RECORD OF DECISION

SMOKEY MOUNTAIN SMELTERS SUPERFUND SITE

KNOXVILLE, KNOX COUNTY, TENNESSEE

Prepared By:
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

September 2015

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ACRONYMS AND ABBREVIATIONS

Alcoa	Aluminum Company of America
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
CSM	conceptual Site model
EA	exposure areas
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
ERRS	Environmental Rapid Response Service
ESD	Explanation of Significant Differences
ESI	Expanded Site Inspection
FDEP	Florida Department of Environmental Protection
FS	feasibility study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IC	institutional control
KCDAPC	Knox County Department of Air Pollution Control
MCL	maximum contaminant level
µg/L	micrograms per liter
MNA	monitored natural attenuation
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
REAC	Response Engineering and Analytical Contract
RI	remedial investigation
RME	reasonable maximum exposures
ROD	Record of Decision
RSL	Regional Screening Level(s)
SARA	Superfund Amendments and Reauthorization Act of 1986
SMS	Smokey Mountain Smelters
START	Superfund Technical Assessment and Response Team

ACRONYMS AND ABBREVIATIONS (continued)

SVOC	semi-volatile organic compounds
TBC	to-be-considered
TDEC	Tennessee Department of Environment and Conservation

PART 1: DECLARATION

1.0 Site Name and Description

This Record of Decision (ROD) is for the Smokey Mountain Smelters (SMS) Superfund Site (Site) located in Knoxville, Knox County, Tennessee. The U.S. Environmental Protection Agency (EPA) Site Identification Number is TND098071061.

2.0 Statement of Basis and Purpose

This decision document selects the remedy for the Site in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 United States Code Section 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300, as amended.

This decision is based on the Administrative Record for the Site, which has been developed in accordance with Section 113(k) of CERCLA, 42 United States Code Section 9613(d). The Administrative Record file is available for review at the Bearden Branch Library, 100 Golf Club Road, Knoxville, Tennessee and at the United States Environmental Protection Agency (EPA) Region 4 Records Center in Atlanta, Georgia. The state of Tennessee, as represented by the Tennessee Department of Environmental Protection (TDEC), concurs with the Selected Remedy.

3.0 Assessment of the Site

The remedial action selected in this ROD is necessary to protect public health and welfare or the environment from actual or threatened releases of hazardous substances to the environment.

4.0 Description of the Selected Remedy

The primary components of the Selected Remedy include:

- A composite cap to prevent direct exposure of receptors and limit additional leaching of waste contaminants to ground water
- pH adjustment of ground water to promote precipitation of metals contamination in ground water

- Monitored remediation of ground water contamination in the surficial aquifer to evaluate the progress of the ground water remedy

- Institutional controls (ICs) to preserve the integrity of the cap, prevent disturbance of the cap and the waste beneath the cap, prevent use of contaminated ground water, and restrict future use to commercial and industrial

5.0 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element.

The Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure. Therefore, statutory Five-Year Reviews will be conducted within five years of the start of construction to ensure that the remedy remains protective of human health and the environment.

6.0 Data Certification Checklist

The following information is included in The Decision Summary (Part 2) of this ROD, while additional information can be found in the Administrative Record file for the Site:

a. Chemicals of Concern (COCs) and their respective concentrations (see Table 8-1);

b. Baseline risk represented by the COCs (see Section 7.0 – Summary of Site Risks);

c. Cleanup levels established for the COCs and the basis for those levels (see Section 8.1 - Cleanup Levels and Table 8-1);

d. How source materials constituting principal threats are addressed (see Section 11.0 - Principal Threat Wastes);

e. Current and reasonably anticipated current and future land use assumptions used in the human health risk assessment and this ROD (see Section 6.0 – Current and Potential Future Land and Water Uses);

f. Potential land use that will be available at the Site as a result of the selected remedy (see Sections 6.0 – Current and Potential Future Land and Water Uses, and 12.3 – Expected Outcome of the Selected Remedy);

g. Estimated capital, lifetime operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Section 12.2 – Selected Remedy Cost); and

h. Key factors that led to selecting the remedy (see Section 12.1 – Summary and Rationale for the Selected Remedy).

7.0 Authorizing Signature

This ROD documents the selected remedy to address contamination at the Site. Due to previous EPA actions at the Site, there is no further action required to address soils, sediments, and surface water. The selected remedy addresses contaminated groundwater. This remedy was selected by the EPA with the concurrence of TDEC. The Director of the Superfund Division in EPA, Region 4 has been delegated the authority to approve and sign this ROD.

United States Environmental Protection Agency Region 4

By: _____ Date: 9/30/15

Franklin E. Hill, Director
Superfund Division

`PART 2: DECISION SUMMARY

This Decision Summary provides a description of the Site-specific factors and analyses that led to the selection of the remedy for the Smokey Mountain Smelters Superfund Site (Site). It includes background information, the nature and extent of contamination, the assessment of human health and environmental risks, the identification and evaluation of remedial action alternatives, and the selection of a remedy that will address risks posed by the contamination.

1.0 Site Name, Location, and Description

The Smokey Mountain Smelters (SMS) Superfund Site (Site) is located at 1508 Maryville Pike in Knoxville, Knox County, Tennessee, in the eastern portion of the state (Figure 1-1). The geographic coordinates for SMS, as measured from the southwestern corner of the on-Site building, are 35.918947 degrees (°) north latitude and 83.927072° west longitude. The 13-acre property is bordered by mixed residential and commercial properties to the north; the Montgomery Village apartment complex approximately 200 feet (ft) to the east; an undeveloped wooded area to the south; and both residential and commercial properties to the west. Active railroad lines owned by Norfolk Southern and CSX Transportation border the property to the east and west, respectively. The majority of the residential areas that border SMS are low density with large areas that are wooded and undeveloped. A Site layout map is shown on Figure 1-2.

Historical Site features associated with both the fertilizer manufacturing operations as well as the secondary aluminum smelter are shown on Figure 1-2. The former process building housed two natural gas-fired rotary furnaces, one casting furnace, and a large overhead crane. When active, large air ducts led to two outside baghouses near the southwestern corner of the building. South of the former process building was the waste pile, which covered four acres. Two settling ponds located south of the former process building were utilized during fertilizer manufacturing but were backfilled during aluminum smelter operations. Other areas historically documented on the property include a small transformer area to the northeast of the former process building, a railroad spur off the Norfolk Southern railroad, a maintenance building, and an unnamed pond.

All buildings have been demolished and all wastes within the waste piles have been consolidated and capped on-Site (Figure 1-2). In order to eliminate surface water runoff on the cap, two rip rap drainage channels have been installed along the east and west perimeters of the property. Surface water runoff flows into an unnamed perennial tributary, which flows for about 450 ft to the East Flenniken Branch. The East Flenniken Branch flows about 1.25 miles and converges with Flenniken Branch. Flow continues south in Flenniken Branch for about 1 mile, where Flenniken Branch converges with the Knob Creek Embayment (Fort Loudon Reservoir) of the Tennessee River at river mile 637.5, approximately 2.3 miles south of SMS. Loudoun

Reservoir is a popular recreational area that is used for boating and fishing at the I.C. King Park. Within the Flenniken Branch drainage area, several wetland areas exist.

2.0 Site History and Enforcement Activities

2.1 Site History

From 1922 to 1948, Knoxville Fertilizer Company operated a fertilizer factory on the SMS property. Prominent structures included a sulfuric acid tank, a 30,000-gallon water tank, a 70,000-gallon reservoir, and the nitrogen house. Fertilizer manufacturing was performed using the phosphate and ammonium sulfate processes, which utilize acid phosphate (super-phosphate). Manufacturing of phosphate fertilizer produces wastewater, which may contain the heavy metals cadmium, mercury, and lead. Drainage from stockpiles of gypsum may contain heavy metals (cadmium, mercury, and lead), fluorides, and phosphoric acid. According to a 1966 topographic map, two settling ponds were present on the eastern portion of the property. The purpose of the settling ponds is unknown. Ownership of the property changed numerous times between 1948 and 1979; however, Site operations continued to consist of manufacturing agricultural products such as fertilizer during that time.

SMS, Inc. (SMS, also known as Rotary Furnace, Inc.) operated at the site from 1979 to 1994. The facility was a secondary aluminum smelting operation. The process involved the melting of scrap aluminum and aluminum dross, a smelting waste byproduct, and casting the molten aluminum metal bars. Raw materials primarily consisted of scrap aluminum and aluminum dross. Waste material from the operation was primarily saltcake, a residue with high salt and low metal content from dross smelting. Other waste materials included baghouse dust and discarded aluminum dross.

A 1983 Knox County Department of Air Pollution Control (KCDAPC) field activity report indicates that a landfill was located in the southern portion of the property. Demolition and industrial waste, as well as slag and cinders from furnace operations, were disposed in the landfill. A 1983 TDEC geologic investigation report indicates that the landfill was used for the disposal of "saltcake," which resulted from processing aluminum ore. Based on historical records, the landfill appears to have been in the same location as the exterior (saltcake) waste pile currently on the SMS property.

From 1983 to 1989, KCDAPC received numerous citizen complaints regarding excessive air emissions and issued several violations to SMS for air quality violations. In 1985, SMS received a permit from the KCDAPC to operate Rotary Aluminum Recovery Furnace #1.

Between 1985 and 1992, the Aluminum Company of America (Alcoa) sent large quantities of wastes, potentially containing hazardous substances, to the SMS facility. The wastes included dross, filters, furnace bottoms, oily scalper chips, tabular balls, saltcake, and pot pads. Cyanide compounds are typically found in spent pot liners.

After shutting down smelting operations in 1994, the former operators left much of the Site in a waste pile consisting of saltcake and aluminum dross without a protective underlying cover or drainage controls. Dross and saltcake release heat and ammonia gas and leach aluminum, ammonia, chlorides and other contaminants if these materials come into contact with water (e.g., during heavy rains).

In response to several Site investigations discussed in Section 3.0, SMS was listed on the National Priorities List (NPL) on September 27, 2010.

2.2 Investigation History

2.2.1 1997 Site Investigation

In 1997, TDEC conducted a Site Investigation during which waste, surface water, and sediment samples were collected. Waste samples obtained from the exterior waste pile contained cadmium, chromium, copper, and zinc. Surface water and sediment samples collected from the East Flenniken Branch and Flenniken Branch contained elevated concentrations of beryllium, copper, lead, zinc, benzo(a)pyrene (BaP), pyrene, and chrysene, as compared to background levels. Sample results were summarized in the Site Investigation Report prepared by TDEC in 1999 (TDEC, 1999).

2.2.2 1998 Public Health Assessment

In 1998, EPA directed the Agency for Toxic Substances and Disease Registry (ATSDR) to perform a public health assessment of SMS. Results from the Site investigation and data available in the 1997 Site Investigation Report prepared by TDEC formed the basis for the assessment. ATSDR concluded that the concentrations of contaminants detected within on-Site, solid waste materials did not pose a public health hazard under current Site conditions based on the limited available data; however, ATSDR noted that the former process building did pose a physical hazard to trespassers. Due to the lack of data, ASTDR was not able to assess the potential impact from Site-related contaminants to ground water and ambient air. Details of the findings are presented in the Public Health Assessment dated August 27, 1998 (ASTDR, 1998).

2.2.3 2002 Expanded Site Inspection

In 2002, TDEC conducted an Expanded Site Inspection (ESI) that included the collection of waste, sediment, and surface water samples. The waste samples collected from the interior waste pile contained concentrations of beryllium, chromium, copper, lead, nickel, silver, and zinc above background levels. The sediment and surface water samples contained elevated concentrations of copper. A leachate seep was observed emanating from the exterior waste pile and entering the unnamed perennial tributary of the East Branch of Flenniken Branch. A sample collected from the leachate contained nickel and polychlorinated biphenyls (PCBs). All results and findings can be found in the ESI report (TDEC, 2005).

2.2.4 2006 Site Investigation

In 2006, EPA directed Lockheed Martin Technology Services (Lockheed Martin) under the Response Engineering and Analytical Contract (REAC) to evaluate the potential threat that Site-related contaminants posed to soil and ground water. The investigation was conducted between October 2006 and December 2006. Observations included:

- A structurally unstable building (the former process building) that housed rotary and casting furnaces;
- Piles of smelting waste inside the process building;
- Used bag filters and bag filter dust in the baghouse area adjacent to the process building;
- Aluminum smelting waste (exterior waste pile) covering the southern portion of the property. The exterior waste pile contained smelter waste with a mostly gray, fine, silty texture.

Samples were collected from the exterior waste pile, a leachate seep emanating from the exterior waste pile, and from the unnamed perennial tributary of the East Branch of Flenniken Branch. Waste and ground water samples collected from borings advanced through the exterior waste pile contained beryllium, cadmium, chromium, copper, lead, mercury, BaP, and PCBs. The leachate sample contained antimony, arsenic, copper, lead, mercury, nickel, and 2-butanone (methyl ethyl ketone). Surface water samples contained antimony, arsenic, copper, cyanide, mercury, nickel, acetone, and 2-butanone at concentrations above background.

Ten waste samples were collected from the process building, outside western and eastern stacks, inside stacks, baghouse, boiler, and inside waste pile for analysis of dioxin/furans. The sample collected from the western stack had the highest concentration of dioxin based on World Health Organization toxic equivalent value of 6,820 parts per trillion. All results and findings of the 2006 Site investigation performed by Lockheed Martin are presented in the Trip Report dated July 13, 2007 (Lockheed Martin, 2007).

2.2.5 2008 Time-Critical Removal Action

In 2008, EPA observed that Site fencing was in poor condition and would not keep trespassers out. Trespassers had cut holes in the fence and created an informal path leading from the Site to the nearby apartment complex. In response, EPA initiated a time critical removal action to provide stronger security measures, keep trespassers away from hazardous substances that remained on Site, and collect more information to decide if EPA needed to remove or treat more waste. Initially, the fences around the site were repaired and obstacles were put in place to keep trespassers from driving motorized vehicles or bicycles onto the site. In 2009, EPA commenced a limited removal action to restrict access to the site. As a result, new fencing including a locked gate was installed.

