



REPORT OF
PHASE II INVESTIGATION
FORMER ABEX FOUNDRY
6600 RIDGE AVENUE/6538 HOBART AVENUE
WELLSTON, MISSOURI

Prepared for:

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TABLE OF CONTENTS

Letter of Transmittal

	<u>Page Numbers</u>
Background	3
Site Activity	4
Soil Investigation	4
Sampling Procedures	4
Field Observations	5
Machine Shop	7
Electrical Transformers	7
Foundry	7
Pump House	8
Oil House/Boiler House	8
Maintenance/Storage & Blacksmith Shop	8
Chemistry Lab	8
Sewer Outfall	9
Sand Disposal Area	9
Parking Lot	9
ASTs	9
USTs	9
Groundwater Investigation	10
Sampling Procedures	10
Groundwater Flow Direction	11
Analytical Results	12
Soil Results	12
Machine Shop	12
Electrical Transformers	12
Foundry	12
Pump House	13
Oil House/Boiler House	13
Maintenance/Storage & Blacksmith Shop	13
Chemistry Lab	14
Sewer Outfall	14
Sand Disposal Area	14
Parking Lot	15
ASTs	16
USTs	16

February 7, 2002
Project #0140

Groundwater Results	16
Conclusions	17
Soil	17
Groundwater	17
Building Debris	18
Appendix A	Site Drawings
Appendix B	Laboratory Data Summary Tables
Appendix C	Soil Boring Logs and Well Construction Diagrams
Appendix D	Laboratory Data Report
Appendix E	Abandonment Registration and Monitoring Well Certification Records

February 7, 2002

Project #0140

BACKGROUND

The project site is located at 6600 Ridge Avenue and 6538 Hobart Avenue in the City of Wellston, St. Louis County, Missouri (see Figure 1 located in Appendix A). The site comprises approximately 12.2 acres and was formerly the location of the Abex Foundry. The site is roughly bounded by Hobart Street/residential to the south, a rail line and AmerenUE to the west, Federal Mogul to the north, and Ogden Street/parking/residential to the east.

The Abex facility operated as a secondary steel foundry from 1923 until closing in 1982. The facility is presently abandoned with many of the former production and support buildings demolished leaving only concrete floor slabs. Numerous piles of building debris and miscellaneous trash are located over the central part of the site where most production previously occurred. Much of the site is currently overgrown with vegetation and is especially heavy on the west and southwestern portions.

The site is presently enrolled in the Missouri Department of Natural Resources' (MDNR) Voluntary Cleanup Program (VCP) through the present owner, Secured Housing, Inc. The St. Louis County Economic Council is negotiating purchase of the site and wishes to continue the site investigation and remediation process presently ongoing with the VCP. Some investigation has been conducted by previous environmental consultants, but all requirements necessary for the VCP to approve a remedial action plan (RAP) and issue a no further action (NFA) declaration have not been met to date.

Potential environmental issues on the site include former underground storage tanks (USTs) removed by others, former above ground storage tanks (ASTs), several electrical transformer yards, bag house area, sand disposal area, boiler fueling areas, machine shop activities, and process operations.

Several site investigations have been conducted on the subject property (by others), including soil and groundwater work by the MDNR. The most recent investigations have been conducted by the consultant for Secured Housing, Inc. and overseen by the VCP. Based on conversations with personnel at the VCP and a recent site visit, there are still a number of potential environmental issues remaining to be resolved prior to approval and implementation of remedial action. These are addressed by this current site investigation.

A Site Plan of the property showing current and historical features (Figure 2) is located in Appendix A.

February 7, 2002

Project #0140

SITE ACTIVITY

Beginning November 26, 2001, EOI conducted a Phase II Environmental Investigation at the former Abex Foundry facility. This investigation included the advancement of 47 soil borings for the collection of subsurface soil samples and one sediment sample. Six of these soil borings were converted to monitoring wells for groundwater evaluation. The locations of the soil borings, sediment sample (SO-1) and monitoring wells (MW-01 through MW-06) are shown on Figure 3 located in Appendix A.

Soil Investigation

Sampling Procedures

Soil borings were advanced using either a direct push probe sampling rig or rotary auger drill rig and 4 1/4-inch ID hollow stem augers. Soil samples from the direct push probe were collected continuously in each soil boring using 2-inch diameter Macrocore samplers. Soil samples using the auger drill rig were collected using split spoon samplers on five foot intervals. All soil samples were scanned in the field for the presence of volatile organic compounds (VOCs) using a photoionization detector (PID) and field observations (e.g., discoloration, odor, etc.). Field logs were maintained in order to record the type of material encountered as well as any indications of contamination. A description of the soils encountered and PID scan results are recorded on soil boring logs located in Appendix C.

Equipment used was properly decontaminated between sampling intervals. Hollow stem augers and drilling equipment were steam cleaned between boreholes. Split spoon samplers were decontaminated between sample events using an Alconox detergent solution and de-ionized rinsate water.

One soil sample from each boring was selected for laboratory analysis, with the exception of borings in the Sand Disposal Area (SDA). Where possible, two soil samples from each boring in the SDA were selected for laboratory analysis (one sample from fill material and one sample from native soil just below the fill material in each boring). Soil samples selected for laboratory analysis were based on field observations of potential soil contamination (i.e., discoloration, odor, PID scan results, sample depth). The soil samples selected for laboratory analysis were retained on ice and transported under proper chain of custody procedures to Teklab, Inc located in Collinsville, Illinois for laboratory analysis. All laboratory analyses were conducted on a normal (two week) turnaround time basis. Specific laboratory analyses for the individual samples collected were based on suspected contaminants of concern related to known historic concerns in the area of each boring. The laboratory analyses were selected from the following list:

- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), Methyl-tert butyl ether (MTBE), and Total Petroleum Hydrocarbons (TPH) using USEPA Method 8015, OA-1.
- TPH using USEPA Method 8015, OA-2.
- Polynuclear Aromatic Hydrocarbons (PAHs) using USEPA Method 8310.
- Volatile Organic Compounds (VOC) using USEPA Method 8260

February 7, 2002
 Project #0140

- Metals-Short List (arsenic, cadmium, chromium, lead, and nickel) using USEPA Method 6010/7410
- Metals-Long List (arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, molybdenum, nickel, vanadium and zinc) using USEPA Method 6010/7410
- Polychlorinated Biphenyls (PCB) using USEPA Method 8082
- Phenol using USEPA Method 9065
- Cyanide using USEPA Method 9014

Complete copies of the laboratory data reports and chain of custody forms are contained in Appendix D. Soil cuttings generated during this investigation were contained in a double lined polyethylene cargo bag and staged onsite pending laboratory results.

Field Observations

Ten soil borings (MW-01 through MW-06 and SDA-1 through SDA-4) were advanced using the rotary auger drill rig, and the remaining borings were advanced using the direct push probe sampling rig. While some buildings and building slabs remain, many of the former buildings no longer exist and numerous piles of debris cover much of the subject property. All sample locations were situated as close to the historic environmental concerns as possible based on the knowledge of the site and current site conditions. The locations of these soil borings are shown on Figure 3 located in Appendix A. Soil boring abandonment registration records are located in Appendix E.

All soil borings were advanced at least 4 feet and up to 21 feet below ground surface (bgs). The majority of the soil borings identified varying degrees of fill material (gravel, slag and sand) as much as 19 feet bgs. Bedrock was not encountered in any of the borings. Depth to groundwater across the site varied based on the amount of fill material covering the original ground surface. However, groundwater was typically observed at approximately 5 and 10 feet bgs. A description of the soils encountered and PID scan results are recorded on soil boring logs located in Appendix C.

The following onsite environmental concerns for each area of concern were addressed by the corresponding soil borings and number of laboratory analyses:

Location/Sample ID	OA-1	OA-2	PAHs	VOCs	Metals-SL	Metals-LL	PCB	Phenol	Cyanide
Machine Shop									
MS-1		1	1	1	1		1		
MW-01		1	1	1	1		1		
Electrical Transformers									
ET-1							1		
ET-2							1		
ET-3							1		
ET-4							1		
ET-5							1		
Foundry									
FN-1		1	1	1	1			1	1

February 7, 2002
 Project #0140

Location/Sample ID	OA-1	OA-2	PAHs	VOCs	Metals-SL	Metals-LL	PCB	Phenol	Cyanide
FN-2		1	1	1	1			1	1
FN-3		1	1	1	1			1	1
FN-4		1	1	1		1		1	1
FN-5		1		1	1			1	1
FN-6		1		1	1			1	1
FN-7	No sample recovery due to rubble.								
FN-8		1		1	1			1	1
ASTs									
AST-1	1	1							
AST-2	1	1							
AST-3	1	1							
AST-4	1	1							
AST-5	1	1							
Pump House									
PH-1		1							
PH-2		1							
PH-3		1							
MW-02		1							
Oil House/Boiler House									
OH/BH-1		1							
OH/BH-2		1							
OH/BH-3		1							
OH/BH-4		1							
USTs									
UST-1	1	1							
UST-2	1	1							
UST-3	1	1							
UST-4	1	1							
UST-5	1	1							
MW-03	1	1							
Maintenance/Storage & Blacksmith Shop									
M/S & BS-1		1			1				
M/S & BS-2		1			1				
MW-04		1			1				
Chemistry Lab									
CL-1		1	1	1		1	1	1	1
Sewer Outfall									
SO-1		1	1	1		1	1	1	1
Sand Disposal Area									
SDA-1					2			2	2
SDA-2			1		1	1		2	2
SDA-3					1	1		2	2
SDA-4			1			1		1	1
MW-05			1		2			2	2

Location/Sample ID	OA-1	OA-2	PAHs	VOCs	Metals-SL	Metals-LL	PCB	Phenol	Cyanide
Parking Lot									
PL-1			1		1			1	1
PL-2			1			1		1	1
PL-3					1			1	1
MW-06					1			1	1

In addition to the above noted samples, Quality Assurance/Quality Control (QA/QC) samples were collected. Additional QA/QC samples included: trip blanks, field blanks, rinsate blanks, field duplicates, and MS/MSD samples. These samples were collected in accordance with the site Quality Assurance Project Plan (QAPP).

