacts on the AOP or air stripping units.

Approximately 40 gallons of groundwater was recently collected from monitoring wells in Area II. The sample was a composite of grabs from individual monitoring wells, which was volumetrically proportioned based on their location relative to estimated full-scale contributions. The composite sample was then shipped to Calgon Corporation's Advanced Oxidation Technology Division. The composite groundwater sample is being analyzed for the following parameters-of-interest: cyanide, PAH's, BTEX, iron, manganese, hardness, alkalinity, and mercury.

Concurrent with the AOP test, an additional sample was collected to perform a bench-scale metals precipitation test. The bench-scale testing will involve pH adjustment of individual samples followed by mixing, settling and supernatant analysis with a gang-type jar stirring apparatus. The results of the supernatant analysis will provide an estimate of the feasibility and cost for full-scale metals precipitation.

The results of the groundwater treatability testing will be provided for review as an addendum to this report. Results are expected by mid-December, 1998.

5.0 VOLUNTARY CLEANUP PLAN

5.1 General

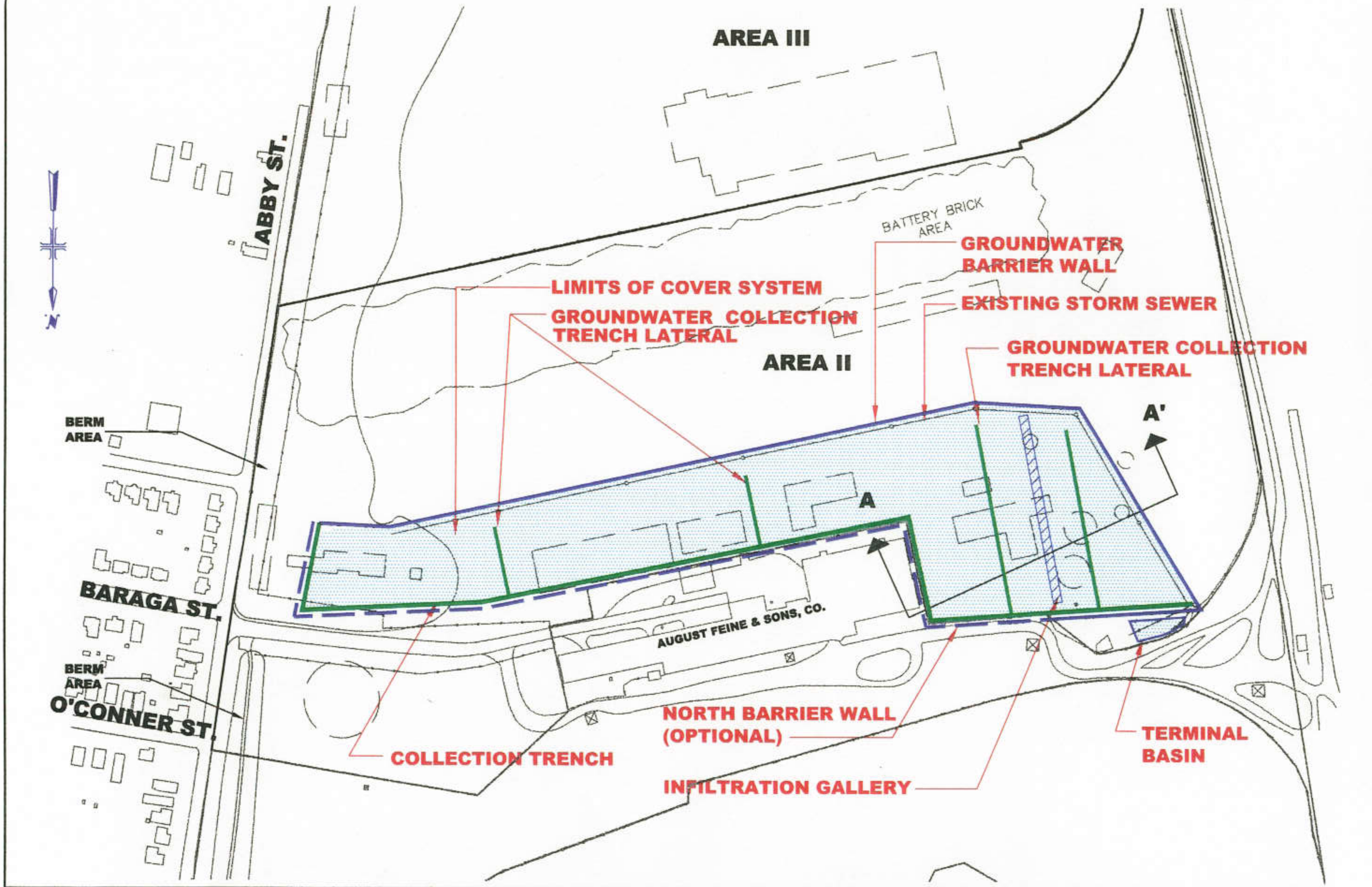
Area II, at approximately 53 acres, is the second largest of the four parcels which collectively comprise the Steel Manufacturing Site. The former Donner-Hanna Coke Plant was located on this parcel.