2.2.6 2009 Integrated Assessment

In April 2009, EPA directed Tetra Tech EM, Inc. under the Superfund Technical Assessment and Response Team (START) contract and Lockheed Martin under the REAC contract to conduct an integrated assessment at the SMS property. Samples collected from the interior and exterior waste piles contained elevated concentrations of copper, mercury, and nickel. The leachate seep contained arsenic, chromium, copper, lead, nickel, and zinc. The surface water samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch contained elevated concentrations of arsenic, copper, lead, mercury, and zinc, as compared to background levels. The sediment samples collected from the East Branch of Flenniken Branch contained elevated concentrations of chromium and copper, as compared to background levels. Waste pile samples contained high concentrations of aluminum, a consequence of past aluminum smelting operations. All findings and results are summarized in the Final Trip Report dated October 1, 2009 (Tetra Tech, 2009).

2.2.7 2010 Time Critical Removal Action

In 2010, EPA initiated a time-critical removal action (interim action) to address the immediate threat posed from Site contaminants. The scope included the demolition of the dilapidated former process building, stormwater runoff controls, and consolidation and on-Site capping of approximately 2,700 cubic yards (yd^3) of aluminum dross, 75,000 yd^3 of saltcake, and other hazardous materials associated with fertilizer production and primary as well as secondary aluminum production. EPA properly disposed or recycled all demolition material. The cap was constructed using one foot of clay, six inches of topsoil, and vegetation. All removal activities were performed using an Environmental Rapid Response Service (ERRS) contractor, Environmental Restoration, LLC. The time-critical removal action was completed in early fall of 2011. Monitoring activities were performed by Oneida Total Integrated Enterprises under EPA's START contract. All Time-Critical Removal Actions were conducted by the EPA Region 4 Superfund Removal and Emergency Response Branch. All these activities are described in the 2012 EPA Time –Critical Removal Final POLREP #13 - FINAL POLREP: Completion of Site Cap & Restoration, May 2012.

3.0 Community Participation

EPA has been actively engaged with the affected community and has strived to maintain a collaborative relationship with those interested residents during the remedy selection process. The community relations activities meet the public participation requirements in CERCLA and the NCP. Outreach efforts have included the distribution of Site fact sheets to the community in 2010 and 2011 and an informational meeting held in late July 2011 with the Montgomery Village Tenant Association.

On August 6, 2015, the notice of availability of the Site documents along with the Proposed Plan meeting notice was published in the Knoxville Times-Sentinel. Copies of the

Proposed Plan were distributed to the surrounding community on August 6, 2015 and EPA hosted a public meeting for the Proposed Plan on August 13, 2015 at the Montgomery Village Housing Complex near the Site. At this meeting EPA presented the RI and FS results and the Proposed Plan. The preferred alternative presented at the meeting is the same as the Selected Remedy described in this ROD. EPA and TDEC were pleased to discuss the Site with the attendees and answer questions. The court reporter's transcript of the meeting is included in Appendix B of this ROD and in the Administrative Record file. A public comment period on the Proposed Plan was held from May 20 to June 18, 2015. EPA's responses to the questions asked at the public meeting are included in the Responsiveness Summary, which is Part 3 of this ROD. No written comments were received during the public comment period.

The local Site repository is a convenient location for the community to review information about the Site. The address of the local repository is:

Bearden Branch Library
100 Golf Club Road
Knoxville, Tennessee 37919
(865) 588-8813

4.0 Scope and Role of the Response Action

The Selected Remedy addresses risks posed by waste and contaminated ground water and is intended to attain remedial action objectives and cleanup levels, and will be the final response action. The Selected Remedy is compatible with the planned future use of the Site.

5.0 Site Characteristics

The information presented here is a summary of the information provided in more detail in *Final RI/FS Report* dated July 2015 (J.M. Waller, 2015c), which is part of the Administrative Record.

5.1 Conceptual Site Model

A Conceptual Site Model (CSM) describes the contaminant sources, the release and transport mechanisms, the receiving media, the exposure media, the exposure routes, and the potentially exposed populations. The primary objective of the CSM is to identify complete and incomplete exposure pathways. A complete exposure pathway has all of the above-listed components, whereas an incomplete pathway is missing one or more. The CSM for the Site consists primarily of an industrial solid waste pile deposited in a small creek valley; this waste pile was an unpermitted landfill which operated from 1979 until 1994 and was subsequently abandoned when operations at the site ceased. The waste has historically caused impacts on surface water and ground water due to infiltration by surface water and rainwater which came in

contact with the waste and generated leachate which then flowed off-site in the surface water pathway and also impacted ground water on-site. Figure 5-1 shows a graphical representation of the CSM for the SMS Site.

As is apparent in Figure 5-1, the two primary sources of contamination are the former fertilizer operations and the former secondary aluminum smelter operations. Each contributed to the former waste pile area, which may be viewed as a source of surface and subsurface soil contamination. The former fertilizer operations released contaminants to settling ponds that impacted subsurface soil and ground water. Potential human receptors to contamination in these media include current/future workers, current/future trespassers, current/future recreational users, future construction workers, and future residents. Potential ecological receptors include birds and mammals.

Releases from the former secondary aluminum smelter operations impacted surface soil, surface water, and sediment. Leaching of contaminants from surface soil may have impacted ground water. Potential human and ecological receptors for impacted surface soil and ground water are the same as cited above. Contaminants in surface soil, surface water, and sediment may bioaccumulate in fish, soil and ground water invertebrates, birds, and mammals. Potential human receptors are current and future anglers. Potential ecological receptors are the aforementioned soil and ground water invertebrates, fish, birds, and mammals. Particulate emissions from the former air stacks potentially impacted indoor air where current/future workers and future residents are potential receptors.

5.2 Topography

Existing Site topography is largely defined by the clay cap and former industrial structures on the Site. In general terms, the Site slopes east and south gently toward the unnamed tributary and East Flenniken Branch channels to the east and south. The maximum topographic elevation present on Site is approximately 940 ft above mean sea level (amsl) northeast of the former industrial facility foundations, and the minimum elevation is approximately 884 ft amsl in the East Flenniken Branch channel. Industrial facility foundations rise prominently from the northern half of the Site, and represent surface topography as found during active Site operations.

The clay cap added in 2010 as part of the time-critical removal action is largely flat, with only a gentle slope to the southeast for most of the cap's expanse in the geographic center of the Site. However, the toe of the slope rapidly grades downward near East Flenniken branch to the south. Railroad cuts define the western (CSX Transportation) and eastern (Norfolk Southern) boundaries of the Site. The Norfolk Southern line is elevated slightly above most of the Site, while the CSX line is in a cut below SMS surface grade.

Topographic cues to geological and hydrogeological structure in the subsurface have largely been obscured by anthropogenic activities. The native topography at SMS was altered

during the Site's industrial operating history and during the 2010 interim remedial action that added the clay cap over the former waste pile and contoured the surface to redirect storm water runoff. However, bedrock is exposed in the unnamed tributary channel to the east of the Site, and in the CSX railroad cut to the west. A topographic map of the Site is provided in Figure 5-2.

5.3 Site-Specific Geology and Hydrogeology

5.3.1 Geology

The rocks underlying the Site are Middle Ordovician Ottosee Shale of the Chickamauga Group. In general, this formation is characterized by karst development including several dolines on the west side of Maryville Pike (approximately 1,400 – 2,000 ft from the Site boundary). The Ottosee Shale and overlying residual deposits occur at ground surface and are underlain at depth by limestone of the Holston Formation. The Ottosee Shale is approximately 1,000 ft thick. The depth of the contact between the Ottosee Shale and the Holston Formation at the Site is unknown due to the lack of deep borings.

The original topography of the Site was altered during its operating history and during the 2010 interim remedial action that added a clay cap over the former waste pile and contoured the surface to redirect storm water runoff. Organic deposits (humic and anthropogenic materials) were noted within the native clay at some borings. Other occurrences of organic matter were noted within the waste.

Native surface soils at the Site consist of yellow brown to brown sandy and silty clays sourced from the Ottosee Shale, which may include localized organic soil development (Lockheed Martin, 2007). The thickness of these unconsolidated deposits varies throughout SMS. Uneven topography combined with irregular weathering, deposition and erosion result in the varying thickness of the native surficial clay. The Ottossee Shale encountered at SMS ranges from a highly weathered to a well indurated brownish shale interbedded with gray carbonate rocks. Within a few feet of the surface, the clay grades to a brown, weathered, and fissile shale. The weathering profile for this shale is variable, but grades towards competency upon approaching carbonate bedrock.

The native clay and shale deposits underlying the waste and overlying the carbonate bedrock grade from being absent in the creek channel on the eastern edge of the Site, to more than 30 ft thick along the CSX railroad cut in the southwestern corner of the Site.

Carbonate bedrock, including a variety of limestone and dolomitic limestone, is present. These carbonates are exposed at the surface in the unnamed tributary to the east of the Site and to the west of the Site in the CSX railroad cut, but may be covered by at least 46 ft of shale and associated native soil, waste, and landfill deposits at the center of the cap area.

5.3.2 Hydrogeology

The ground water investigation of SMS included investigation of three distinct, but most likely interconnected, hydrogeologic units. In descending depth, these units are as follows:

- Perched ground water in the former on-Site landfill
- Ground water in the clayey surficial aquifer
- Ground water in the upper portion of limestone, shale, and sandstone bedrock.

5.3.2.1 *Perched Ground Water*

The uppermost ground water is perched water observed in buried waste material in the on-Site landfill. A comparison of ground water elevations measured during the RI to the elevations reported from the 2006 investigation indicates a significant decrease in ground water levels in areas of buried waste since construction of the cap. Current ground water elevations in the capped waste area have shown decreases of between 2 and 11 ft as compared to the reported 2006 ground water elevations. This suggests that ground water within the waste material is slowly dissipating resulting from the cap preventing recharge. In addition, due to the cap and the decrease in water levels in the waste material, the unnamed tributary of East Flenniken Branch and the pond along the southeast Site boundary have dried up, supporting the conclusion that those water bodies were previously fed by discharging perched ground water from the waste material.

5.3.2.2 *Surficial Ground Water*

Ground water occurs above competent bedrock in the clay and weathered shale over most of the Site, although bedrock was encountered at some RI drilling locations prior to penetrating the water table. Depths to ground water in the regolith were observed during the RI from approximately 4 to 40 ft.

Figure 5-3 presents a potentiometric surface contour map of the surficial aquifer constructed from ground water elevations measured in June 2014. The figure shows a general ground water flow direction to the west and northwest in the regolith. Horizontal ground water gradients ranged from 0.034 in the northeast part of the Site to 0.073 in the former waste pile area. Over the central portion of the Site, little to no vertical gradient exists between the regolith and the underlying bedrock. However, in the northeast and southwest portions of the Site, downward gradients were observed from the regolith to the bedrock.

Estimated horizontal hydraulic conductivities ranged from 0.05 to 5.8 ft/day; the geometric mean of the surficial hydraulic conductivities was 0.67 ft/day. Calculated ground water seepage velocities ranged from 0.11 to 0.25 ft/day (40 to 91 ft/year).

5.3.2.3 *Bedrock Ground Water*

Bedrock beneath the Site is a complex system of interlayered and interbedded limestone, shale, and sandstone. Ground water occurs in the bedrock in fractures, joints, bedding planes, and solution-enlarged karst features (in the limestone only). Depths to water measured during the RI in bedrock monitoring wells at the Site ranged from approximately 5.6 to 38 ft.

Figure 5-4 presents a potentiometric surface contour map of the bedrock aquifer constructed from ground water elevations measured in June 2014. The figure shows a general ground water flow direction to the west, with a potentiometric high in the northeast part of the Site. The average horizontal ground water gradient was 0.032. Vertical gradients between the surficial and the bedrock were discussed above.

Hydraulic conductivities calculated for the bedrock wells are general indicators of the productivity of the wells, but these values are generally not useful in evaluating ground water flow velocity or contaminant transport in this type of aquifer. Horizontal hydraulic conductivities ranged from 0.09 to 12 ft/day. The geometric mean of the bedrock hydraulic conductivities was 1.3 ft/day.

The heterogeneity displayed in the Site's bedrock lithology, and the complex nature of the structural features has a direct impact on the hydrogeologic character of the Site. For this reason, the best model for ground water flow through the bedrock will incorporate not only gradients in hydraulic head, but also account for regional and local structural trends, such as prevalent fracture and fault patterns, and flow anisotropy induced by variations in lithology, bedding orientation, and structural deformation. For these reasons, ground water seepage velocities were not calculated for the bedrock aquifer.

5.4 Climate

Knox County, situated in the Tennessee Valley between the Great Smoky Mountains and the Cumberland Mountains, is located at an altitude of 900 ft. The city of Knoxville falls in the humid subtropical climate zone. Due to the elevation, the temperatures are more moderate than areas to the south and west within the same climate zone. The mean annual temperatures range from 87 degrees Fahrenheit (°F) to 66 °F in the summer and 45 °F to 25 °F in the winter. The average annual rainfall is 48 inches and the average winter snowfall is 11.5 inches.

5.5 Nature and Extent of Contamination

5.5.1 Suspected Source Areas

Sources of contamination at SMS are related to the former fertilizer plant and secondary aluminum smelter operations. Specific source areas include the following: former waste pile area, former settling ponds, former transformer pad, former process building, railroad spur, and recovered underground storage tanks. Within the former process building, specific targeted

source areas are the stacks and floor drains. In addition, prior to the time-critical removal action in 2010, the stockpiles of aluminum dross and saltcake were also source areas. Figure 1-2 is a layout of the historical Site features. Currently, all suspected source areas are covered under the clay caps as part of the time-critical removal action completed in 2011. Ground water within the waste disposal area was assessed as part of the RI. Wastes were sampled in areas outside of the capped areas and included in discussions of the nature and extent of contamination and the risk assessment. The wastes left under the capped areas have been partially characterized as mainly saltcake, dross, concrete, metal and tires. The impact of these wastes on the ground water will be addressed by the remedy.