Machine Shop

Two soil borings (one converted into a monitoring well) were advanced in the area of the former machine shop, located on the eastern portion of the property. Soil from MS-1, located on the western portion of the former machine shop, identified fill material just below the concrete slab to at least 5 feet bgs. Soil from the 2-5 foot depth, just below the concrete slab, was selected for laboratory analysis. Soil from MW-01, located on the eastern portion of the former machine shop, identified discolored and odorous soil just below the concrete slab. A soil sample from this depth (0.5-2.5 feet bgs) was selected for laboratory analysis. Soil boring MW-01 was advanced to 14 feet bgs and converted into a groundwater monitoring well (installed at 14 feet bgs).

Electrical Transformers

Five areas of the subject site were previously identified as transformer storage areas. While the transformers have since been removed, the concrete slabs below the former transformers still remain. These five transformer areas and sampling locations include: inside the southwest corner of the former foundry building (ET-1), near the southwest corner of the former maintenance shop (ET-2), north of the former pump house (ET-3 and ET-4), and near the southwest corner of the former machine shop (ET-5). Destructive concrete core samples from 0-3 inches were collected from each of the transformer pads. The ET-2, -3, -4, and -5 samples were collected in areas of observed staining on each pad. No staining was observed on the concrete pad sampled at ET-1.

Foundry

Seven soil samples from eight sample locations were collected from the former foundry building and associated maintenance shop located on the north central portion of the property. Samples FN-1 through FN-6 were advanced throughout the former foundry building and sample FN-8 was advanced near the former maintenance shop of the foundry building. No recovery was obtained from three attempts at sample point FN-7, located near the southeast corner of the former foundry building. After initial drilling through the concrete slab (approximately 8-inches thick) in this area, a vertical 2.5-foot void was observed. At the base of this void was concrete rubble. The sampling equipment was unable to advance through this concrete rubble. No other fill material was observed within these FN-7 sample locations. The PID was used to screen the void below the slab. No PID readings were detected that would indicate a hazardous atmosphere below the concrete slab. The area of the foundry with this subsurface void appears to be limited as the three sample attempts were within a 5-foot by 5-foot area of the foundry slab, and no other sample points observed similar conditions.

February 7, 2002

Project #0140

All borings in the foundry area were advanced through the remaining concrete slab to 4-12 feet bgs. Material encountered within these borings included gravel, sand and slag (fill). No field indications of soil contamination were observed in any of these borings. In general, sample locations were selected from just below the concrete slab.

Pump House

Four soil borings were advanced in the area of the former pump house located near the south central portion of the property. The location of these borings includes one to the east (PH-1), one to the southeast (PH-2), one to the south (PH-3) and one to the southwest (MW-02) of the former pump house. The first three borings (PH-1, -2, and -3) were advanced to 8-foot bgs and MW-02 was advanced to 16 feet bgs and converted into a groundwater monitoring well (installed at 14 feet bgs). No field observations of soil contamination were observed in any of these borings. Soil samples were collected from 5-7 feet bgs in PH-1, -2, and -3, and from 4-6 feet bgs in MW-02.

Oil House/Boiler House

Four soil borings were advanced in the area of the former oil house and boiler house, located on the western portion of the property. The original buildings no longer exist so these four borings (OH/BH-1, -2, -3 and -4) were situated throughout the area of the former buildings. Borings OH/BH-1, -2 and -3 were advanced to 8-foot bgs and OH/BH-4 was advanced to 12-foot bgs. These borings primarily revealed fill material (gravel and sand); however clay was encountered at 6 feet bgs in OH/BH-2. No field observations of soil contamination were observed within any of these borings. Sample depths were selected from 6-8 feet bgs in OH/BH-1, -2 and -3 and 8-10.5 feet bgs in OH/BH-4.

Maintenance/Storage & Blacksmith Shop

Three soil borings (M/S&BS-1, -2 and MW-04) were advanced in the area of the former maintenance/storage & blacksmith shop located near the northwestern portion of the property. Two of these borings (M/S&BS-1 and -2) were advanced through the foundation of the former buildings, and MW-04 was advanced just west of the former operations. The first two borings (M/S&BS-1 and -2) were advanced through the former building foundation to 4-foot bgs and MW-04 was advanced to 16-foot bgs and converted into a groundwater monitoring well (installed at 14-foot bgs). These borings primarily revealed fill material (gravel, sand and slag); however silty clay was encountered at 9-foot bgs in MW-04. No field indicators of soil contamination were observed in any of these borings. Soil samples were collected from 2-4 feet bgs in M/S&BS-1 and -2 and from 4-6 feet bgs in MW-04.

Chemistry Lab

One soil boring (CL-1) was advanced in the area of the former chemistry lab located near the center of the property. The original chemistry lab building no longer exists and debris is piled throughout this area, and therefore this boring was situated as close to the former lab location as possible. This boring was advanced to 4-foot bgs and consisted of fill material (gravel, wood, brick, limestone dust and sand). No field observations of soil contamination were observed within this boring. A soil sample from this boring was selected from 2.5-4 feet bgs.

February 7, 2002

Project #0140

Sewer Outfall

One sediment sample was collected approximately seven feet downstream from the sewer outfall discharging from the southwest corner of the property. This sample was collected using a stainless steel hand auger. Water in the stream at the point of sampling was approximately 6-inches deep. The stream bed consisted of rock, gravel and coarse sand. A sample of this material was collected from 3-9 inches into the sediment.

Sand Disposal Area

Five soil borings (SDA-1 through -4 and MW-05) were advanced throughout the former sand disposal area covering the southwestern corner of the property. Access to this area was limited due to dense vegetation and unstable ground. Borings were advanced through the fill material where possible, and into native soil. Between 13 and 19 feet of fill material (concrete, slag, rock and sand) overlying native soil was observed in the sand disposal area. With the exception of SDA-4, two soil samples were collected from each boring (one from fill material and one from native soil just below the fill material). Boring SDA-4 encountered auger refusal in the fill material at 7.5 feet bgs, and thus only one sample was collected. Sample depths in each boring include: 9-11 feet bgs and 16-18 feet bgs in SDA-1, 14-16 feet bgs and 19-21 feet bgs in SDA-2, 4-6 feet bgs and 11-13 feet bgs in SDA-3, 4-6 feet bgs in SDA-4, and 9-11 feet bgs and 16-18 feet bgs in MW-05. After boring completion, MW-05 was converted into a groundwater monitoring well (installed at 18-feet bgs).

Parking Lot

Four soil borings (PL-1, -2, -3 and MW-06) were advanced in the parking lot located on the north and northeastern portion of the property. Borings PL-1, -2 and -3 were advanced between 7 and 12 feet bgs. MW-06 was advanced to 16 feet bgs and converted into a groundwater monitoring well (installed at 14-feet bgs). The western borings (PL-1 and -2) observed 5 to 9 feet of fill material (gravel, sand, brick, wood and glass) overlaying silty clay. The other two borings consisted mainly of silty clay containing some fill material. Soil tested from MW-06 disclosed elevated PID scan results (>100 ppm). No other field observations of soil contamination were observed in any of the borings. Soil samples were collected from 2-4 feet in PL-1 through -3 and from 9-11 feet in MW-06.

ASTs

Five soil borings were advanced in areas of former aboveground storage tanks (ASTs) located throughout the property. The locations of these ASTs include: the southwest corner of the former foundry building (AST-1), the northwest corner of the former machine shop (AST-2), west of the former machine shop (AST-3), northwest of the pump house (AST-4), and south of the former boiler house (AST-5). All five borings were advanced to 4 feet bgs. These borings primarily showed fill material (gravel, sand and brick); however clay was encountered at 3 feet bgs in AST-2. Moderate PID readings (40-60 ppm) were observed in borings AST-1 and -2 and elevated PID readings (>100 ppm) were observed in borings AST-3, -4 and -5. Sample depths were selected from near surface soils.