The extensive sampling performed during Phase II ESA indicated that a large portion of the coke, byproducts, and manufactured gas areas had environmental concerns in both subsurface soils and groundwater. Specific containments or parameters of concern identified in the soil/fill were PAHs (benzo(a)pyrene and naphthalene), several metals, (cadmium, calcium, copper, aluminum, lead, mercury and magnesium) benzene and toluene. Although perimeter groundwater monitoring wells analyses indicate no significant impact on off-site receptors, interior wells within the process area demonstrate an impact on groundwater with high levels of VOCs, SVOCs, and metals (arsenic, chromium, lead and cyanide).

Supplemental field investigations currently being performed by TurnKey in the southern portion of Area II will be documented and submitted to the NYSDEC for review as an addendum to this report. Based upon observations made during the supplemental field investigation activities, that area of the site is believed to have no significant environmental concerns. If laboratory analytical results indicate otherwise, the Voluntary Cleanup Plan will be modified accordingly.

5.2 Soils Treatment, Consolidation and Containment

Due to the extent and nature of environmental conditions in the surface and subsurface soils, contamination in the northern portion of Area II and the large number of building foundations and piping remaining below grade, physical containment in-place is the preferred remedial approach for this portion of the site. Containment will be accomplished by constructing a cover system over the area shown on Figure 5-1 to reduce the amount of infiltration and reduce direct