5.5.2 Surface Soils

Surface soil sampling results were evaluated against the November 2011 EPA Region 9 Industrial/Commercial and Residential Regional Screening Levels (RSLs) for human health and ecological screening values (ESVs) for ecological. None of the surface soil samples analyzed for PCBs, dioxins, or furans exceeded the RSLs. The screening comparison against RSLs found the following metals as chemicals of potential concern (COPCs): aluminum, arsenic, cobalt, iron, and manganese. The screening comparison against ESVs, found the COPCs detected in the surface soils as follows: aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, and manganese. Sample locations are shown on Figure 5-5. Surface soil sampling results are tabulated in Table 5-1.

Aluminum concentrations exceeded the residential RSL (70,000 mg/kg) in four grid surface soil locations, H05, H07, J03, and N05, all in the northern portion of the SMS property. Arsenic was detected in all 52 grid locations sampled at concentrations that exceed both the residential RSL of 0.39 mg/kg and industrial RSLs of 1.6 mg/kg. Cobalt detections exceed the residential RSL of 23 mg/kg in six surface soil samples: SMSSFG07, SMSSFF08, SMSSFF12, SMSSFF13, SMSSFB12, and SMSSFC12. The iron concentration in surface soil SMSSFH05 exceeds the residential RSL of 55,000 mg/kg. Lead was non-detect in all samples except sample location J01; a concentration of 64,000 mg/kg was detected in a sample collected May 2011. However, a confirmation sample collected from the same location in September 2011 was reported as non-detect. Manganese concentrations exceed the residential RSL of 1,800 mg/kg in ten surface soil samples including: SMSSFB12, SMSSFC12, SMSSFD12, SMSSFF12, SMSSFF13, SMSSFF918, SMSSFG07, SMSSFM04, SMSSFN04, and SMSSFN05. Table 5-1 provides a color-coded view of sample locations with metals exceeding the residential or industrial RSLs.

A total of 57 data points were evaluated for metals and are summarized in Table 5-2. A summary of COPCs exceeding the ESV are as follows.

- Aluminum ranged from 8,500 mg/kg to 120,000 mg/kg in 57 samples.
- Arsenic ranged from 10 mg/kg to 36 mg/kg in 47 samples.
- Barium ranged from 170 mg/kg to 210mg/kg in 3 samples.

Table 5-1
Surface Soils Exceeding RSLs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Analyte Group			Metals					
Analyte			Aluminum	Arsenic	Cobalt	Iron	Lead	Manganese
Results Unit			mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
USEPA Industrial RSL[1]			NE	3	NE	NE	800	NE
USEPA Residential RSL[1]			77000	0.67	23	55000	400	1800
Station ID	Sample ID	Sample Data						
SMSB12								
	SMSSFB12	5/11/2011	15000	**18 CLP36**	37	34000	54	4400
SMSB13								
	SMSSFB13	5/11/2011	16000	**10 CLP36**	15	22000	20	630
SMSC12								
	SMSSFC12	5/11/2011	14000	**12 CLP36**	27	25000	36	2700
SMSC13								
	SMSSFC13	5/11/2011	8500	**17 CLP36**	3.5 J,Q-2	26000	44	280
	SMSSFC913*	5/11/2011	11000	**16 CLP36**	13	28000	51	1300
SMSD10								
	SMSSFD10	5/10/2011	24000	**9.0 CLP36**	17	36000	31	1000
SMSD11								
	SMSSFD11	5/10/2011	28000	**7.7 CLP36**	15	39000	30	980
SMSD12								
	SMSSFD12	5/10/2011	16000	**14 CLP36**	22	35000	26	1800
SMSD13								
	SMSSFD13	5/10/2011	24000	**6.9 CLP36**	9.7	40000	35	100
SMSD14								
	SMSSFD14	5/10/2011	13000	**12 CLP36**	8.9	26000	21	520
SMSE11								
	SMSSFE11	5/9/2011	30000	**31 CLP36**	14	51000	43	1000
SMSE12								
	SMSSFE12	5/9/2011	21000	**16 CLP36**	20	36000	39	1300
SMSE13								
	SMSSFE13	5/10/2011	21000	**18 CLP36**	9.9	35000	25	340
SMSE15								
	SMSSFE15	5/12/2011	12000	**15 CLP36**	9.7	33000	22	740
SMSE16								
	SMSSFE16	5/12/2011	15000	**15 CLP36**	9.2	32000	22	740
SMSF08								
	SMSSFF08	5/11/2011	21000	**13 CLP36**	25	53000	36	1700
SMSF12								
	SMSSFF12	5/9/2011	19000 J,QM-4	**15 CLP36**	25	31000	48	2200
SMSF13								
	SMSSFF13	5/10/2011	17000	**17 CLP36**	28	20000	26	2000
SMSF15								
	SMSSFF15	5/12/2011	19000	**19 CLP36**	7.6	30000	18	280
SMSF16								
	SMSSFF16	5/12/2011	18000	**17 CLP36**	11	40000	25	900
SMSF17								
	SMSSFF17	5/12/2011	24000	**26 CLP36**	12	49000	36	1000
SMSF18								
	SMSSFF18	5/12/2011	13000	**9.8 CLP36**	9.9	21000	43	1300
	SMSSFF918*	5/12/2011	13000	**7.9 CLP36**	9.4	13000	39	2000
SMSG06								
	SMSSFG06	5/11/2011	34000	**8.1 CLP36**	6.0	20000	40	690
SMSG07								
	SMSSFG07	5/11/2011	35000	**19 CLP36**	41	23000	99	2300

Table 5-1
Surface Soils Exceeding RSLs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	Metals					
		Analyte	Aluminum	Arsenic	Cobalt	Iron	Lead	Manganese
		Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
		USEPA Industrial RSL[1]	NE	3	NE	NE	800	NE
		USEPA Residential RSL[1]	77000	0.67	23	55000	400	1800
Station ID	Sample ID	Sample Data						
SMSG12								
	SMSSFG12	5/11/2011	16000	**12 CLP36**	12	27000	17	640
SMSG17								
	SMSSFG17	5/12/2011	12000	**13 CLP36**	9.5	28000	21	740
SMSG18								
	SMSSFG18	5/12/2011	23000	**31 CLP36**	8.4	46000	32	500
SMSG19								
	SMSSFG19	5/12/2011	17000	**17 CLP36**	14	26000	33	1400
SMSH05								
	SMSSFH05	5/11/2011	58000	**9.7 CLP36**	20	92000	150	1300
	SMSSFH95*	5/11/2011	84000	**9.8 CLP36**	20	75000	130	1700
SMSH07								
	SMSSFH07	5/11/2011	120000	**12 CLP36**	6.3	16000	140	630
SMSH12								
	SMSSFH12	5/11/2011	18000	**21 CLP36**	9.6	35000	28	350
SMSH17								
	SMSSFH17	5/12/2011	17000	**22 CLP36**	7.6	38000	24	620
SMSI03								
	SMSSFI03	5/11/2011	13000	**8.3 CLP36**	6.6	18000	70	720
SMSI04								
	SMSSFI04	5/11/2011	41000	**J,CLP35,CLP36,QN**	9.7	24000	32 J,QM-4	850
SMSI12								
	SMSSFI12	5/11/2011	25000	**36**	9.8	42000	26	320
SMSJ01								
	SMSSFJ01	5/10/2011	42000	**18 CLP36**	13	30000	**64000**	980
	SMSSFJ01_0-6	9/27/2011	19000	**7.2 J,QM-1**	16	38000	53	1200 J,QM-2
SMSJ02								
	SMSSFJ02	5/10/2011	42000	**10 CLP36**	16	39000	70	1200
SMSJ03								
	SMSSFJ03	5/11/2011	97000	**14 CLP36**	14	36000	81	1100
SMSJ04								
	SMSSFJ04	5/11/2011	32000	**11 CLP36**	19	32000	110	750
SMSJ11								
	SMSSFJ11	5/11/2011	23000	**20 CLP36**	15	43000	18	630
SMSK04								
	SMSSFK04	5/11/2011	27000	**15 CLP36**	14	43000	48	1200
SMSK09								
	SMSSFK09	5/11/2011	26000	**13 CLP36**	14	37000	18	200
SMSK10								
	SMSSFK10	5/11/2011	18000	**22 CLP36**	15	26000	20	700
SMSL04								
	SMSSFL04	5/9/2011	38000	**17 CLP36**	16	46000	54	940
	SMSSFL94*	5/9/2011	41000	**16 CLP36**	10	47000	52	630
SMSL07								
	SMSSFL07	5/11/2011	19000	**14 CLP36**	7.8	33000	42	590
SMSL08								
	SMSSFL08	5/11/2011	19000	**10 CLP36**	6.6	35000	12	210

Table 5-1
Surface Soils Exceeding RSLs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	Metals					
		Analyte	Aluminum	Arsenic	Cobalt	Iron	Lead	Manganese
		Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
		USEPA Industrial RSL[1]	NE	3	NE	NE	800	NE
		USEPA Residential RSL[1]	77000	0.67	23	55000	400	1800
Station ID	Sample ID	Sample Data						
SMSM03								
	SMSSFM03	5/9/2011	29000	**17 CLP36**	17	41000	60	1300
SMSM04								
	SMSSFM04	5/9/2011	20000	**14 CLP36**	41	34000	38	3800
SMSM05								
	SMSSFM05	5/9/2011	35000	**21 CLP36**	10	31000	77	740
SMSM06								
	SMSSFM06	5/11/2011	28000	**19 CLP36**	11 J,QM-4	46000	30	780
SMSN04								
	SMSSFN04	5/9/2011	66000	**16 CLP36**	19	36000	64	2400
	SMSSFN94*	5/9/2011	56000	**14 CLP36**	11	47000	36	1400
SMSN05								
	SMSSFN05	5/9/2011	86000	**19 CLP36**	17	49000	150	2000

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1] USEPA, 2015. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

*Denote duplicate sample

Bold	Analytical results exceeding the USEPA Industrial RSL
	Analytical results exceeding the USEPA Residential RSL

USEPA - United States Environmental Protection Agency

RSLs - Regional Screening Levels

mg/kg - milligram per kilogram

NE - not established

ND - non detect

Qualifiers

CLP35 - Percent recovery for the Post Digestion Spike was above the upper acceptance limit.

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

J - The identification of the analyte is acceptable; the reported value is an estimate.

QM-1 - Matrix Spike Recovery less than method control limits

QM-4 - Matrix Precision outside method control limits

Table 5-2
Surface Soils Exceeding ESVs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	Metals																
		Analyte	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Cyanide	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
		Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
		Region 4 ESVs for Surface Soil	50	10	165	1.1	1.6	0.4	20	40	0.9	200	50	100	0.1	30	0.81	2	50
Station ID	Sample ID	Sample Data																	
SMSB12																			
	SMSSFB12	5/11/2011	15000	18 CLP36	84	1.5	0.47 J,Q-2,Q-5	32	37	21	0.28 J,Q-2	34000	54	4400	0.034 J,Q-2	13	2.9 J,CLP36,Q-2	36	64
SMSB13																			
	SMSSFB13	5/11/2011	16000	10 CLP36	130	1.3	0.32 J,Q-2,Q-5	18	15	12	0.16 J,Q-2	22000	20	630	0.047 J,Q-2	15	2.5 J,CLP36,Q-2	27	46
SMSC12																			
	SMSSFC12	5/11/2011	14000	12 CLP36	110	1.3	ND	24	27	12	ND	25000	36	2700	0.050 J,Q-2	12	ND	27	39
SMSC13																			
	SMSSFC13	5/11/2011	8500	17 CLP36	56	ND	0.61 J,Q-5	16	3.5 J,Q-2	18	0.22 J,Q-2	26000	44	280	0.29	6.9	ND	24	42
	SMSSFC913*	5/11/2011	11000	16 CLP36	64	ND	0.56 J,Q-5	18	13	17	ND	28000	51	1300	0.50	7.7	ND	28	42
SMSD10																			
	SMSSFD10	5/10/2011	24000	9.0 CLP36	71	1.2	0.47 J,Q-2	27	17	27	0.085 J,Q-2	36000	31	1000	0.067 J,Q-2	26	1.8 J,CLP36,Q-2	33	81
SMSD11																			
	SMSSFD11	5/10/2011	28000	7.7 CLP36	120	1.9	0.68	29	15	50	0.15 J,Q-2	39000	30	980	0.17	35	1.6 J,CLP36,Q-2	35	190
SMSD12																			
	SMSSFD12	5/10/2011	16000	14 CLP36	95	1.5	0.47 J,Q-2,Q-5	29	22	18	0.068 J,Q-2	35000	26	1800	0.023 J,Q-2	15	2.5 J,CLP36,Q-2	31	52
SMSD13																			
	SMSSFD13	5/10/2011	24000	6.9 CLP36	40	1.7	0.49	24	9.7	21	ND	40000	35	100	0.032 J,Q-2	22	1.4 J,CLP36,Q-2	38	58
SMSD14																			
	SMSSFD14	5/10/2011	13000	12 CLP36	48	0.74	0.30 J,Q-2	15	8.9	11	ND	26000	21	520	0.057 J,Q-2	9.9	1.7 J,CLP36,Q-2	26	42
SMSE11																			
	SMSSFE11	5/9/2011	30000	31 CLP36	75	1.5	0.75	32	14	44	ND	51000	43	1000	0.064 J,Q-2	27	1.4 J,CLP36,Q-2	45	95
SMSE12																			
	SMSSFE12	5/9/2011	21000	16 CLP36	75	0.99	0.65	32	20	53	ND	36000	39	1300	0.065 J,Q-2	20	2.4 J,CLP36,Q-2	34	88
SMSE13																			
	SMSSFE13	5/10/2011	21000	18 CLP36	51	1.1	0.40 J,Q-2	21	9.9	18	ND	35000	25	340	0.024 J,Q-2	16	1.7 J,CLP36,Q-2	30	50
SMSE15																			
	SMSSFE15	5/12/2011	12000	15 CLP36	39	0.72	0.61 J,Q-5	17	9.7	11	ND	33000	22	740	0.056 J,Q-2	11	ND	28	38
SMSE16																			
	SMSSFE16	5/12/2011	15000	15 CLP36	46	0.78	0.67 J,Q-5	14	9.2	13	0.091 J,Q-2	32000	22	740	0.071 J,Q-2	11	ND	30	46
SMSF08																			
	SMSSFF08	5/11/2011	21000	13 CLP36	110	1.6	0.86 J,Q-5	35	25	270	ND	53000	36	1700	0.042 J,Q-2	27	2.7 J,CLP36,Q-2	32	1200
SMSF12																			
	SMSSFF12	5/9/2011	19000 J,QM-4	15 CLP36	80 J,QM-2	1.1	0.42 J,Q-2	26	25	20 J,QM-4	0.18 J,Q-2	31000	48	2200	0.077 J,Q-2,QM-2	16 J,QM-4	2.6 J,CLP36,Q-2	36	50 J,QM-4
SMSF13																			
	SMSSFF13	5/10/2011	17000	17 CLP36	65	1.4	0.46 J,Q-2,Q-5	27	28	9.0	ND	20000	26	2000	0.052 J,Q-2	10	2.8 J,CLP36,Q-2	37	36
SMSF15																			
	SMSSFF15	5/12/2011	19000	19 CLP36	51	0.60	ND	20	7.6	17	ND	30000	18	280	0.057 J,Q-2	11	ND	33	41
SMSF16																			
	SMSSFF16	5/12/2011	18000	17 CLP36	56	0.89	0.81 J,Q-5	17	11	14	0.091 J,Q-2	40000	25	900	0.077 J,Q-2	13	ND	37	55
SMSF17																			
	SMSSFF17	5/12/2011	24000	26 CLP36	66	1.3	1.2 J,Q-5	21	12	23	0.13 J,Q-2	49000	36	1000	0.085 J,Q-2	17	ND	43	65
SMSF18																			
	SMSSFF18	5/12/2011	13000	9.8 CLP36	96	0.84	0.52 J,Q-5	16	9.9	28	ND	21000	43	1300	0.097 J,Q-2	13	ND	23	56
	SMSSFF918*	5/12/2011	13000	7.9 CLP36	160	0.76	ND	11	9.4	10	ND	13000	39	2000	0.069 J,Q-2	9.6	ND	20	50