USTs

Six soil borings were advanced in areas of former underground storage tanks (USTs) located throughout the property. The locations of these USTs include: north of the Office/Welfare

February 7, 2002
Project #0140

Building (UST-1) and northwest and west of the former machine shop (UST-2 through UST-5 and MW-03). These six borings were advanced between 8 and 16 feet bgs. These borings consisted of varying degrees of fill material (gravel, sand and brick), clay, silty clay and clayey silt. Petroleum odors and elevated PID readings (>100 ppm) were observed in borings UST-3 and -4 and MW-03. In addition, moderate PID readings (45-80 ppm) were observed in borings UST-1 and -5, and elevated PID readings (>100 ppm) were observed in boring UST-2, however, no odors or soil discoloration were noted within soil from these three borings. Soil samples from these borings were selected from areas most likely impacted based on these field observations.

Groundwater Investigation

Sampling Procedures

Six soil borings were converted into groundwater monitoring wells. The locations of the wells were selected based on known historical environmental concerns and to provide the widest possible groundwater profile of the property. Four of the wells (MW-01, -04, -05 and -06) were installed near the outer perimeter of the property and two wells (MW-02 and -03) were installed near interior concerns onsite. The locations of these monitoring wells are shown on Figure 3 located in Appendix A. Monitoring well certification records are located in Appendix E.

Wells installed during this investigation were constructed using two-inch diameter PVC sumps, screens and risers, sand filter packs, bentonite seals, above-grade and flush-mounted protective casings and locking well caps. Well construction diagrams are located on soil boring logs located in Appendix C. On December 18, 2001, prior to sampling, the wells were developed using HDPE bailers. The purpose of developing the monitoring wells is to withdraw water and sediment that typically results from disturbing the aquifer during the drilling process. In addition to disturbing and smearing the subsurface soils in the area of the groundwater, sand is added to and surrounds the PVC well screen in the annular space that results from withdrawing the drilling augers. The process of removing groundwater from the newly installed well (well development) continually draws the surrounding groundwater into the PVC pipe and helps to clean and remove fine soil particles that typically result from disruptions to the aquifer. Ultimately, the development process ensures that the most representative formation water is present during the sample collection process. Approximately 5 well volumes of groundwater were removed from each well during development. The development water was containerized in UN/DOT approved 55-gallon drums and staged onsite.

Following development, the wells were allowed to recharge for 24 hours. On December 19, 2001, the wells were purged, removing at least one well volume of water, and sampled using a peristaltic pump. The groundwater samples collected were retained on ice and transported under proper chain of custody procedures to Teklab, Inc. located in Collinsville, Illinois. All laboratory analyses were conducted on a normal (two week) turnaround time basis. Specific laboratory analyses for the individual samples collected were based on suspected contaminants of concern related to known historic environmental concerns in the area of each well. The laboratory analyses were selected from the following list:

- Total Petroleum Hydrocarbons (TPH) using USEPA Method 8015, OA-2.

February 7, 2002

Project #0140

- Polynuclear Aromatic Hydrocarbons (PAHs) using USEPA Method 8310.
- Volatile Organic Compounds (VOC) using USEPA Method 8260
- Metals-Long List (arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, molybdenum, nickel, vanadium and zinc) using USEPA Method 6010/7410
- Polychlorinated Biphenyls (PCB) using USEPA Method 8082

Samples collected for metals and PAHs were field filtered using 0.45 μ membrane filters prior to dispensing into pre-cleaned and properly preserved glassware.

A complete laboratory data report and chain of custody form are contained in Appendix D. Groundwater from the wells was analyzed for the parameters listed below:

Well Number	Well Location	TPH OA-2	PAHs	VOCs	Metals – LL	PCBs
MW-01	Machine Shop	X		X	X	
MW-02	Pump House	X		X	X	
MW-03	UST	X	X	X	X	
MW-04	Maintenance/Storage & Blacksmith Shop	X		X	X	
MW-05	Sand Disposal Area	X	X	X	X	X
MW-06	Parking Lot	X	X	X	X	

Groundwater Flow Direction

On December 18, 2001, prior to purging the wells, static groundwater elevations were collected in order to determine the groundwater flow direction. Based on measured groundwater elevations of the six monitoring wells, a groundwater elevation contour map was prepared. This map indicates that groundwater flows in a southwesterly direction.

Figure 4 located in Appendix A depicts the calculated groundwater flow in the area of the subject site.

ANALYTICAL RESULTS

Soil Results

Laboratory analytical results are compared to remedial objectives under the Missouri Department of Natural Resources (MDNR), Voluntary Cleanup Program (VCP) which are based on the Cleanup Levels for Missouri (CALM) document dated September 2001. Using this document, Tier I soil cleanup levels for this property are compared to B (commercial) and C (industrial) remedial objectives (ROs). Using these cleanup criteria, land use restrictions must be recorded in a restrictive covenant placed in the property chain of title.

Under each land use scenario, soil contaminant concentrations are further compared to exposure routes. The direct exposure Ingestion/Dermal Contact/Inhalation Pathway Soil Target Concentration (C_{IDI}) relates to the major pathways of human exposure: passive ingestion of soil, inhalation of contaminated dust particles, inhalation of vapors of volatile contaminants, and dermal absorption. The Leaching to Groundwater Pathway Soil Target Concentration (C_{LEACH}) relates to the concentration of a specific contaminant in soil where it could leach to and adversely affect groundwater quality.

The results of the laboratory analyses for the soil samples are summarized in Tables 1 through 12 located in Appendix B. The complete laboratory data reports and chain of custody forms are located in Appendix E.

Machine Shop

Petroleum hydrocarbon contamination was detected in soil from MS-1 (2-5 feet bgs) and MW-01 (0.5-2.5 feet bgs). This hydrocarbon contamination includes TPH concentrations of 15,909 mg/kg (MS-1) and 9,124 mg/kg (MW-01). These TPH concentrations are significantly greater than the C_{IDI} cleanup criteria of 500 mg/kg (Scenario B) and 1,000 mg/kg (Scenario C). In addition, arsenic was detected in soil from MS-1 at 12.8 mg/kg. This concentration is slightly above the C_{IDI} cleanup criteria for Scenario B (11 mg/kg) but below the C_{IDI} cleanup criteria for Scenario C (14 mg/kg). No other contaminants of concern were detected above applicable ROs from soil samples collected from the machine shop.

Electrical Transformers

PCB contaminated concrete was detected in ET-3, one of two concrete pads located north of the pump house. This PCB concentration (7.2 mg/kg) is above the C_{IDI} cleanup criteria for Scenario B (0.9 mg/kg) and Scenario C (2.5 mg/kg). PCBs were not detected in any of the other transformer sample locations.

Foundry

Metals contamination was detected in soil from FN-4 (chromium), FN-5 (chromium and nickel) and FN-6 (chromium). These chromium concentrations (124 mg/kg in FN-4, 547 mg/kg in FN-5, and 88 mg/kg in FN-6) exceed the C_{LEACH} RO for both Scenarios B and C (38 mg/kg). The nickel concentration in FN-5 (202 mg/kg) is also above the C_{LEACH} RO for Scenarios B and C (170 mg/kg). In addition, while not specifically detected in the soil sample, the analytical detection limits for arsenic in soil sample FN-1 and beryllium in FN-4 exceed the C_{IDI} ROs for

February 7, 2002
Project #0140

Scenarios B and C. (*Refer to the explanation below concerning elevated laboratory detection limits for samples.) No other contaminants of concern were detected above applicable ROs from soil samples collected in the foundry area.

*The majority of laboratory detection limits for this project are less than the ROs and thus direct comparison of the resultant laboratory data with the CALM Tier 1 tables provides the cleanup status and significance of a particular soil sample result. Elevated laboratory detection limits result from sample dilutions performed during the laboratory sample preparation process and may increase the detection limits to greater than what the ROs are. Often dilutions of the original sample may be necessary and typically result from "dirty" samples. These samples may have very high contaminant concentrations, above the direct quantification capacity of the laboratory instruments used for analysis. Or, the samples may have interferences from other similar contaminants that would result in an unclear identification and possibly "mask" the contaminant of interest. Either of these conditions requires that dilutions of the original sample be made. For example, a ten-to-one dilution of the original sample with water (highly purified) results in the detection limits being raised 10 times. Therefore, when the analytical detection limits are elevated above the parameter-specific ROs, it is possible that the contaminant could occur at a concentration above the RO but less than the reported and elevated detection limit. The result would be officially reported as a "non-detect".

Pump House

Petroleum hydrocarbon contamination was detected in soil from PH-3 (5-7 feet bgs), located south of the pump house building. This TPH concentration (883.8 mg/kg) exceeds the Scenario B C_{IDI} cleanup objective (500 mg/kg) but is less than the Scenario C C_{IDI} RO (1,000 mg/kg). No other contaminants of concern were detected above applicable ROs from soil samples collected from the pump house area.