AREA II - CONCEPTUAL CONTAINMENT SYSTEM SITE PLAN

LTV STEEL COMPANY / THE HANNA FURNACE CORPORATION

FIGURE 5-1

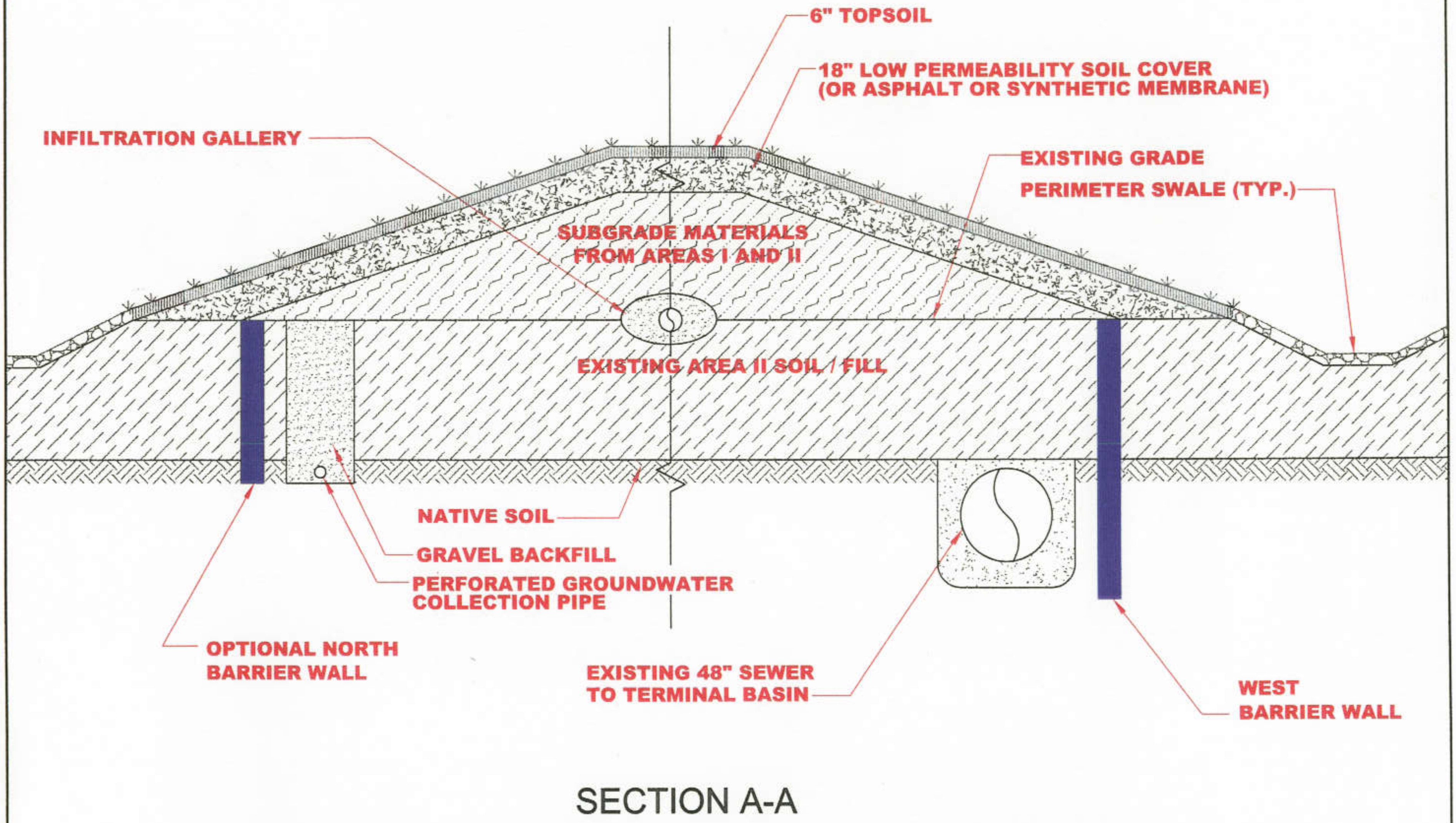
exposure and by installing a groundwater collection system (see Section 5.3) in concert with a low-permeability barrier wall around the perimeter of the area.

Petroleum and tar-contaminated soils from Subareas K and L of Area I and stabilized/solidified blue-stained soils from Area III (Refer to the Areas III and IV Voluntary Site Assessment and Cleanup Report for details) will be utilized as subgrade fill material beneath the cover system. Additional quantities of soil with elevated site constituents (if above site specific risk-based screening levels) which may be excavated during site development will also be placed and compacted in this area until such time as the cover system construction is complete. After that, it will become necessary to dispose of impacted soils at an acceptable off-site disposal facility. Disposal of on-site soil materials beneath the Area II cover system is an environmentally sound disposal alternative, reduces the cost of the voluntary clean-up by eliminating off-site disposal and provides needed fill material necessary to get positive surface water runoff from the proposed cover system.

As an additional measure to reduce the contaminant levels in the containment area, bioremediation technologies will be evaluated during the design stage of the cleanup program to determine if bio-augmentation of the soils is a feasible concept for treating the contaminated soils beneath the cover system. Any degradation of contaminant levels is viewed as having a positive environmental impact on the site.