Table 5-2
Surface Soils Exceeding ESVs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	Metals																
		Analyte	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Cyanide	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
		Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
		Region 4 ESVs for Surface Soil	50	10	165	1.1	1.6	0.4	20	40	0.9	200	50	100	0.1	30	0.81	2	50
Station ID	Sample ID	Sample Data																	
SMSG06																			
	SMSSFG06	5/11/2011	34000	8.1 CLP36	76	1.4	2.1 J,Q-5	32	6.0	250	0.40 J,Q-2	20000	40	690	0.13	46	ND	22	520
SMSG07																			
	SMSSFG07	5/11/2011	35000	19 CLP36	120	1.5	1.6 J,Q-5	54	41	110	0.74	23000	99	2300	0.35	30	2.3 J,CLP36,Q-2	52	480
SMSG12																			
	SMSSFG12	5/11/2011	16000	12 CLP36	42	0.57	0.21 J,Q-2,Q-5	20	12	8.7	ND	27000	17	640	0.045 J,Q-2	9.5	2.5 J,CLP36,Q-2	30	36
SMSG17																			
	SMSSFG17	5/12/2011	12000	13 CLP36	43	0.61	0.56 J,Q-5	17	9.5	11	ND	28000	21	740	0.083 J,Q-2	8.5	ND	26	38
SMSG18																			
	SMSSFG18	5/12/2011	23000	31 CLP36	58	0.98	1.1 J,Q-5	26	8.4	23	ND	46000	32	500	0.058 J,Q-2	16	ND	40	64
SMSG19																			
	SMSSFG19	5/12/2011	17000	17 CLP36	60	0.83	0.44 J,Q-5	18	14	7.2	ND	26000	33	1400	0.070 J,Q-2	9.9	ND	32	ND
SMSH05																			
	SMSSFH05	5/11/2011	58000	9.7 CLP36	150	4.1	2.8 J,Q-5	62	20	820	ND	92000	150	1300	0.12	130	1.9 J,CLP36,Q-2	40	2900
	SMSSFH95*	5/11/2011	84000	9.8 CLP36	120	4.4	4.5 J,Q-5	83	20	1600	0.42 J,Q-2	75000	130	1700	0.14	97	ND	46	4200
SMSH07																			
	SMSSFH07	5/11/2011	120000	12 CLP36	92	3.8	2.2 J,Q-5	84	6.3	1900	0.28 J,Q-2	16000	140	630	0.14	110	ND	51	1400
SMSH12																			
	SMSSFH12	5/11/2011	18000	21 CLP36	29	0.94	0.55 J,Q-5	17	9.6	20	ND	35000	28	350	0.075 J,Q-2	14	1.9 J,CLP36,Q-2	31	47
SMSH17																			
	SMSSFH17	5/12/2011	17000	22 CLP36	31	0.87	0.77 J,Q-5	17	7.6	17	ND	38000	24	620	0.081 J,Q-2	14	ND	29	48
SMSI03																			
	SMSSFI03	5/11/2011	13000	8.3 CLP36	56	1.6	1.2 J,Q-5	17	6.6	78	0.18 J,Q-2	18000	70	720	0.14	15	ND	17	240
SMSI04																			
	SMSSFI04	5/11/2011	41000	22 J,CLP35,CLP36,QM-1	87	2.2	1.2 J,Q-5	34 J,QM-1	9.7	290	0.25 J,Q-2	24000	32 J,QM-4	850	0.063 J,Q-2	40 J,QM-1	ND	28	240 J,QM-6
SMSI12																			
	SMSSFI12	5/11/2011	25000	36	45	1.1	0.64 J,Q-5	28	9.8	33	ND	42000	26	320	0.035 J,Q-2	18	1.8 J,CLP36,Q-2	39	62
SMSJ01																			
	SMSSFJ01	5/10/2011	42000	18 CLP36	140	2.3	1.3	38	13	110	0.21 J,Q-2	30000	64000	980	0.092 J,Q-2	36	ND	45	4300
	SMSSFJ01_0-6	9/27/2011	19000	7.2 J,QM-1	91	1.6	0.67	25	16	44	ND	38000	53	1200 J,QM-2	0.096	18	ND	32	120
SMSJ02																			
	SMSSFJ02	5/10/2011	42000	10 CLP36	140	2.5	1.4	42	16	72	0.22 J,Q-2	39000	70	1200	0.28	38	1.5 J,CLP36,Q-2	45	230
SMSJ03																			
	SMSSFJ03	5/11/2011	97000	14 CLP36	210	5.7	1.8 J,Q-5	67	14	580	0.61	36000	81	1100	0.41	57	ND	61	360
SMSJ04																			
	SMSSFJ04	5/11/2011	32000	11 CLP36	140	1.6	2.1 J,Q-5	39	19	57	ND	32000	110	750	0.087 J,Q-2	27	ND	39	240
SMSJ11																			
	SMSSFJ11	5/11/2011	23000	20 CLP36	58	1.3	0.62 J,Q-5	25	15	24	ND	43000	18	630	0.073 J,Q-2	26	1.5 J,CLP36,Q-2	29	68
SMSK04																			
	SMSSFK04	5/11/2011	27000	15 CLP36	98	1.3	2.3 J,Q-5	44	14	150	ND	43000	48	1200	0.94	34	ND	33	190
SMSK09																			
	SMSSFK09	5/11/2011	26000	13 CLP36	80	0.92	0.62 J,Q-5	32	14	51	ND	37000	18	200	0.070 J,Q-2	15	4.0 J,CLP36,Q-2	37	91
SMSK10																			
	SMSSFK10	5/11/2011	18000	22 CLP36	41	0.67	0.51 J,Q-5	24	15	22	0.29 J,Q-2	26000	20	700	0.077 J,Q-2	13	2.7 J,CLP36,Q-2	33	55
SMSL04																			
	SMSSFL04	5/9/2011	38000	17 CLP36	120	1.6	1.6	45	16	120	0.56 J,Q-2	46000	54	940	0.15	43	3.9 CLP36	48	330
	SMSSFL94*	5/9/2011	41000	16 CLP36	100	1.4	1.8 J,Q-5	44	10	140	0.26 J,Q-2	47000	52	630	0.15	53	ND	50	240
SMSL07																			
	SMSSFL07	5/11/2011	19000	14 CLP36	63	0.83	1.5 J,Q-5	37	7.8	43	0.36 J,Q-2	33000	42	590	0.16 J,Q-2	15	3.1 J,CLP36,Q-2	39	750

Table 5-2
Surface Soils Exceeding ESVs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	Metals																
		Analyte	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Cyanide	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
		Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
		Region 4 ESVs for Surface Soil	50	10	165	1.1	1.6	0.4	20	40	0.9	200	50	100	0.1	30	0.81	2	50
Station ID	Sample ID	Sample Data																	
SMSL08																			
	SMSSFL08	5/11/2011	19000	10 CLP36	36	0.50	0.38 J,Q-2,Q-5	24	6.6	12	ND	35000	12	210	0.017 J,Q-2	8.7	2.6 J,CLP36,Q-2	34	34
SMSM03																			
	SMSSFM03	5/9/2011	29000	17 CLP36	150	2.0	0.98	34	17	89	0.19 J,Q-2	41000	60	1300	0.045 J,Q-2	38	2.2 J,CLP36,Q-2	36	330
SMSM04																			
	SMSSFM04	5/9/2011	20000	14 CLP36	54	0.69	0.48	29	41	9.5	ND	34000	38	3800	0.055 J,Q-2	11	2.2 J,Q-2,CLP36	37	44
SMSM05																			
	SMSSFM05	5/9/2011	35000	21 CLP36	140	1.9	1.3	44	10	190	0.35 J,Q-2	31000	77	740	0.077 J,Q-2	46	6.5 CLP36	33	240
SMSM06																			
	SMSSFM06	5/11/2011	28000	19 CLP36	100	1.0	1.2 J,Q-5	39	11 J,QM-4	22	ND	46000	30	780	0.070 J,Q-2,QM-2	17	ND	50	65
SMSN04																			
	SMSSFN04	5/9/2011	66000	16 CLP36	190	2.4	1.4	62	19	320	0.22 J,Q-2	36000	64	2400	0.11 J,Q-2	52	3.1 J,CLP36,Q-2	53	400
	SMSSFN94*	5/9/2011	56000	14 CLP36	130	1.6	1.7 J,Q-5	60	11	180	0.35 J,Q-2	47000	36	1400	0.13	40	ND	62	230
SMSN05																			
	SMSSFN05	5/9/2011	86000	19 CLP36	170	4.2	2.4	82	17	490	1.0	49000	150	2000	0.11	79	5.6 CLP36	64	440

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA, 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html#tbl4

*Denote duplicate sample

Analytical results exceeding the ESV for Surface Soil

USEPA - United States Environmental Protection Agency

ESVs - Ecological Screening Values

mg/kg - milligram per kilogram

ND - Non Detect

Qualifiers

CLP35 - Percent recovery for the Post Digestion Spike was above the upper acceptance limit.

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

Q-5 - Serial dilution precision outside method control limits

QM-1 - Matrix Spike Recovery less than method control limits

QM-2 - Matrix Spike Recovery greater than method control limits

QM-4 - Matrix Precision outside method control limits

QM-6 - Matrix Spike Recovery less than 10%

- Beryllium ranged from 1.1 mg/kg to 5.7 mg/kg in 35 samples.
- Cadmium ranged from 1.6 mg/kg to 4.5 mg/kg in 12 samples.
- Chromium ranged from 11mg/kg to 84 mg/kg in 57 samples
- Cobalt ranged from 20 mg/kg to 41 mg/kg in 10 samples.
- Copper ranged from 43 mg/kg to 1900 mg/kg in 26 samples.
- Iron ranged from 13,000 mg/kg to 92,000 mg/kg in 57 samples.
- Lead ranged from 51 mg/kg to 64,000 mg/kg (location SMSJ01 resampled) in 17 samples.
- Manganese from 100 mg/kg to 4,400 mg/kg in 57 samples.
- Mercury ranged from 0.11 mg/kg to 0.94 mg/kg in 18 samples.
- Nickel ranged from 30 mg/kg to 130 mg/kg in 17 samples.
- Selenium ranged from 1.4 mg/kg to 5.6 mg/kg in 30 samples.
- Vanadium ranged from 20 mg/kg to 64 mg/kg in 57 samples.
- Zinc ranged from 40 mg/kg to 4300 mg/kg in 40 samples.

A total of five data points were evaluated for PCBs and are summarized in Table 5-3. Location SMSM05 exceeded the ESV for PCB-1016 (45 microgram per kilogram [µg/kg]) and PCB-1260 (27 µg/kg). PCBs were not detected in any other samples.

A total of eight data points were evaluated for dioxin and are summarized in Table 5-4. All eight samples exceeded the mammalian TEQ screening level as reported by SESD.

5.5.3 Subsurface Waste and Sludge

Sixteen waste borings were advanced to collect subsurface waste, sludge, or ground water samples for chemical analysis and to record the waste profile (Figure 5-6). Subsurface sludge samples were collected from 8–12 ft below ground surface (bgs), 13–17 ft bgs, 10–15 ft bgs, and 17–23.5 ft bgs. Analytical results for these sludge samples were compared to industrial/commercial and residential RSLs, and ground water protection RSLs.