Oil House/Boiler House

Petroleum hydrocarbon contamination was detected in soil from OH/BH-1 (6-8 feet bgs). This TPH concentration (2,900 mg/kg) exceeds both the Scenario B and C C_{IDI} cleanup criteria of 500 mg/kg and 1,000 mg/kg, respectively. No other contaminants of concern were detected above applicable ROs from soil samples collected from the oil house/boiler house.

Maintenance/Storage & Blacksmith Shop

Petroleum hydrocarbon and metals contamination were detected in soil in the area of the maintenance/storage and blacksmith shop. The elevated TPH concentration (552 mg/kg) was identified in sample M/S&BS-2 at 2-4 feet bgs. This concentration exceeds the Scenario B C_{IDI} cleanup objective (500 mg/kg) but is less than the Scenario C C_{IDI} RO (1,000 mg/kg). Metals contamination (chromium) was identified in soil from M/S&BS-2 (85.4 mg/kg) and MW-04 (65 mg/kg). These chromium concentrations exceed the C_{LEACH} RO for both Scenarios B and C (38 mg/kg). In addition, while not specifically detected, the analytical detection limit for arsenic in soil sample M/S&BS-2 exceeds the C_{IDI} ROs for Scenario B. (*Refer to the explanation above in the Foundry Section concerning elevated laboratory detection limits for samples.) No other contaminants of concern were detected above applicable ROs from soil samples collected in the maintenance/storage and blacksmith shop.

February 7, 2002

Project #0140

Chemistry Lab

Metals (beryllium) and PAH [benzo(a)pyrene] contamination were detected in soil in the area of the chemistry lab (CL-1, 2.5-4 feet bgs). The elevated beryllium concentration (0.268 mg/kg) exceeds the Scenario B (0.07 mg/kg) and Scenario C (0.2 mg/kg) C_{IDI} cleanup objectives. The benzo(a)pyrene contamination (0.27 mg/kg) exceeds the Scenario B C_{IDI} cleanup objective (0.2 mg/kg) but is less than the Scenario C C_{IDI} RO (0.6 mg/kg). No other contaminants of concern were detected above applicable ROs from soil samples collected in the chemistry lab.

Sewer Outfall

Metals (beryllium and chromium), petroleum hydrocarbon, and PAH [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h)anthracene] contamination were detected in soil in the area of the sewer outfall.

The beryllium concentration (0.381 mg/kg) exceeds the Scenario B (0.07 mg/kg) and Scenario C (0.2 mg/kg) C_{IDI} cleanup criteria. The chromium concentration (54.5 mg/kg) exceeds the C_{LEACH} ROs for Scenarios B and C.

The elevated TPH concentration (527 mg/kg) exceeds the Scenario B C_{IDI} cleanup objective (500 mg/kg) but is less than the Scenario C C_{IDI} RO (1,000 mg/kg).

The PAH contaminants at the sewer outfall exceeding applicable ROs include:

- Benzo(a)anthracene (2.5 mg/kg) above C_{IDI} Scenario B (2 mg/kg), and C_{LEACH} Scenario B and C (0.2 mg/kg) cleanup criteria,
- Benzo(a)pyrene (2.9 mg/kg) above C_{IDI} Scenario B (0.2 mg/kg) and Scenario C (0.6 mg/kg) cleanup criteria,
- Benzo(b)fluoranthene (2.4 mg/kg) above C_{IDI} Scenario B (1 mg/kg), and C_{LEACH} Scenario B and C (0.6 mg/kg) cleanup criteria,
- Benzo(k)fluoranthene (0.83 mg/kg) above C_{LEACH} Scenario B and C (0.6 mg/kg) cleanup criteria,
- Chrysene (2.8 mg/kg) above C_{LEACH} Scenario B and C (0.2 mg/kg) cleanup criteria,
- Dibenzo(a,h)anthracene (0.53 mg/kg) above C_{IDI} Scenario B (0.2 mg/kg) cleanup criteria,

No other contaminants of concern were detected above applicable ROs from soil samples collected from the sewer outfall.

Sand Disposal Area

Metals contamination (arsenic, beryllium, chromium and manganese) was detected in soil from the sand disposal area. Where possible, two samples were collected from each boring in this area (one from fill material and one from native soil just below the fill material). Elevated metal concentrations identified in these borings include the following:

Chromium (594 mg/kg) was detected above applicable ROs in SDA-1 from 9-11 feet bgs ("fill"). This chromium concentration is above the C_{LEACH} Scenario B and C (38 mg/kg) cleanup criteria.

Arsenic (13.8 mg/kg) and beryllium (0.524 mg/kg) were detected in SDA-2 above applicable ROs from 19-21 feet bgs ("native"). The arsenic concentration is above the C_{IDI} Scenario B (11

mg/kg) and the beryllium concentration is above the C_{IDI} Scenario B (0.07 mg/kg) and Scenario C (0.2 mg/kg) cleanup criteria.

Chromium (268 mg/kg) and manganese (6,440 mg/kg) were detected above applicable ROs in SDA-3 from 4-6 feet bgs ("fill"). The chromium concentration exceeds the C_{LEACH} RO for both Scenarios B and C (38 mg/kg). The manganese concentration exceeds the C_{IDI} RO for Scenario B (5,200 mg/kg). In addition, while not specifically detected, the analytical detection limit for beryllium exceeds the C_{IDI} ROs for Scenario B. (*Refer to the explanation above in the Foundry Section concerning elevated laboratory detection limits for samples.).

Beryllium (0.203 mg/kg) and chromium (73.2 mg/kg) were detected above applicable ROs in SDA-4 from 4-6 feet bgs ("fill"). The beryllium concentration exceeds the C_{IDI} RO for Scenario B (0.07 mg/kg) and Scenario C (0.2 mg/kg). The chromium concentration exceeds the C_{LEACH} RO for both Scenarios B and C (38 mg/kg).

Chromium (51.9 mg/kg) was detected above applicable ROs in MW-05 from 9-11 feet bgs ("fill"). This chromium concentration exceeds the C_{LEACH} RO for both Scenarios B and C (38 mg/kg).

No other contaminants of concern were detected above applicable ROs from soil samples collected in the Sand Disposal Area.

Parking Lot

Metals (arsenic, beryllium, cadmium, chromium, manganese and nickel) and PAHs [benzo(a)anthracene, benzo(a)pyrene and chrysene] contamination was identified in soil from the parking lot.

Metals (arsenic at 13.4 mg/kg and chromium at 213 mg/kg) and PAH [benzo(a)anthracene at 0.34 mg/kg, benzo(a)pyrene at 0.57 mg/kg and chrysene at 0.46 mg/kg] were detected above applicable ROs in PL-1, located near the northwest corner of the parking lot. The arsenic concentration is above the C_{IDI} Scenario B (11 mg/kg) and the chromium concentration exceeds the C_{LEACH} RO for both Scenarios B and C (38 mg/kg). Benzo(a)anthracene and chrysene both exceed C_{LEACH} RO for both Scenarios B and C (0.2 mg/kg) and benzo(a)pyrene is above the C_{IDI} cleanup criteria for Scenario B (0.02 mg/kg).

Metals (arsenic, beryllium, cadmium, chromium, manganese and nickel) were detected above applicable ROs in PL-2, located near the southwest corner of the parking lot. These metal exceedences include:

- Arsenic (45.1 mg/kg) above the C_{IDI} for Scenario B (11 mg/kg) and Scenario C (14 mg/kg),
- Beryllium (0.118 mg/kg) above the C_{IDI} for Scenario B (0.07 mg/kg),
- Cadmium (17.9 mg/kg) above the C_{LEACH} for Scenarios B and C (11 mg/kg),
- Chromium (1,160 mg/kg) above the C_{LEACH} for Scenarios B and C (38 mg/kg),
- Manganese (5,430 mg/kg) above the C_{IDI} for Scenario B (5,200 mg/kg),
- Nickel (352 mg/kg) above the C_{LEACH} for Scenarios B and C (170 mg/kg),

February 7, 2002

Project #0140

Arsenic (11.4 mg/kg) was detected above applicable ROs in MW-06, located in the northeast corner of the parking lot. This arsenic concentration exceeds C₁₀₁ RO for Scenario B (11 mg/kg).

No other contaminants of concern were detected above applicable ROs from soil samples collected in the Sand Disposal Area.

ASTs

Petroleum hydrocarbon contamination (3,320 mg/kg) was identified in soil from AST-5 (3-4 feet bgs), located south of the former oil house. This TPH concentration exceeds the C₁₀₁ cleanup criteria for both Scenario B (500 mg/kg) and Scenario C (1,000 mg/kg). No other contaminants of concern were detected above applicable ROs from soil samples collected from the former aboveground storage tank locations.