The Area II cover system will be either a low permeability vegetated soil cover, a synthetic membrane followed by a six-inch vegetative soil layer or an asphaltic parking lot. The landfill subgrade will be graded so that the water does not pool on top of the cover system but instead flows to perimeter drainage swales. The edge of the cover system will extend beyond the groundwater collection system and barrier wall described in Section 5.3. A conceptual detail of the cover system is shown in Figure 5-2. The cover system will include surface water controls for maximizing surface water runoff.

FIGURE 5-2



TURNKEY ENVIRONMENTAL RESTORATION, LLC

AREA II CONCEPTUAL CONTAINMENT SYSTEM CROSS-SECTION

LTV STEEL COMPANY / THE HANNA FURNACE CORPORATION

5.3 Groundwater Collection/Containment

Groundwater from the area beneath the cover system will be collected and contained through the construction of a perimeter groundwater collection system and groundwater barrier wall. The collection system will consist of a gravel filled trench constructed along the northern and eastern sides of the containment area. The bottom of the trench will extend into the native soil. Four laterals are currently envisioned to extend south from the perimeter system through the plume source areas. These groundwater collection laterals increase the efficiency of drainage in the three subareas of the site where parameter concentrations in the groundwater are highest. The groundwater collections system is configured to:

- Collect on-site groundwater along the northern area perimeter and from impacted on-site areas of highest parameter concentrations.
- Collect and hydraulically contain off-site groundwater along the northern area perimeter.
- Hydraulically contain groundwater from the soils containment area.

The groundwater modeling currently being performed (see Section 4.4) will predict the effectiveness of the proposed groundwater collection and containment system.

A low permeability barrier wall will be constructed along the south, west and northwest sides of the containment area to isolate soils and groundwater with elevated parameter concentrations in the north source areas from the site groundwater system. In doing so, the barrier wall will increase collection system efficiency and reduce the quantity of groundwater pretreated and discharged to the BSA. Materials under consideration for the construction of the barrier wall include either a bentonite slurry, a compacted clay bentonite-impregnated geotextile (*i.e.*,"bentomat") or possibly a synthetic membrane barrier. The base of the barrier wall will be keyed a minimum of one foot into the underlying native soil. At some future time, the wall may be extended around the northern and eastern sides of the containment area after it has been determined that all potential off-site contamination has been mitigated.

A series of soil borings will be performed along the proposed alignment of both the groundwater collection system and barrier wall during the design phase. These borings will be used to establish design elevations of the collection pipes, collection and barrier wall trenches; determine the need for the location and elevation of groundwater pump stations and identify potential subsurface structures that may interfere with the barrier wall or groundwater collection systems.

5.4 Groundwater Pretreatment

The predicted quality of collected groundwater is summarized in Table 5-1. Based upon this data and preliminary discussions with the Buffalo Sewer Authority (BSA), pretreatment of the collected groundwater is expected to be required to:

- Remove non-aqueous phase liquids (NAPL)
- Reduce total toxic organic (TTO) concentrations (consisting primarily of benzene, xylene and toluene) to less than 2mg/liter, and
- Possibly reduce mercury concentrations.

A treatability study of the groundwater using advanced oxidation process (AOP) is currently underway. The AOP process generates hydroxyl radicals, which oxidize BTEX and many other organics to carbon dioxide and water. Alternative organic treatment technologies using air stripping or chemical oxidation are also being evaluated on a bench- or desk-top basis.

Upon receipt of the results of the groundwater modeling (*i.e.*, influent quantity and quality) and treatability testing (*i.e.*, effluent quality and parameter loadings to sewer), a meeting will be held with the BSA to delineate discharge requirements and sewer use fees.

The pretreatment facility will be housed in a pre-engineered building to be constructed on-site. The location of the facility is likely to be along the northern perimeter of Area II , probably near Abby Street. The exact location will be determined during design.

A portion of the pretreated groundwater will be recycled back into the former light oil and tar storage tank sub areas of the site through a perforated pipe infiltration gallery place beneath the final cover system. The recycled and pre-treated water will flush water-soluble parameters from soil to expedite the cleanup.