Arsenic, cobalt, iron, lead, manganese, and thallium were detected in subsurface waste samples higher than the screening criteria. Specifically, arsenic was detected above the residential and industrial/commercial RSL in four samples ranging in concentration from 10 – 21 mg/kg. The residential RSL was exceeded in one sample collected from soil from MW-03B for cobalt (37 mg/kg), iron (63,000 mg/kg), and manganese (3,100 mg/kg). Thallium exceeded the residential and industrial/commercial RSL in soil collected from J08 at a concentration of 11 mg/kg. A summary of the samples exceeding metals in waste samples are presented in Table 5-5.

No subsurface sludge or soil from these locations contained concentrations of pesticides or PCBs exceeding industrial, residential, or ground water protection screening values. See

Table 5-3
Surface Soils Exceeding ESVs for PCBs
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

				Station ID	SMSSFL04	SMSSFL04	SMSSFM04	SMSSFM05	SMSSFM06
				Sample ID	SMSSFL04	SMSSFL94	SMSSFM04	SMSSFM05	SMSSFM06
				Media Code	SF	SF	SF	SF	SF
				Sample Date/Time	5/9/2011	5/9/2011	5/9/2011	5/9/2011	5/11/2011
Analyte	Industrial / Commerical RSL[1]	Residential RSL[1]	**ESV[2,3]**	Units					
PCB-1016 (Aroclor 1016)	21,000	3,900	20	µg/kg dry	< 13 U	< 13 U	< 12 U	**45 J, I-5**	< 14 U
PCB-1221 (Aroclor 1221)	540	140		µg/kg dry	< 26 U	< 26 U	< 23 U	< 92 U, CR	< 28 U
PCB-1232 (Aroclor 1232)				µg/kg dry	< 13 U	< 13 U	< 12 U	< 46 U, CR	< 14 U
PCB-1242 (Aroclor 1242)	740	220		µg/kg dry	< 13 U	< 13 U	< 12 U	< 46 U, CR	< 14 U
PCB-1248 (Aroclor 1248)				µg/kg dry	< 13 U	< 13 U	< 12 U	< 46 U, CR	< 14 U
PCB-1254 (Aroclor 1254)				µg/kg dry	< 14 U	< 13 U	< 12 U	< 28 U, CRa	< 14 U
PCB-1260 (Aroclor 1260)				µg/kg dry	< 14 U	< 13 U	< 12 U	**27 J, I-5**	< 14 U
PCB-1262 (Aroclor 1262)	NE	NE		µg/kg dry	< 14 U	< 13 U	< 12 U	< 28 U, CRa	< 14 U
PCB-1268 (Aroclor 1268)				µg/kg dry	< 14 U	< 13 U	< 12 U	< 28 U, CRa	< 14 U

Notes

[1] USEPA, 2011. US Environmental Protection Agency Region IX, Regional Screening Levels, June 2011.
[2] USEPA, 1995. US Environmental Protection Agency, Supplemental Guidance to RAGS: Region 4 Bulletins Ecological Risk Assessment.
http://epa.gov/region4/wastepgs/oftecer/otsguid.htm

[3] The value of the entry utilized is the ESV for total PCBs

Analytical results exceeding the USEPA RSL for industrial/commercial are shaded in gray.

Analytical results exceeding the USEPA RSL for residential are shaded in pink.

Bold Analytical results exceeding the ESV are presented in BOLD..

USEPA - United States Environmental Protection Agency

RSL - Regional Screening Level

µg/kg - microgram per kilogram

NE - not established

SF - surface soil

PCBs - polychlorinated biphenyls

Contaminant of Potential Concern

Qualifier Definitions

U - The analyte was not detected at or above the reporting limit.

CR - MRLs for Ar1221, 1232, 1242, 1248 elevated due to presence of Ar1016 in sample.

CRa - MRLs for Ar1254, 1262, 1268 elevated due to presence of Ar1260 in sample.

I-5 - Mixture of Aroclors in sample; predominant Aroclors reported

J - The identification of the analyte is acceptable; the reported value is an estimate.

Table 5-4
Surface Soils Exceeding ESVs for Dioxin
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

	Station ID	SMSH05	SMSH05	SMSH07	SMSI04	SMSJ03	SMSJ04	SMSL07	SMSK04
	Sample ID	SMSSFH05	SMSSFH95	SMSSFH07_0-3	SMSSFI04	SMSSFJ03_0-6	SMSSFJ04	SMSSFL07_1-6	SMSSFK04
	Media Code	SF	SF	SF	SF	SF	SF	SF	SF
	Sample Date/Time	5/11/2011	5/11/2011	9/27/2011	5/11/2011	9/27/2011	5/11/2011	9/27/2011	5/11/2011
Analyte	Units								
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	ng/kg dry	110	89	88	55	98	95	180	75
1,2,3,4,6,7,8-Heptachlorodibenzofuran	ng/kg dry	74	52	31	17	41	49	5.1	19
1,2,3,4,7,8,9-Heptachlorodibenzofuran	ng/kg dry	6.6 J, CLP25	4.8 J, CLP25	2.8 J, CLP01	1.6 J, CLP01, CLP25	3.0 J, CLP01	4.4 J, CLP01, CLP25	0.16 U	4.0 U, J, CLP25
1,2,3,4,7,8-Hexachlorodibenzodioxin	ng/kg dry	3.1 J, CLP01	2.4 U, CLP18	1.5 J, CLP01	0.86 J, CLP01	2.1 J, CLP01	1.5 J, CLP01	1.1 J, CLP01	1.4 U, CLP18
1,2,3,4,7,8-Hexachlorodibenzofuran	ng/kg dry	18	14	6.6	2.9 J, CLP01	18	10	0.34 J, CLP01	2.5 U, CLP18
1,2,3,6,7,8-Hexachlorodibenzodioxin	ng/kg dry	6.8	5.4	4.0 U, CLP18	1.8 J, CLP01	6.2	4.2 J, CLP01	1.5 J, CLP01	2.8 J, CLP01
1,2,3,6,7,8-Hexachlorodibenzofuran	ng/kg dry	13	9.5	7.2	2.4 J, CLP01	7.4	12	0.38 J, CLP01	2.7 J, CLP01
1,2,3,7,8,9-Hexachlorodibenzodioxin	ng/kg dry	5.8 J, CLP25	3.8 J, CLP01, CLP25	1.3 U, CLP18	1.4 U, J, CLP18, CLP25	1.5 U, CLP18	3.2 J, CLP01, CLP25	0.62 J, CLP01	2.3 J, CLP01, CLP25
1,2,3,7,8,9-Hexachlorodibenzofuran	ng/kg dry	4.2 J, CLP01	2.9 U, CLP18	2.7 J, CLP01	0.75 J, CLP01	2.1 J, CLP01	4.1 U, CLP18	0.090 U	1.7 U
1,2,3,7,8-Pentachlorodibenzodioxin	ng/kg dry	5.5 U, CLP18	3.8 U, CLP18	1.9 U. CLP18	0.79 U, CLP18	6.0 U, CLP18	3.2 U, CLP18	0.39 U, CLP18	1.4 U
1,2,3,7,8-Pentachlorodibenzofuran	ng/kg dry	6.5 J, CLP25	4.6 J, CLP01, CLP25	4.3 J, CLP01	1.4 J, CLP01, CLP25	37	2.9 U, J, CLP18, CLP25	0.10 U, CLP18	1.5 J, CLP01, CLP25
2,3,4,6,7,8-Hexachlorodibenzofuran	ng/kg dry	19	14	11	3.3 J, CLP01	14	30	0.68 J, CLP01	4.2 U, CLP18
2,3,4,7,8-Pentachlorodibenzofuran	ng/kg dry	18	14	20	3.5 J, CLP01	23	54	0.29 U, CLP18	4.8 J, CLP01
2,3,7,8-Tetrachlorodibenzodioxin	ng/kg dry	0.87 J, CLP01, CLP25	0.54 U, J, CLP18, CLP25	0.28 U, CLP18	0.24 U, J, CLP18, CLP25	1.8	0.45 J, CLP01, CLP25	0.090 U	0.53 U, J, CLP25
2,3,7,8-Tetrachlorodibenzofuran	ng/kg dry	10 CLP10	7.7 CLP10	6.6 CLP10	2.6 U, B-4	11 CLP10	4.9 CLP10	0.25 J, CLP01, CLP24	3.1 U, B-4
Heptachlorodibenzodioxin (Total)	ng/kg dry	350 J, Q-3	280 J, Q-3	180 J, Q-3	130 J, Q-3	220 J, Q-3	220 J, Q-3	410 J, Q-3	170 J, Q-3
Heptachlorodibenzofuran (Total)	ng/kg dry	140 J, Q-3	99 J, Q-3	62 J, Q-3	41 J, Q-3	90 J, Q-3	140 J, Q-3	8.8 J, Q-3	40 J, Q-3
Hexachlorodibenzodioxin (Total)	ng/kg dry	130 J, Q-3	88 J, Q-3	54 J, Q-3	29 J, Q-3	99 J, Q-3	43 J, Q-3	20 J, Q-3	31 J, Q-3
Hexachlorodibenzofuran (Total)	ng/kg dry	160 J, Q-3	120 J, Q-3	130 J, Q-3	31 J, Q-3	200 J, Q-3	360 J, Q-3	7.4 J, Q-3	40 J, Q-3
Octachlorodibenzodioxin	ng/kg dry	2100	1400	1300	540	1200	1800	14000, J, CLP02	4200
Octachlorodibenzofuran	ng/kg dry	110	90	36	41	60	110	4.2 J, CLP01	30
Pentachlorodibenzodioxin (Total)	ng/kg dry	81 J, Q-3	55 J, Q-3	32 J, Q-3	16 J, Q-3	64 J, Q-3	23 J, Q-3	3.0 J, Q-3	12 J, Q-3
Pentachlorodibenzofuran (Total)	ng/kg dry	170 J, Q-3	130 J, Q-3	270 J, Q-3	32 J, Q-3	430 J, Q-3	580 J, Q-3	4.9 J, Q-3	49 J, Q-3
TEQ (Avian Toxic. Equiv. Value, WHO TEQ-98)	ng/kg dry	43 J, D-5	32 J	33 J, D-5	8.8 J, D-5	50 J, D-5	70 J, D-5	3.0 J, D-5	12 J, D-5
TEQ (Fish Toxic. Equiv. Value, WHO TEQ-98)	ng/kg dry	25 J, D-5	18 J	17 J, D-5	4.7 J, D-5	27 J, D-5	38 J, D-5	3.0 J, D-5	7.1 J, D-5
TEQ (Mammalian Toxic. Equiv. Value, WHO TEQ-2005)	ng/kg dry	**23 J, D-5**	**17 J**	**14 J, D-5**	**4.6 J, D-5**	**24 J, D-5**	**29 J, D-5**	**7.2 J, D-5**	**7.7 J, D-5**
Tetrachlorodibenzodioxin (Total)	ng/kg dry	42 J, Q-3	27 Q-3	19 J, Q-3	8.8 J, Q-3	21 J, Q-3	7.4 J, Q-3	0.090 U, J, Q-3	6.6 J, Q-3
Tetrachlorodibenzofuran (Total)	ng/kg dry	110 J, Q-3	78 J, Q-3	170 J, Q-3	24 J, Q-3	220 J, Q-3	210 J, Q-3	1.5 J, Q-3	33 J, Q-3

Notes

Results exceeding the Ecological Screening Value of 2.5 ppt (Mammalian TEQ) are presented in **BOLD**.

Results exceeding the EPA Soil Screening Level of 1 ppb (1000 ppt) (Mammalian TEQ) are shaded in gray.

ppb - part per billion

ppt - part per trillion

ng/kg - nanogram per kilogram

WHO - World Health Organization

TEQ - toxic equivalents

Contaminant of Potential Concern

Qualifier Definitions

U - The analyte was not detected at or above the reporting limit.

B-4 - Level in blank impacts MRLs.

CLP01 - Concentration reported is less than the lowest standard on calibration curve

CLP10 - 2,3,7,8-TCDF confirmed by second column.

CLP18 - Estimated Maximum Possible Concentration (EMPC) Reported

CLP25 - PE sample recovery scored as warning-low.

D-5 - Estimated quantitation for one or more individual constituents comprising >10% of the total.

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-3 - Instrument not calibrated for all constituents of the total concentration result.