USTs

Petroleum hydrocarbon contamination (2,320 mg/kg) was identified in soil from MW-03 (9-11 feet bgs), located south of the former foundry. This TPH concentration exceeds the C₁₀₁ cleanup criteria for both Scenario B (500 mg/kg) and Scenario C (1,000 mg/kg). No other contaminants of concern were detected above applicable ROs from soil samples collected from the former underground storage tank locations.

Groundwater Results

Groundwater Cleanup Objectives are based on Groundwater Target Concentration (GTARC) Scenarios B and C criteria from the MDNR CALM document September, 2001. The results of the laboratory analyses for the groundwater samples are summarized in Table 13 located in Appendix B. The complete laboratory data reports and chain of custody forms are located in Appendix E.

All six of the groundwater samples detect metals in excess of GTARC ROs for Scenarios B and C. With the exception of MW-05, located in the sand disposal area, all of the monitoring wells detected manganese (as high as 7.08 mg/L) in excess of the applicable GTARC RO for manganese (0.05 mg/L). Chromium was detected in MW-05 (1.46 mg/L) in excess of the applicable GTARC RO for chromium (0.1 mg/L).

In addition, while not specifically detected, analytical detection limits for PAHs [benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and Indeno(1,2,3-cd)pyrene] in groundwater samples from MW-03, -05 and -06 exceed their associated GTARC ROs. While able to report these compounds as low as 130 ppt, the laboratory is not able to meet the extremely low GTARC concentration for these compounds (4.4 ppt). (*Refer to the explanation above in the Foundry Section concerning elevated laboratory detection limits for samples.)

No other contaminants of concern were detected above applicable ROs from groundwater samples collected from these six onsite monitoring wells located throughout the property.

February 7, 2002
Project #0140

The results of the laboratory analyses for the groundwater samples are summarized in Table 13 located in Appendix B. The complete laboratory data report and chain of custody form is located in Appendix E.

CONCLUSIONS

This investigation was designed to qualify potential onsite contamination as a result of historical onsite operations.

A total of 47 soil borings were advanced in specified area of concern throughout the subject property for surface and subsurface soil collection and laboratory analysis. Six of these soil borings were converted to monitoring wells for groundwater collection and laboratory analysis. In addition, one sediment sample was collected in the area of the sewer outfall.

Soil

In general, this soil investigation identified the following contaminants above applicable remediation objectives:

Scenario B Cleanup Criteria:

- TPH was detected in 6 areas (7 borings) throughout the subject site. These areas include the machine shop, pump house, oil house/boiler house, maintenance/storage & blacksmith shop, one AST location, one UST area and the sewer outfall.
- Metals were detected in the machine shop, foundry, maintenance/storage & blacksmith shop, chemistry lab, sand disposal area, parking lot and the sewer outfall.
- PAHs were detected in the chemistry lab, parking lot and the sewer outfall.

Figure 5 located in Appendix B depicts the areas of environmental concern using the Scenario B cleanup criteria.

Scenario C Cleanup Criteria:

- TPH was detected in 4 areas (5 borings) throughout the subject site. These areas include the machine shop, oil house/boiler house, one AST location and one UST area.
- Metals were detected in the foundry, maintenance/storage & blacksmith shop, chemistry lab, sand disposal area, parking lot and the sewer outfall.
- PAHs were detected in the parking lot and the sewer outfall.

Figure 6 located in Appendix B depicts the areas of environmental concern using the Scenario C cleanup criteria.

Groundwater

In general, this investigation detected manganese and chromium above applicable remediation objectives in onsite groundwater. Specifically, the following contaminants were detected in onsite groundwater above applicable remediation objectives:

February 7, 2002

Project #0140

- Manganese was detected in groundwater above applicable ROs from MW-01, -02, -03, -04 and -06.
- Chromium was detected in groundwater above applicable ROs from MW-05.

No TPH, VOCs, PAHs, or PCBs were detected above applicable cleanup criteria in any of the groundwater samples during this investigation.

Building Debris

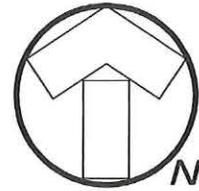
In addition to the onsite soil and groundwater concerns characterized during this investigation, EOI identified the following asbestos-containing materials at the site:

- Roofing Material (Black and Gray) - former Foundry and Office Buildings,
- Floor Tile and Linoleum - Office Building and stockpiled at the northwest corner of the former Foundry building,
- Pipe Insulation (cementitious) - near Melting Dept. Storage Building,
- Transite Sheeting (corrugated and flat sheets) - Concentrated around former Machine Shop, but debris scattered throughout site,
- Transite Pipe - adjacent to Concrete debris piles,
- Galbestos Roof/siding - Melting Dept. Storage Building.

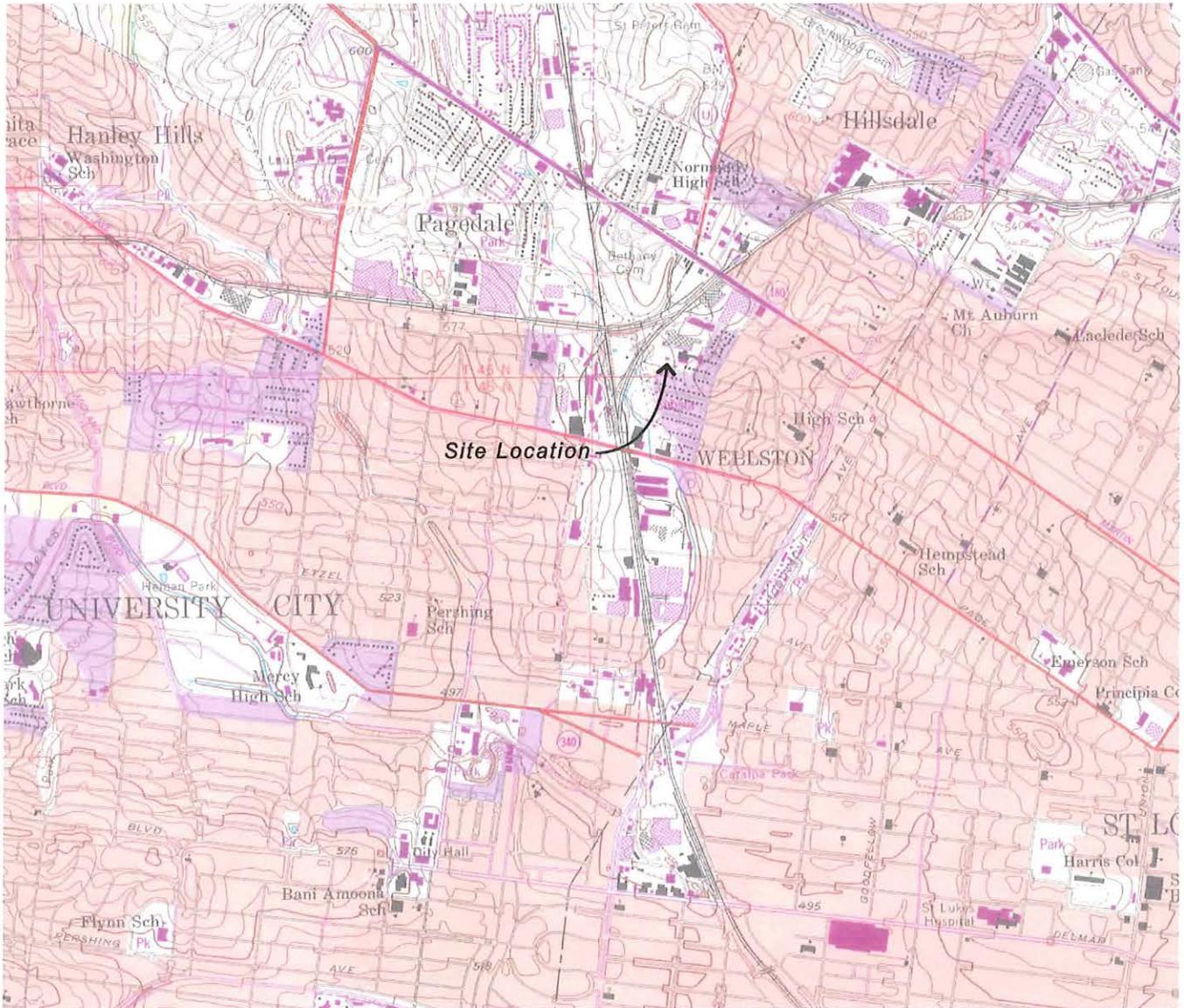
Figure 7 located in Appendix B depicts areas of asbestos containing building materials.

Other miscellaneous items of environmental concern observed at the site include fluorescent light tubes, ballasts, thermostats and automotive tires. Lead-based paint was not addressed because EOI was informed that all painted debris will be taken off-site and properly disposed.