TABLE 5 - 1
SUPPLEMENTAL SITE ASSESSMENT AND
VOLUNTARY CLEAN-UP PLAN FOR
AREA II – FORMER DONNER-HANNA COKE PLANT PARCEL

PREDICTED QUALITY OF
COLLECTED GROUNDWATER

Parameter	Influent Concentration (mg/l)	
	Average	Peak
BTEX	0.420	15
PAHs	1.7	6.0
Total Cyanide	2.7	10
Total Lead	0.063	0.23
Total Arsenic	0.023	11
Total Mercury	?	?

5.5 Terminal Basin Decommissioning

The existing terminal basin collects groundwater flow in the northwest corner of Area II. Feeding the basin is a 48-inch diameter sewer leading from the center of Area II and a pipe that handles stormwater and sanitary flow from the Feine facility. The basin will be decommissioned and abandoned as part of the remedial efforts at the site. Power will be disconnected and the basin backfilled. The basin will remain in-place outside of the proposed groundwater barrier wall and the existing 48-inch sewer will be tied into the new collection system. Flows from Feine will need to be rerouted to the Abby Street collection system owned by the BSA.

5.6 Future Development Considerations

Future development of Area II must take into account that the cover system and groundwater collection/containment system over the northern portion of the site cannot be disturbed. This area of the parcel could however be utilized as a "green area", possible passive park, a parking area or for other compatible uses. Passive uses of that area could occur as long as the integrity of the cover system is not disturbed.

Future development will also need to take into account the long-term operation and maintenance of the groundwater collection and pretreatment facility