Table 5-5
Subsurface Soils Exceeding RSLs for Metals
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

				Station ID	SMSL04 E	SMSL04N	SMSL04S2	SMSJ07	SMSJ08	SMSJ09	MW03B
				Sample ID	SMSSBL04 E 0-5	SMSSBL04 N 0-5	SMSSBL04 S2 10-15	SMSBJ07 8-12	SMSBJ08-13-17	SMSSBJ09 10-15	MW03B SB 7-9
				Media Code	SB	SB	SB	SL	SL	SL	SB
				Sample Date/Time	5/11/2011	5/11/2011	5/11/2011	5/11/2011	5/9/2011	5/10/2011	5/22/2012
Analyte	Industrial / Commerical RSL[1]	Residential RSL[1]	Units								
Aluminum	990,000	77,000	mg/kg dry		31000	41000 J,QM-4	39000	31000	120000	110000	12,000 J, QC-2
Antimony	410	31	mg/kg dry		< 5.9 U	< 5.6 U,J,QM-1, QM-4	< 7.0 U	< 5.6 U	< 7.6 U	< 5.1 U	ND
Arsenic	1.6	0.39	mg/kg dry		11 CLP36	7 J,CLP36, QM-1, QM	10 CLP36	21 CLP36	4.3 U, B-4	4.8 U, B-4	0.14
Barium	190,000	15,000	mg/kg dry		54	170 J, QM-4	220	86	96	110	71
Beryllium	2,000	160	mg/kg dry		0.76	1.5 J, QM-4	7.2	1.3	2.1	7.8	1.4
Cadmium	800	70	mg/kg dry		0.48 J, Q-2, Q-5	1.6 J, Q-5, QM-4	1.2 J, Q-5	1.1	1.1	6.1	ND
Calcium	NE	NE	mg/kg dry		3700	13000	18000 J, Q-5	2300 J, Q-5	19000 J, Q-5	22000 J, Q-5	8,200
Chromium	1,500,000	120,000	mg/kg dry		36	43 J, QM-4	44	40	62	290	52
Cobalt	300	23	mg/kg dry		6.5	17 J, QM-4	15	8.7	6.0 J, Q-2	9.6	37
Copper	41,000	3,100	mg/kg dry		20	110 J, QM-4, QM-6	28	38	610	2000	9.2
Cyanide	20,000	1,600	mg/kg dry		< 0.59 U	0.53 J, Q-2	< 0.65 U	< 0.52 U	0.11 J, Q-2	0.45 J, Q-2	ND
Iron	720,000	55,000	mg/kg dry		40000	50000 J, QM-4	51000	38000	14000	18000	63,000
Lead	800	400	mg/kg dry		15	100 J, QM-4	20	36	36	130	54
Magnesium	NE	NE	mg/kg dry		2300	3200 J, QM-4	4100	1400	14000	12000	1,000
Manganese	23,000	1,800	mg/kg dry		180	980	500	300	910	690	3,100
Mercury	43	10	mg/kg dry		0.091 J, Q-2	< 0.23 R, QM-2	0.032 J, Q-2	0.065 J, Q-2	0.12 J, Q-2	0.21	ND
Nickel	20,000	1,500	mg/kg dry		22	29 J, QM-4	83	15	91	330	11
Potassium	NE	NE	mg/kg dry		2800	4100 J, QM-4	3000	5000	3300	1700	ND
Selenium	5,100	390	mg/kg dry		< 3.4 U	< 3.2 U	< 4.1 U	1.8 J, CLP36, Q-2	< 4.5 U	0.67 J, CLP36, Q-2	ND
Silver	5,100	390	mg/kg dry		< 0.98 U	< 0.93 U	< 1.2 U,J, Cra	< 0.93 U	< 1.3 U	< 0.85 U	ND
Sodium	NE	NE	mg/kg dry		< 490 U	< 460 U	99 J, Q-2	11000	13000	15000	ND
Thallium	10	0.78	mg/kg dry		< 2.5 U	< 2.3 U	< 2.9 U	< 2.3 U	11 CLP36	5.7 CLP36	ND
Vanadium	5,200	390	mg/kg dry		45	58 J, QM-4	49	60	36	43	40
Zinc	310,000	23,000	mg/kg dry		62	270 J, QM-1, QM-4	120	96	340	2100	42

Table 5-5
Subsurface Soils Exceeding RSLs for Metals
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

Notes

[1] USEPA, 2011. US Environmental Protection Agency Region IX, Regional Screening Levels, June 2011.

Analytical results exceeding the USEPA RSL for industrial/commercial are shaded in gray.

Analytical results exceeding the USEPA RSL for residential are shaded in pink.

USEPA - United States Environmental Protection Agency

RSL - Regional Screening Level

mg/kg - milligram per kilogram

NE - not established

ND - non detect

SB - subsurface soil

SL - sludge

GW - groundwater

Contaminant of Potential Concern

Qualifier Definitions

U - The analyte was not detected at or above the reporting limit.

J - The identification of the analyte is acceptable; the reported value

B-4 - Level in blank impacts MRLs.

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

CRa - Result is less than -CRQL

Q-2 - Result greater than MDL but less than MRL.

Q-5 - Serial dilution precision outside method control limits

QC-2 - Analyte concentration high in continuing calibration verification standard

QM-1 - Matrix Spike Recovery less than method control limits

QM-2 - Matrix Spike Recovery greater than method control limits

QM-4 - Matrix Precision outside method control limits

QM-6 - Matrix Spike Recovery less than 10%

R - The presence or absence of the analyte can not be determined from the data due to severe quality control problems. The data are rejected and considered unusable.

Tables 5-5 and 5-6 of the *Final RI/FS Report* dated July 2015 (J.M. Waller, 2015c) for a summary of the data for pesticides and PCBs, respectively.

Arsenic, barium, beryllium, cadmium, copper, and, lead were detected in sludge samples at concentrations which exceed the ground water protection screening RSL. Table 5-6 presents a summary of the samples exceeding the ground water protection RSL.

5.5.4 Surface Water

Twenty-two co-located surface water/sediment locations (Figure 5-7) were sampled and analyzed for TAL metal concentrations. Seven metals: aluminum, copper, iron, lead, nickel, zinc, and cyanide had one or more samples in which the acute and/or chronic water quality criteria was exceeded. Aluminum exceeded the chronic water quality criteria (87 µg/L) in 18 surface water samples with concentrations ranging from 230 µg/L (at the Knob Creek reference samples SMSSW10) to 6,900 µg/L (at the seep located at the toe of the recently capped area SMSSW02). Copper exceeded the chronic water quality criteria (6.54 µg/L) in two surface water samples with concentrations ranging from 9.1 µg/L at SMSSW04 which is located in the upper portion of Flenniken Branch just downstream of Witherspoon Recycling to 300 µg/L at SMSSW02.

Cyanide, iron, nickel and zinc exceeded their respective chronic water quality criteria in seep sample SMSSW02. Lead exceeded the chronic water quality criteria in five surface water samples with concentrations ranging from 2.8 µg/L at SMSSW06 which is the upstream most sample in the wetland area to 9.8 µg/L at SMSSW02. Surface water samples SMSSW04 and SMSSW04D contained lead at 3.8 µg/L and SMSSW09 spring contained lead at 4.3 µg/L. Table 5-7 summarizes the surface water samples exceeding the water quality criteria for metals.

PCBs were analyzed in fifteen surface water samples and there were no positive detected concentrations in any of these samples. Pesticides were analyzed for in fourteen surface water samples with no positive detected concentrations observed.

Bis-2-ethylhexylphthalate exceeded the chronic water quality criteria in one sample, SMSSW12 (Table 5-8).

5.5.5 Sediment

Detected concentrations of inorganic and organic constituents were compared to available screening criteria. A conservative scenario of recreational use of the surface water and exposure to sediment was considered and the associated human health residential RSLs were used. Arsenic was the most prevalent metal detected in sediments that exceeded its residential RSL. Manganese was the only other metal detected at concentrations that exceeded the residential RSL.

The sediment samples evaluated for metals and are summarized in Table 5-9. A summary of COPCs exceeding the ESV are as follows.

Table 5-6
Subsurface Soils Exceeding Ground Water Protection RSLs for Metals
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

			Analyte Group	Metals					
			Analyte	Arsenic	Barium	Beryllium	Cadmium	Copper	Lead
			Results Unit	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
			USEPA MCL SSL[1]	0.29	82	3.2	0.38	46	14
Station ID	Sample ID	Sample Depth (ft)	Sample Data						
SMSL04 E									
	SMSSBL04 E 0-5	0.5-5	5/11/2011	11 CLP36	54	0.76	0.48 J,Q-2,Q-5	20	15
SMSL04N									
	SMSSBL04 N 0-5	0.5-5	5/11/2011	17 J,CLP36,QM-1,QM-4	170 J,QM-4	1.5 J,QM-4	1.6 J,Q-5,QM-4	110 J,QM-4,QM-6	100 J,QM-4
SMSL04S2									
	SMSSBL04 S2 10-15	10-15	5/11/2011	10 CLP36	220	7.2	1.2 J,Q-5	28	20
MW03B									
	MW03 SB7-9	7-9	5/22/2012	0.14	71	1.4	ND	9.2	54

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1] USEPA. 2015. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Analytical results exceeding the USEPA MCL SSL

USEPA - United States Environmental Protection Agency

MCL - Maximum Contaminants Level

SSL - Soil Screening Level

mg/kg - milligram per kilogram

ft - feet

ND - non detect

Qualifiers

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

Q-5 - Serial dilution precision outside method control limits

QM-1 - Matrix Spike Recovery less than method control limits

QM-4 - Matrix Precision outside method control limits

QM-6 - Matrix Spike Recovery less than 10%

Table 5-7
Surface Water Exceeding Water Quality Criteria for Inorganics
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

Analyte Group			Metals							Classicals	
Analyte			Aluminum	Copper[b]	Cyanide	Iron	Lead[b]	Mercury	Zinc[b]	Chloride	Nitrite
Results Unit			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	mg/l
USEPA Region 4 WQC Chronic[1]			750[a]	9.22	22	1000[a]	33.78	NE	65.04	230	NE
USEPA Region 4 WQC Acute[1]			87[a]	6.54	5.2	NE	1.32	0.012	58.91	860	NE
Station ID	Sample ID	Sample Data									
SMSSDSW01											
	SMSSW01	5/4/2011	**330 J,Q-5**	0.85 J,Q-2	1.3 J,CLP27,Q-2	480	ND	ND	4.3	2.6	0.066 J
	SMSSW01	8/27/2013	**300**	ND	ND	730	ND	ND	ND	3.5	ND
	SMSSW01	3/3/2014	**3200**	ND	ND	6000	ND	ND	ND	ND	ND
SMSSDSW02											
	SMSSW02	5/2/2011	**6900 J,Q-5**	**300** [c]	**190 J,CLP27**	2000	**9.8** [c]	**0.38**	120	**4510**	ND
	SMSSW02	6/4/2013	ND	49	ND	ND	ND	**0.065 J,Q-2**	14 J,Q-2		
	SMSSW02	3/4/2014	**940**	**16 J,Q-2** [c]	ND	ND	ND	ND	ND	ND	0.22 J
SMSSDSW03											
	SMSSW03	5/4/2011	**760 J,Q-5**	2.4	2.5 J,CLP27,Q-2	770	ND	ND	3.7	27.8	0.033 J
	SMSSW03	8/27/2013	**93 J,Q-2**	3.8 J,Q-2	3.7 J,Q-2	95 J,Q-2	ND	ND	ND	551	ND
	SMSSW03	11/13/2013	**1400**	ND	ND	2700	**3.6** [c]	ND	11	346	0.064 J
	SMSSW03	3/5/2014	**2400**	5.9 J,Q-2	ND	680	ND	ND	ND	330	0.16 J, Q-2
SMSSDSW04											
	SMSSW04	5/4/2011	**1200 J,Q-5**	9.1	ND	850	**3.8** [c]	ND	19	170	0.089 J
	SMSSW04D	5/4/2011	**1100 J,Q-5**	9.6	2.8 J,CLP27,Q-2	740	**3.8** [c]	ND	17	169	0.036 J
	SMSSW04	8/27/2013	**140 J,Q-2**	3.6 J,Q-2	ND	250	ND	ND	ND	609	0.063 J
	SMSSW94*	8/27/2013	**1000**	ND	ND	1100	2.5 J,Q-2	ND	ND	601	0.071 J
	SMSSW04	11/12/2013	**220**	ND	ND	960	ND	ND	ND	**1230**	0.16
	SMSSW04	3/4/2014	**560**	2.9 J,Q-2	ND	420	1.3 J,Q-2	ND	ND	170	ND
	SMSSW94*	3/4/2014	**430**	ND	ND	300	ND	ND	ND		
	SMSSW04	6/23/2014	**4600**	19 J,Q-2	ND	7000 J, CLP26	ND	**0.11 J,Q-2**	95	**2700**	ND
	SMSSW904*	6/23/2014	**1600**	ND	ND	2500 J, CLP26	ND	**0.035 J,Q-2**	ND	**2600**	ND
SMSSDSW05											
	SMSSW05	5/5/2011	**320 J,Q-5**	2.3	4.3 J,CLP27,Q-2	310	1.1	ND	4.5	31.4	0.038 J
	SMSSW05	8/26/2013	**180 J,Q-2**	ND	ND		ND	ND	ND	43.6	ND
	SMSSW05	6/24/2014	**260**	ND	ND	ND	ND	ND	4.9 J,Q-2	68	ND
SMSSDSW06											
	SMSSW06	5/3/2011	**440 J,Q-5**	4.1	1.7 J,CLP27,Q-2	590	2.8	ND	12	151	0.21
SMSSDSW07											
	SMSSW07	5/5/2011	**300 J,Q-5**	2.0 J,Q-2	2.1 J,CLP27,Q-2	300	ND	ND	2.6	15.5	0.037 J
SMSSDSW08											
	SMSSW08	5/3/2011	**240 J,Q-5**	2.6	4.8 J,CLP27,Q-2	140 J,Q-2	ND	ND	4.6	322	0.21
	SMSSW08	11/12/2013	**760**	ND	ND	1500	3.1	ND	12	420	0.045 J
	SMSSW08	3/4/2014	**350**	ND	ND	430	ND	ND	ND	170	0.082 J, Q-2
SMSSW08SPRING											
	SMSSW08SPRING	5/3/2011	**280 J,Q-5**	2.1	1.9 J,CLP27,Q-2	120 J,Q-2	ND	ND	3.8	25	0.97
	SMSSW08SPRING	8/27/2013	**95 J,Q-2**	3.5 J,Q-2	ND	200	ND	ND	ND	406	ND
	SMSSW08SPRING	11/12/2013	**180**	ND	ND	350	ND	ND	ND	451	0.039 J
SMSSDSW09											
	SMSSW09	5/3/2011	**310 J,Q-5**	2.3	2.7 J,CLP27,Q-2	210	ND	ND	4.9	316	0.21
	SMSSW09	11/12/2013	**700**	ND	ND	1400	2.8	ND	18	406	0.047 J
	SMSSW09	3/3/2014	**1700**	ND	ND	2000	ND	ND	ND	100	0.16 J, Q-2
SMSSW09SPRING											
	SMSSW09SPRING	5/3/2011	**580 J,Q-5**	1.8 J,Q-2	3.0 J,CLP27,Q-2	710	**4.3** [c]	ND	ND	167	0.33
	SMSSW09SPRING	8/26/2013	**450**	4.2 J,Q-2	ND	1300	ND	ND	ND	110	ND
	SMSSW09SPRING	11/12/2013	**9400**	**43** [c]	ND	22000	**38** [c]	**0.13**	120	131	ND
	SMSSW09SPRING	3/3/2014	**960**	ND	ND	1500	ND	ND	ND	64	ND
	SMSSW09SPRING	6/22/2014	**170 J,Q-2**	ND	ND	ND	ND	ND	ND	370	ND
SMSSDSW10											
	SMSSW10	5/5/2011	**230 J,Q-5**	0.79 J,Q-2	2.5 J,CLP27,Q-2	260	ND	ND	4.5	6.1	0.095 J
	SMSSW10	8/26/2013	**150 J,Q-2**	ND	ND	300	ND	ND	ND	11.7	ND
	SMSSW10	3/4/2014	**370**	ND	ND	390	ND	ND	ND	5.5	ND
	SMSSW10	6/24/2014	**220**	ND	ND	ND	ND	ND	ND	80	ND
SMSSDSW11											
	SMSSW11	8/26/2013	**91 J,Q-2**	ND	ND	230	ND	ND	11 J,Q-2	24	ND
	SMSSW11	3/3/2014	**1200 J,QM-2**	ND	ND	1600 J, QM-2	ND	ND	ND	5.6	0.16 J, H-1, Q-2
SMSSDSW12											
	SMSSW12	9/27/2011	**850**	ND	ND	4300	1.2	ND	ND		
	SMSSW912*	9/27/2011	**1200**	ND	ND	5400	1.3	ND	ND		
	SMSSW12	3/4/2014	**600**	3.1 J,Q-2	ND	630	**2.1 J,Q-2** [c]	ND	ND	150 J, H-1	ND
SMSSDSW13											
	SMSSW13	11/13/2013	**110**	ND	ND	240	ND	ND	14	155	ND
	SMSSW13	3/3/2014	**1500**	ND	ND	1900	ND	ND	ND	71	ND
SMSSDSW14											
	SMSSW14	3/3/2014	**1800**	ND	ND	2500	ND	ND	ND	51 J, H-1	0.16 J, H-1
	SMSSW14	6/22/2014	**94 J,Q-2**	ND	ND	ND	ND	ND	ND	130	ND
SMSSDSW15											
	SMSSW15	9/26/2011	**2200**	ND	ND	4300	**5.8** [c]	ND	33		
SMSSDSW16											
	SMSSW16	9/26/2011	**920**	ND	ND	1700	2.0	ND	14		
SMSSDSW17											
	SMSSW17	9/26/2011	**490**	ND	ND	990	1.2	ND	ND		
SMSSDSW18											
	SMSSW18	9/26/2011	**360**	ND	ND	720	ND	ND	ND		
SMSSDSW19											
	SMSSW19	9/26/2011	**330**	ND	ND	680	ND	ND	ND		
SMSSDSW20											
	SMSSW20	9/26/2011	**390**	ND	ND	780	ND	ND	ND		
	SMSSW20	8/26/2013	**130 J,Q-2**	ND	ND	280	ND	ND	ND	21.4	ND
	SMSSW20	11/12/2013	**330**	ND	ND	830	1.1	ND	ND	58.8	ND
	SMSSW20	3/4/2014	**380**	ND	ND	400	ND	ND	ND	22	ND