APPENDIX A
SITE DRAWINGS

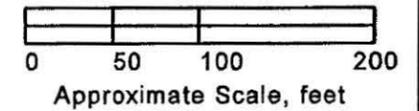
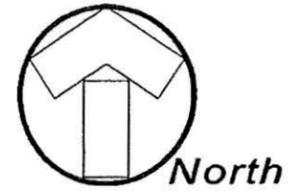
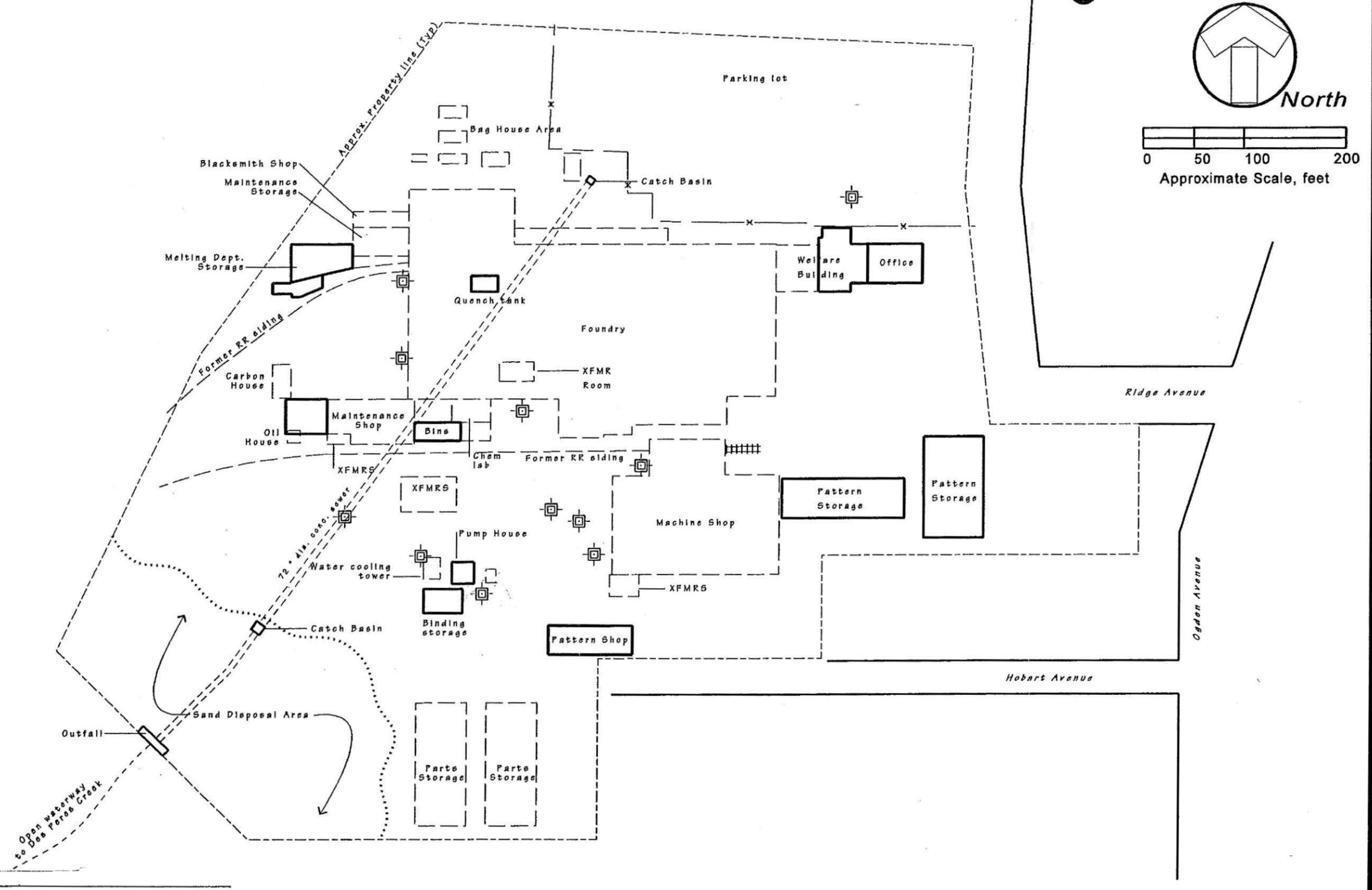


North

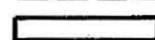


Source: USGS 7.5 min. quadrangle " Clayton, MO. "

Site Location Map
Former Abex Foundry
Wellston, Missouri

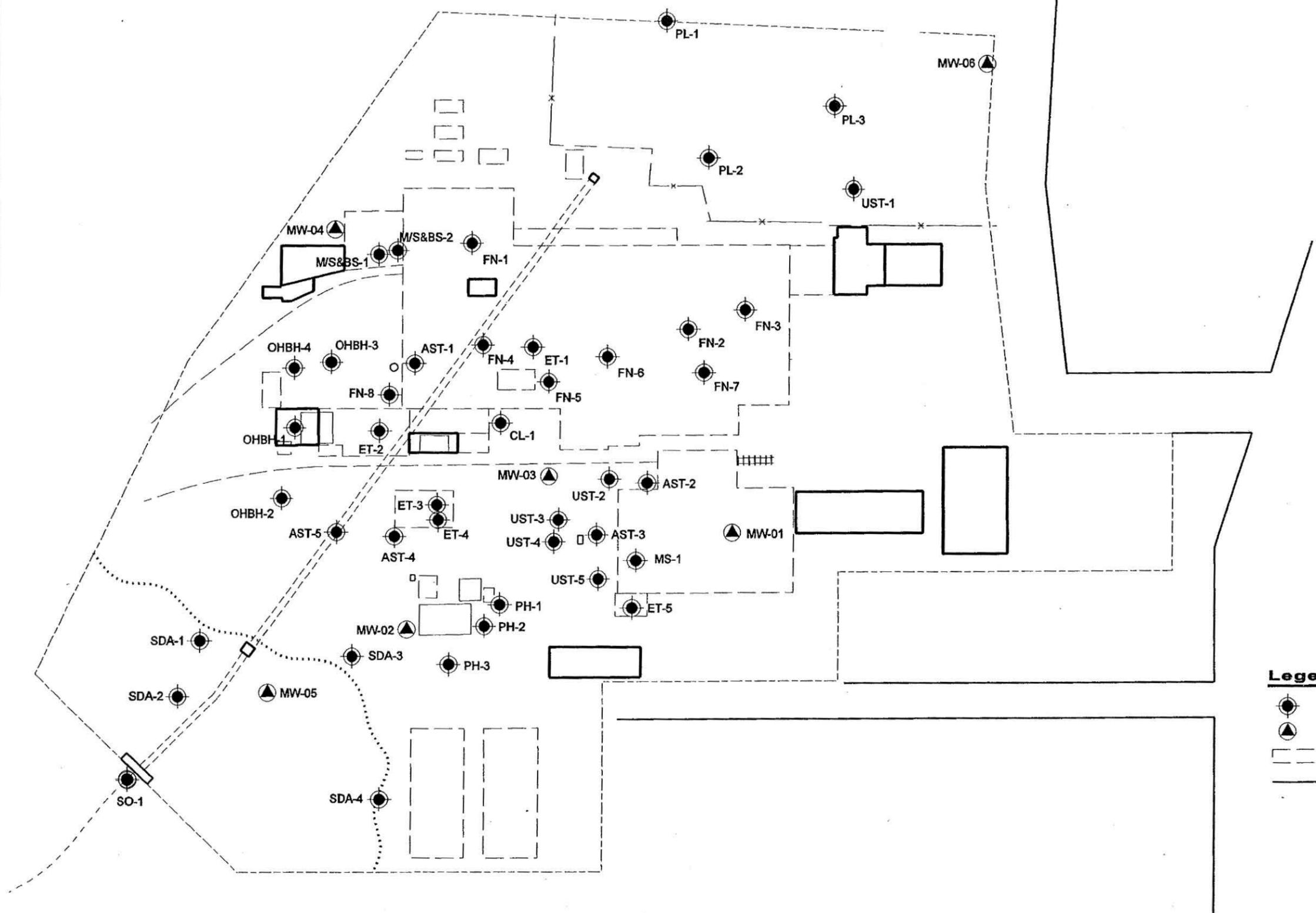
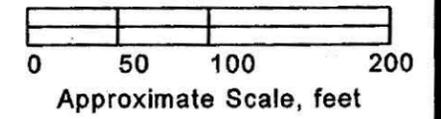