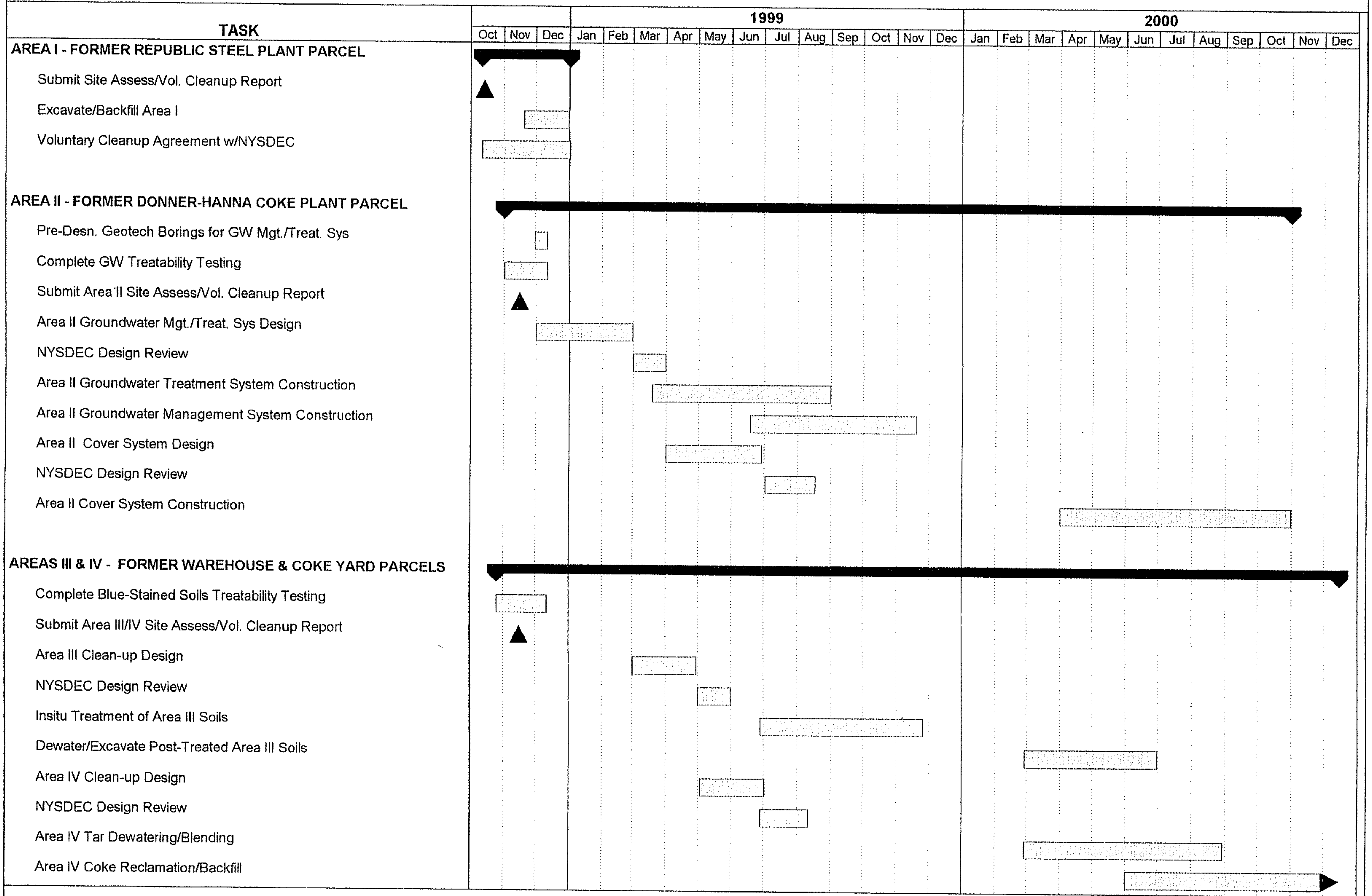
6.0 PROJECT SCHEDULE

Due to the interdependent nature of the proposed voluntary cleanups in each area, a draft project schedule for the Voluntary Site Cleanup of the entire Steel Manufacturing Site is included as Figure 6-1. The schedule assumes that the Site Assessment Reports and Voluntary Cleanup Plans for Areas III and IV will be combined and that additional field data currently being prepared for Areas II, III and IV will be submitted to the Department as addenda as they become available. Significant assumptions related to Area II and upon which the schedule is based include:

- NYSDEC approval of the Voluntary Cleanup Agreement by January 1, 1999.
- Delay in the start of Area II construction could extend the overall project schedule beyond the year 2000.
- Area II groundwater collection and pretreatment system design/construction are critical path items.
- Groundwater pretreatment system construction must precede groundwater collection in Areas II, III and IV.
- Groundwater barrier wall construction should proceed simultaneously with or precedent to the Area II groundwater collection system to minimize extraneous groundwater flows.
- Area III soils should not be excavated and placed in Area II until the groundwater collection and pretreatment systems are fully functional.
- Closure of all or part of the Area II cover system should be delayed until Areas III and IV soil excavations are complete to minimize off-site disposal.

Many of the remedial tasks can be performed concurrently to speed up the site cleanup. All work is expected to be complete for all parcels by the end of the year 2001.