Table 5-7
Surface Water Exceeding Water Quality Criteria for Inorganics
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html#tbl1

[a] USEPA Region 4 WQC Non-Priority Pollutants.

[b] USEPA Region 4 WQC Hardness Dependent Based on the following equations:

Compound	**Chronic Screening Value**	Acute Screening Value
Copper	$e^{(0.8545(\ln H) - 1.465)}$	$e^{(0.9422(\ln H) - 1.464)}$
Lead	$e^{(1.273(\ln H) - 4.705)}$	$e^{(1.273(\ln H) - 1.464)}$
Zinc	$e^{(0.8473(\ln H) + 0.7614)}$	$e^{(0.8473(\ln H) + 0.8604)}$

[c] Analytical result evaluated against equation-adjusted WQC for those samples where hardness exceeded 50, as calculated in Table 4-4 – General Chemistry in Surface Water, as well as exceeded priority and non-priority WQC (Final Remedial Investigation/Feasibility Study Report, Smokey Mountain Smelters, Knoxville, Knox County, Tennessee, July 2015 [J.M. Waller, 2015c]). Adjusted screening values are presented below and are color coded and bold where applicable to analytical results

			Adjusted Screening Value for Copper		Adjusted Screening Value for Lead		Adjusted Screening Value for Zinc	
			Acute	**Chronic**	Acute	**Chronic**	Acute	**Chronic**
Station ID	Sample ID	Sample Date						
SMSSDSW02								
SMSSW02		5/2/2011	35.14	**25.21**				
		3/4/2014		**14.94**				
SMSSDSW03								
SMSSW03		11/13/2013				**1.65**		
SMSSDSW04								
SMSSW04		5/4/2011				**1.78**		
		5/4/2011				**1.81**		
SMSSW09SPRING								
SMSSW09SPRING		5/3/2011				**4.14**		
		11/12/2013		**42.15**		**4.26**		
SMSSDSW12								
SMSSW12		3/4/2014				**1.40**		
SMSSDSW15								
SMSSW15		9/26/2011				**3.05**		

*Denote duplicate sample

Analytical results exceeding the USEPA Region 4 WQC Chronic

Bold Analytical results exceeding the USEPA Region 4 WQC Acute

USEPA - United States Environmental Protection Agency

WQC - Water Quality Criteria

µg/L - microgram per liter

NE - not established

ND - Non Detect

Blank - No datum

Qualifiers

CLP26 - PE sample recovery scored as warning-high.

CLP27 - PE sample recovery scored as action low.

H-1 - Recommended holding time exceeded

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

Q-5 - Serial dilution precision outside method control limits

QM-2 - Matrix Spike Recovery greater than method control limits

Table 5-8
Surface Water Exceeding Water Quality Criteria for SVOCs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

		Analyte Group	SVOCs
		Analyte	Bis(2-ethylhexyl) phthalate
		Results Unit	µg/l
		USEPA Region 4 WQC Chronic[1]	0.3
Station ID	Sample ID	Sample Data	
SMSSDSW12			
	SMSSW12	3/4/2014	34

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html#tbl1

*Denote duplicate sample

Analytical results exceeding the USEPA Region 4 WQC Chronic

USEPA - United States Environmental Protection Agency

WQC - Water Quality Criteria

SVOCs- Semi volatile organic compounds

µg/L - microgram per liter

Table 5-9
Sediment Exceeeding ESVs for Metals
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Analyte Group			Metals							
Analyte			Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Silver	Zinc
Results Uni			mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
EPA Region 4 ESVs for Sediment Effects Valu[1]			7.24	0.676	18.7	30.2	0.13	15.9	0.733	124
USEPA Region 4 ESVs - Sediment[1]			7.24	1	18.7	30.2	0.13	15.9	2	124
Station ID	Sample ID	Sample Data								
SMSSDSW01										
	SMSSD01	5/4/2011	**8.8 CLP36**	ND	8.6 J,CLP26	18	ND	8.4 J,CLP26	ND	59
SMSSDSW03										
	SMSSD03	5/4/2011	**13 CLP36**	ND	**110 J,CLP26**	**34**	ND	**33 J,CLP26**	ND	120
	SMSSD03	4/16/2012	**18 CLP36**	ND	**21**	**34**	ND	8.9 J,CLP26	ND	41
SMSSDSW04										
	SMSSD04	5/4/2011	**12 CLP36**	ND	**140 J,CLP26**	**51**	ND	**35 J,CLP26**	ND	**240**
	SMSSD04	4/17/2012	**15 CLP36**	0.085 J,Q-2	**110**	**75**	ND	**32 J,CLP26**	ND	**290**
	SMSSD04D	5/4/2011	**10 CLP36**	ND	**110 J,CLP26**	**61**	ND	**35 J,CLP26**	ND	**190**
	SMSSD904*	4/17/2012	**9.6 CLP36**	0.14 J,Q-2	**61**	**40**	ND	**17 J,CLP26**	ND	**150**
SMSSDSW05										
	SMSSD05	5/5/2011	**9.9 CLP36**	ND	**75 J,CLP26**	**36**	ND	**20 J,CLP26**	ND	**250**
	SMSSD05	4/17/2012	**7.9 CLP36**	ND	**20**	26	ND	**17 J,CLP26**	ND	94
SMSSDSW06										
	SMSSD06	5/3/2011	**11 CLP36**	ND	17 J,CLP26	29	ND	9.8 J,CLP26	**3.0**	96
SMSSDSW07										
	SMSSD07	5/5/2011	2.6 CLP36	ND	17 J,CLP26	13	ND	**19 J,CLP26**	ND	75
SMSSDSW08										
	SMSSD08	5/3/2011	**8.4 CLP36**	ND	**180 J,CLP26**	**52**	**0.17**	**17 J,CLP26**	ND	**450**
	SMSSD08	4/16/2012	**7.6 CLP36**	0.18 J,Q-2	**91**	**36**	ND	**24 J,CLP26**	ND	**140**
SMSSDSW09										
	SMSSD09	5/3/2011	**11 CLP36**	ND	**72 J,CLP26**	**34**	ND	**20 J,CLP26**	ND	**230**
SMSSDSW11										
	SMSSD11	9/26/2011	6.0	0.26	7.6	**33**	0.034	7.4	ND	**350**
	SMSSD11	4/17/2012	**7.5 CLP36**	ND	6.0	19	ND	7.2 J,CLP26	ND	30
	SMSSD11	5/14/2012	3.7	ND	11	**37**	ND	10	ND	39
SMSSDSW12										
	SMSSD12	9/27/2011	**9.0**	0.29	**50**	24	0.023	12	ND	63
	SMSSD912*	9/27/2011	6.1	ND	**44**	17	ND	13	ND	51
SMSSDSW13										
	SMSSD13	9/27/2011	5.3	0.50	**23**	28	0.057	7.6	ND	110
SMSSDSW15										
	SMSSD15	9/26/2011	4.1	0.83	**33**	28	0.10	7.8	ND	**130**
SMSSDSW16										
	SMSSD16	9/26/2011	6.1	**1.1**	**47**	**37**	0.11	13	ND	**170**
SMSSDSW17										
	SMSSD17	9/26/2011	5.8	**1.6**	**50**	**40**	**0.14**	12	ND	**180**
SMSSDSW18										
	SMSSD18	9/26/2011	6.1 J,QI-1	0.58	**43**	**58**	0.067	15	ND	**200**
	SMSSD18	4/17/2012	**11 CLP36**	0.38 J,Q-2	**140**	**44**	ND	13 J,CLP26	ND	**640**
SMSSDSW19										
	SMSSD19	9/26/2011	5.3	0.47	**26**	26	0.054	15	ND	98
SMSSDSW20										
	SMSSD20	9/26/2011	5.1 J,QI-1	0.78	**33**	**33**	0.094	15	ND	**130**

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html#tbl3

*Denote duplicate sample

Analytical results exceeding the USEPA Region 4 ESVs for Sediment - Effects Value

Bold Analytical results exceeding the USEPA Region 4 ESVs for Sediment

USEPA - United States Environmental Protection Agency

ESVs - Ecological Screening Values

mg/kg - milligram per kilogram

NE - not established

ND - Non Detect

Qualifiers

CLP26 - PE sample recovery scored as warning-high.

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

QI-1 - Internal standard was outside of method control limits.

- Arsenic ranged from 8.4 mg/kg to 13 mg/kg in samples SMSSD01, SMSSD03, SMSSD04, SMSSD04D, SMSSD05, SMSSD06, and SMSSD12.
- Cadmium ranged from 1.1 mg/kg to 1.6 mg/kg in samples SMSSD16 and SMSSD17.
- Copper ranged from 23 mg/kg to 180 mg/kg in 15 samples including SMSSD03, SMSSD04, SMSSD04D, SMSSD05, SMSSD08, SMSSD09, SMSSD12, SMSSD912, SMSSD13, SMSSD15, SMSSD16, SMSSD17, SMSSD18, SMSSD19, and SMSSD20.
- Lead ranged from 33 mg/kg to 61 mg/kg in 11 samples including SMSSD03, SMSSD04, SMSSD04D, SMSSD05, SMSSD08, SMSSD09, SMSSD11, SMSSD16, SMSSD17, SMSSD18, and SMSSD20.
- Mercury ranged from 0.17 mg/kg to 0.14 mg/kg in samples SMSSD08 and SMSSD17, respectively.
- Nickel ranged from 17 mg/kg to 35 mg/kg in samples SMSSD03, SMSSD04, SMSSD04D, SMSSD05, SMSSD07, SMSSD08, and SMSSD09.
- Silver was detected in sample SMSSD06 at 3.0 mg/kg.
- Zinc ranged from 130 mg/kg to 450 mg/kg in 11 samples including SMSSD04, SMSSD04D, SMSSD05, SMSSD08, SMSSD09, SMSSD11, SMSSD15, SMSSD16, SMSSD17, SMSSD18, and SMSSD20.

In general the highest metal concentrations in sediment were found in the middle portion of Flenniken Branch, the lower portions of the wetland area, and where the Flenniken Branch discharges into the Knob Creek Embayment.

Sediment samples were evaluated for PCBs and are summarized in Table 5-10. PCB-1260 exceeded the ESV benchmark of 33 µg/kg in four samples (SMSSD04, SMSSD04D, SMSSD08 and SMSSD05), with concentrations ranging from 38 µg/kg to 230 µg/kg.

The sediment samples evaluated for pesticides are summarized in Table 5-10. There were no positively detected pesticides in any of the sediment samples collected.

The evaluated analytical results for SVOCs in sediments are divided and summarized in Table 5-10. A summary of HMW ecological COPCs exceeding the Effect Values are as follows.

- BaP ranged from 100 µg/kg to 130 µg/kg in samples SMSSD01, SMSSD05, and SMSSD11.
- Fluoranthene ranged from 140 µg/kg to 230 µg/kg in samples SMSSD01 and SMSSD05.
- Total HMW PAHs ranged from 2,599 µg/kg to <1,740 µg/kg in samples SMSSD01 and SMSSD05, respectively.