Legend

-  Remants of Former Structure
-  Existing Structure
-  Approximate Tank Area

Historical Features
Former Abex Foundry
Wellston, Missouri

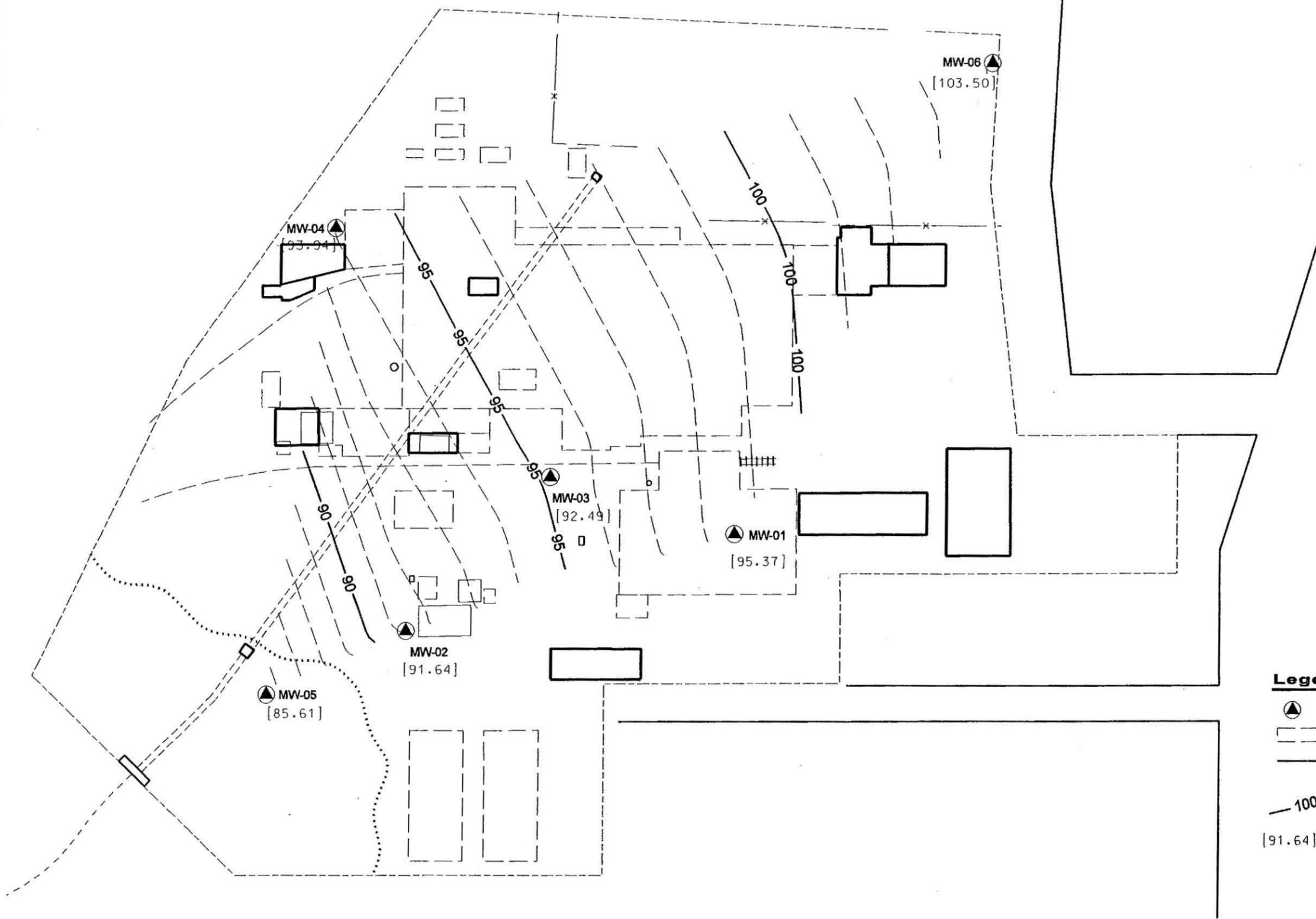
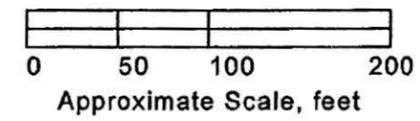
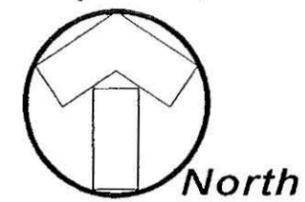
Figure 2



- Legend**
-  Probehole Location
 -  Monitoring Well Location
 -  Former Structure
 -  Existing Structure

Sampling Locations
Former Abex Foundry
Wellston, Missouri

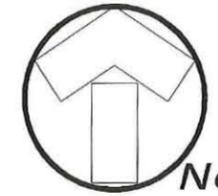
Figure 3



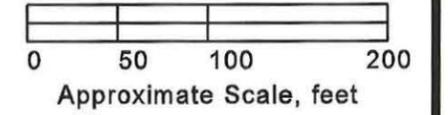
Legend

	Monitoring Well Location
	Former Structure
	Existing Structure
	Potentiometric Surface Elevation
	Groundwater Elevation

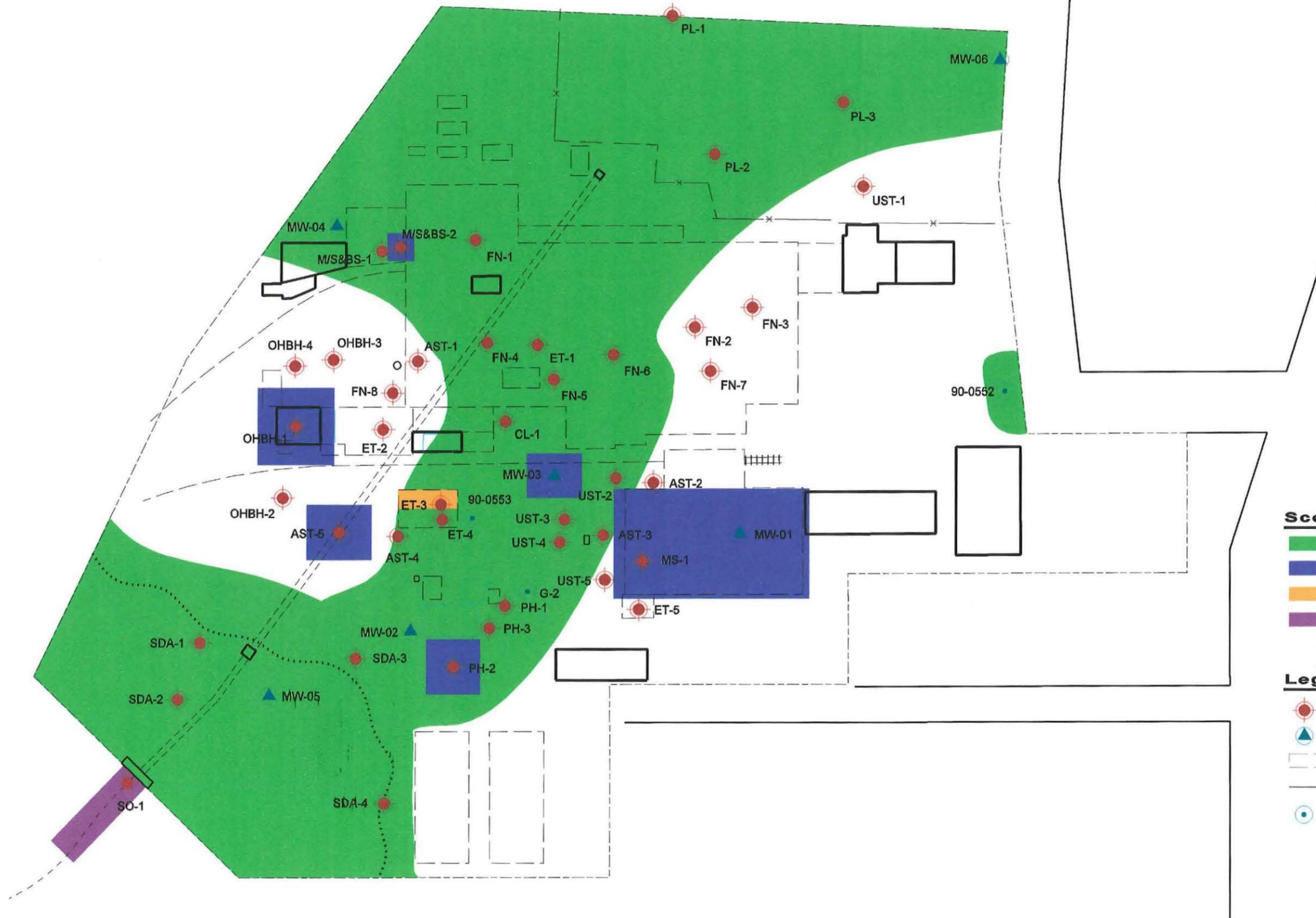
Potentiometric Map, 18 December 2001
Former Abex Foundry
Wellston, Missouri



North



Approximate Scale, feet



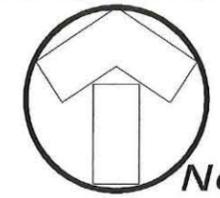
Scenario B Cleanup Criteria

- Engineered Barrier (302369 sq. ft.)
- TPH Soil Removal (31025 sq. ft.)
- PCB Concrete Removal
- Sediment Removal

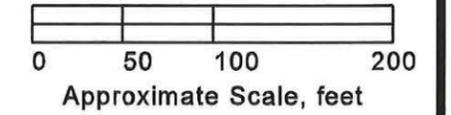
Legend

- Probehole Location
- Monitoring Well Location
- Former Structure
- Existing Structure
- Sample Location (by Others)