STEEL MANUFACTURING SITE
DRAFT VOLUNTARY CLEANUP SCHEDULE



Wed 11/11/98

FIGURE 6-1

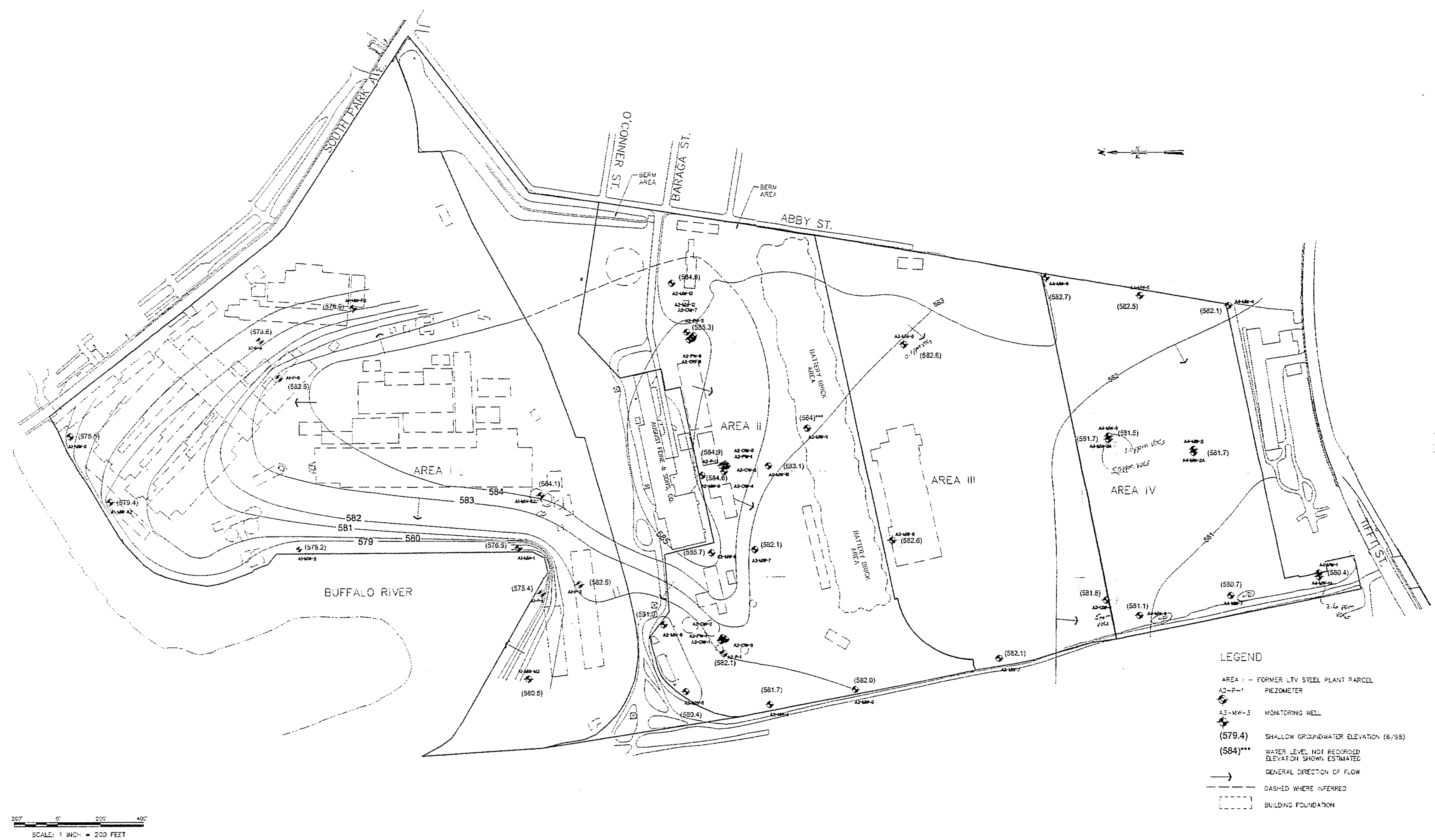
7.0 REFERENCES

1. South Buffalo Redevelopment Plan: Steel Manufacturing Site, Voluntary Cleanup Site Assessment Report, Malcolm Pirnie, September 1997.

2. Gas Research Institute – "Management of Manufactured Gas Plant Sites," Vol. 1. Published by Amherst Scientific Publishers, 1996.

3. February 27, 1998 response to NYSDEC comments by LTV Steel and Supplemental Field Investigation Work Plan, Steel Manufacturing Site, February 1998, Malcolm Pirnie.

PLATE 1



TURNKEY ENVIRONMENTAL RESTORATION, LLC

REVISIONS

NO.	BY	DATE	REMARKS

DES. ____
DWN. ____
CKD. ____

LTV STEEL COMPANY / THE HANNA FURNACE CORPORATION
SUPPLEMENTAL SITE ASSESSMENT AND VOLUNTARY CLEANUP PLAN
STEEL MANUFACTURING SITE

GROUNDWATER ISOPOTENTIAL MAP

DATE NOVEMBER 1998
SHEET 1 OF 1
CAD REF. NO. TKPLT3.DWG