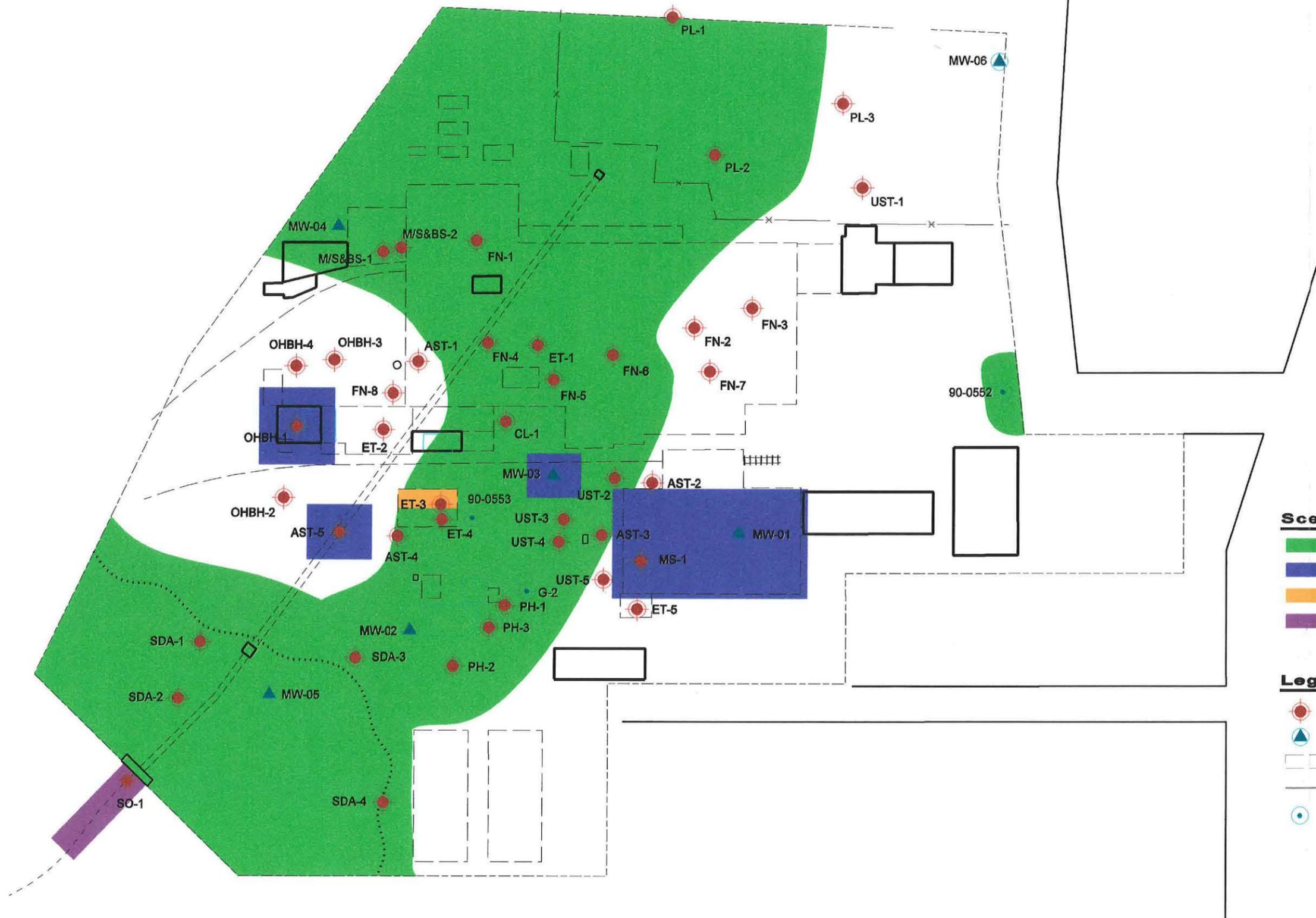
Scenario B Cleanup
Former Abex Foundry
Wellston, Missouri



North



Approximate Scale, feet



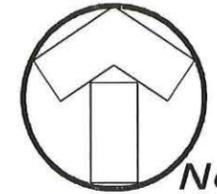
Scenario C Cleanup Criteria

- Engineered Barrier (283310 sq. ft.)
- TPH Soil Removal (27900 sq. ft.)
- PCB Concrete Removal
- Sediment Removal

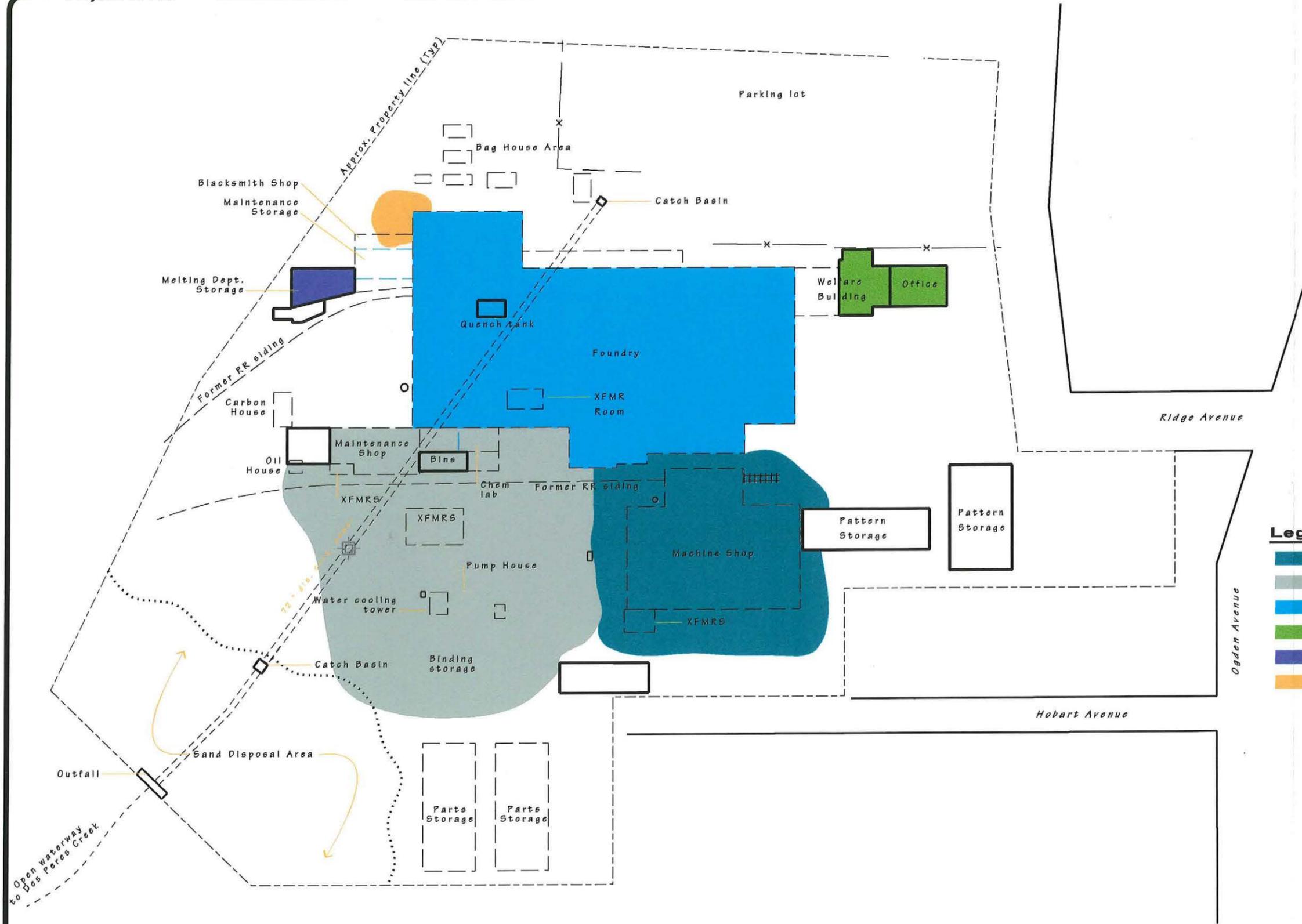
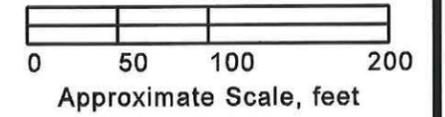
Legend

- Probehole Location
- Monitoring Well Location
- Former Structure
- Existing Structure
- Sample Location (by Others)

Scenario C Cleanup
Former Abex Foundry
Wellston, Missouri



North



Legend

-  Concentrated Transit Siding Debris
-  Soil/asbestos Debris Removal
-  Roofing/asbestos Debris Removal
-  Floortile and Linoleum
-  Roofing Material Removal
-  Floortile Stockpile

Note: Asbestos transit piping suspected throughout Site.

Asbestos Containing Materials

Former Abex Foundry
Wellston, Missouri