The remaining HMW COPCs, (benzo(a)anthracene, chrysene, dibenzo(a,h)anthracene, and pyrene) exceeded their benchmark values only in sample SMSSD01, which was proposed as the upstream background location. The benchmark for Total LMW COPCs was only exceeded in two samples (SMSSD01 and SMSSD05).

Table 5-10
Sediment Exceeding ESVs for PCBs, Pesticides, and SVOCs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Analyte Group			PCBs			Pesticides			SVOCs					
Analyte			PCB-1248 (Aroclor 1248)	PCB-1254 (Aroclor 1254)	PCB-1260 (Aroclor 1260)	4,4'-DDD (p,p'-DDD)	4,4'-DDT (p,p'-DDT)	Endrin	Benzo(a)anthracene	Benzo(a)pyrene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Pyrene
Results Unit			µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry	µg/kg dry
USEPA Region 4 ESVs for Sediment Effects Value[1]			21.6	21.6	21.6	1.22	1.19	0.02	74.8	88.8	108	6.22	113	153
USEPA Region 4 ESVs - Sediment[1]			33	NE	33	NE	3.3	3.3	NE	NE	NE	NE	NE	NE
Station ID	Sample ID	Sample Data												
SMSSDSW01														
	SMSSD01	5/4/2011	ND	ND	ND	ND	ND	ND	130	150	180	52	230	250
SMSSDSW03														
	SMSSD03	4/16/2012	ND	22 J,CLP01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SMSSDSW04														
	SMSSD04	5/4/2011	ND	ND	**230**	ND	ND	ND	51	68	66	ND	77	86
	SMSSD04	4/17/2012	ND	ND	**100**	ND	**9.5**	**6.4**	ND	ND	ND	ND	ND	ND
	SMSSD04D*	5/4/2011	ND	ND	**150**	ND	ND	ND	ND	ND	ND	ND	ND	45
	SMSSD904*	4/17/2012	ND	ND	**56**	ND	**5.0**	**3.6 J,CLP01**	ND	ND	ND	ND	ND	ND
SMSSDSW05														
	SMSSD05	5/5/2011	ND	**38**	ND	ND	ND	ND	100	96	ND	140	150	ND
	SMSSD05	4/17/2012	ND	19 J,CLP01	ND	**6.0**	ND	ND	ND	ND	ND	ND	ND	ND
SMSSDSW08														
	SMSSD08	5/3/2011	ND	ND	**78**	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SMSSD08	4/16/2012	ND	ND	**65**	ND	**6.1**	**4.2 J,CLP01**	ND	ND	ND	ND	ND	ND
SMSSDSW09														
	SMSSD09	5/3/2011	ND	ND	**26**	ND	ND	ND	ND	ND	ND	ND	ND	ND
SMSSDSW11														
	SMSSD11	4/17/2012	ND	ND	**46 J,CLP01**	ND	**3.6 J,CLP01**	ND	ND	ND	ND	ND	ND	ND
SMSSDSW18														
	SMSSD-05-18-BLEND	5/14/2012	ND	ND	**39**	2.9 J,Q-4	**4.3**	ND	ND	120	55	ND	79	92
	SMSSD18	4/17/2012	**110**	ND	**84**	ND	**8.7**	**6.4**	ND	ND	ND	ND	ND	ND

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html#tbl3

*Denote duplicate sample

	Analytical results exceeding the USEPA Region 4 ESVs for Sediment - Effects Value
Bold	Analytical results exceeding the USEPA Region 4 ESVs for Sediment

PCBs - polychlorinated biphenyl

SVOCs - Semi Volatile Organic Compounds

USEPA - United States Environmental Protection Agency

ESVs - Ecological Screening Values

µg/kg - microgram per kilogram

NE - not established

ND - Non Detect

Qualifiers

CLP01 - Concentration reported is less than the lowest standard on calibration curve

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-4 - Greater than 40 % difference between primary and confirmatory GC columns

5.5.6 Fish Tissue

The Knob Creek Embayment is the closest location downstream to the Site where sizable fish can be found. Fish tissue samples collected in The Knob Creek Embayment in May 2011 are shown on Figure 5-7. Tissue samples for three fish species were collected: largemouth bass (fillet), carp (fillet) and bluegill (whole-body composites). Six samples of each species were collected from the cove where Flenniken Branch discharges into the embayment and two samples of each species were collected from a reference area where Knob Creek discharges in the embayment. Fish tissue results were compared to EPA Fish Ingestion RSLs.

Twenty-five fish samples were analyzed for metals concentration. Two metals, arsenic and mercury had concentrations in one or more samples that exceeded the Fish Ingestion RSL. Two carp samples and all six bluegill samples exceeded the arsenic RSL with the highest concentrations (0.20 mg/kg) detected in bluegill – arsenic was not positively identified in any of the reference samples. Mercury was detected in three largemouth bass samples (one of which was a duplicate sample) at concentrations exceeding the Fish Ingestion RSL. The highest mercury concentration in a largemouth bass fillet was 0.29 mg/kg. It should also be noted that the State of Tennessee has posted a mercury and PCB fish ingestion advisory for the Fort Louden Reservoir portion of the Tennessee River which is connected to the Knob Creek Embayment and influences water levels within the embayment.

Seven fish samples (2 largemouth bass, 2 carp and 3 bluegill) samples were analyzed for PCBs and dioxins. All seven samples exceeded the Fish Ingestion RSL for PCB-1260; the highest concentration (0.52 mg/kg) was detected in a bluegill sample. As previously discussed, the State of Tennessee currently has a PCB fish ingestion advisory for this portion of the Tennessee River.

No subsurface sludge or soil from the Site waste piles analyzed contained concentrations of PCBs exceeding industrial, residential direct contact levels, or ground water protection screening values. In the 2002 Site Investigation, PCBs were observed in the leachate samples. After installation of the compacted clay cap in 2010, fifteen surface water samples were collected from the Site surface water and there were no positive detected PCB concentrations in any of these samples. No PCBs or pesticides exceeded the MCLs in any of the ground water samples.

Sediment samples were evaluated for PCBs and are summarized in Table 5-10. PCB-1260 exceeded the ESV benchmark of 33 µg/kg in four samples (SMSSD04, SMSSD04D, SMSSD08 and SMSSD05), with concentrations ranging from 38 µg/kg to 230 µg/kg. The ecological risk assessment concluded that the sediments were not likely having a negative impact on birds or mammals exposed to these levels at the Site.

The Site is approximately three miles upstream from the Tennessee River. As previously discussed, the State of Tennessee currently has a PCB fish ingestion advisory for the Tennessee River in Knoxville. Fish tissue samples were taken downstream from the Site.

Seven fish samples (2 largemouth bass, 2 carp and 3 bluegill) samples were analyzed for PCBs and dioxins. All seven samples exceeded the Fish Ingestion RSL for PCB-1260; the highest concentration (0.52 mg/kg) was detected in a bluegill sample.

While previous Site operations may have had an impact on PCB levels found in the Tennessee River, the current Site conditions and the analytical data from surface and ground water show that there are no PCBs detected in Site surface water or at levels exceeding MCLs in ground water currently.

The Tennessee River is a large river with a very large watershed which contains many historical sources of PCBs. Fish accumulate PCBs throughout their lifetime and these PCBs do not break down in the fish. Larger fish can have higher concentrations that the fish may have picked up from other locations other that the location where the fish were caught. Therefore, the PCB concentrations observed in the fish samples, in whole or in part, cannot be determined to be site-related.

All twenty-five fish samples were analyzed for pesticides and SVOCs. All pesticide and SVOC concentrations fish samples were below the RSLs.

A summary of the analytical results are presented on Tables 5-20 through 5-24 of the *Final RI/FS Report* dated July 2015 (J.M. Waller, 2015c).

5.5.7 Ground Water

Ground water sample results were compared to relevant Maximum Contaminant Levels (MCLs). Fifteen monitor wells were sampled and analyzed for metals, PCBs, pesticides, VOCs, and SVOCs. No PCBs or pesticides exceeded the MCLs in any of the ground water samples. The following metals exceeded the MCLs: aluminum, antimony, arsenic, beryllium, cadmium, copper, chromium, cobalt, iron, lead, manganese, mercury, molybdenum, nickel, thallium, and zinc. The only organics that exceeded the MCL were bis(2-ethylhexyl)phthalate at four locations, tetrachloroethylene at one location, methylene chloride at one location, and pentachlorophenol at five locations. The extent of the impacts to the shallow and deep ground water are shown on Figures 5-8 and 5-9. Tables 5-11 and 5-12 provide the summary of the analytical results.

5.5.8 Soil Gas

Analytical results of soil gas samples onsite below cap (Source No. 1) of the former waste pile area within the subsurface as well as the surface soils located offsite at Montgomery Village are summarized in Table 5-30 of the *Final RI/FS Report* dated July 2015 (J.M. Waller, 2015c).

Table 5-11
Ground Water Exceeding MCLs for Metals
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

Analyte Group			Metals												
Analyte			Aluminum	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Selenium	Thallium
Results Unit			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
USEPA MCL[1]			200[a]	6	10	4	5	100	1300	300[a]	15	50[a]	2	50	2
Statio	Sample ID	Sample Date													
SMSMW01A															
	SMSMW01A	6/27/2012	1300	ND	ND	ND	44	ND	ND	1000	ND	30000	ND	22 J,CLP36,Q-2	ND
	SMSMW901A*	6/27/2012	1400	ND	ND	ND	43	ND	ND	1100	ND	30000	ND	18 J,Q-2,CLP36	ND
	SMSMW01AF	6/27/2012	400	ND	ND	ND	46	ND	11 J,Q-2	ND	ND	31000	ND	17 J,CLP36,Q-2	ND
	SMSMW901AF*	6/27/2012	450	ND	ND	ND	47	ND	9.6 J,Q-2	ND	ND	32000	ND	19 J,CLP36,Q-2	ND
	SMSMW01A	8/27/2013	1600	ND	ND	ND	26	ND	ND	1200	ND	23000	ND	13 J,CLP36,Q-2	ND
	SMSMW01A	11/14/2013	ND	ND	ND	ND	29	ND	ND	ND	ND	30000	ND	35	ND
	SMSMW01A	3/5/2014	ND	ND	ND	ND	11 J,Q-2	ND	34 J,Q-2	ND	ND	16000	ND	ND	45 J,CLP36,Q-2
	SMSMW01A	6/25/2014	610	ND	ND	ND	27	ND	43	ND	ND	24000	ND	11 J,CLP36,Q-2	ND
SMSMW02A															
	SMSMW02A	6/26/2012	4000	ND	2.7 J,Q-2,CLP36	ND	ND	ND	71	ND	9.7 J,Q-2	ND	ND	ND	ND
	SMSMW02AF	6/26/2012	1600	15 J,Q-2	ND	ND	ND	ND	3.4 J,Q-2	ND	ND	ND	ND	ND	ND
	SMSMW02A	6/5/2013	1600	12 J,Q-2	ND	ND	ND	ND	ND	ND	ND	32	0.027 J,Q-2	ND	ND
	SMSMW02A	8/26/2013	1600	12 J,Q-2	ND	ND	0.32 J,Q-2	ND	12 J,Q-2	70 J,Q-2	7.0 J,Q-2	23	ND	ND	ND
	SMSMW02A	11/13/2013	7500	13	4.4	ND	0.56	ND	250 J,QM-2	1300	22	60	ND	3.0	ND
	SMSMW02A	3/5/2014	1400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SMSMW02A	6/24/2014	2700	6.2 J,Q-2	ND	ND	ND	ND	54	ND	7.6 J,Q-2	ND	ND	ND	ND
	SMSMW902A*	6/24/2014	2500	7.1 J,Q-2	ND	ND	ND	ND	44	ND	ND	ND	ND	ND	3.3 J,CLP36,Q-2
SMSMW03B															
	SMSMW03B	6/28/2012	110 J,Q-2	ND	ND	ND	ND	ND	75	ND	15	77000	ND	ND	ND
	SMSMW903B*	6/28/2012	100 J,Q-2	ND	ND	ND	ND	ND	73	ND	11	78000	ND	ND	ND
	SMSMW03BF	6/28/2012	82 J,Q-2	ND	ND	ND	ND	ND	83	ND	18	76000	ND	ND	ND
	SMSMW903BF*	6/28/2012	120 J,Q-2	ND	ND	ND	ND	ND	74	ND	15 J,QM-1	78000	ND	ND	ND
	SMSMW03B	8/28/2013	580	ND	6.9 J,CLP36,Q-2	4.8 J,Q-2	0.84 J,Q-2	ND	95	400	ND	20000	ND	ND	ND
	SMSMW03B	11/13/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	120000	ND	ND	ND
	SMSMW03B	3/5/2014	ND	ND	ND	ND	ND	ND	160 J,Q-2	ND	ND	100000	ND	ND	98 J,CLP36,Q-2
	SMSMW03B	6/25/2014	360	ND	ND	ND	ND	38	ND	910 J,CLP26	ND	110000	ND	ND	ND
SMSMW04A															
	SMSMW04A	6/27/2012	1000	ND	ND	ND	22	ND	ND	2300	ND	26000	0.041 J,Q-2	ND	ND
	SMSMW04AF	6/27/2012	84 J,Q-2	ND	ND	ND	23	ND	4.9 J,Q-2	ND	ND	28000	0.056 J,Q-2	ND	ND
	SMSMW04A	8/28/2013	370	ND	3.8 J,CLP36,Q-2	ND	26	ND	ND	510	ND	28000	ND	ND	ND
	SMSMW04A	11/13/2013	2300	ND	6.2	ND	23	ND	ND	5800	3.7	37000	0.47	13	ND
	SMSMW04A	3/5/2014	ND	ND	ND	ND	30 J,Q-2	ND	27 J,Q-2	ND	ND	39000	ND	ND	57 J,CLP36,Q-2
	SMSMW04A	6/26/2014	1100	ND	ND	ND	28	ND	14 J,Q-2	2800 J,CLP26	ND	32000	0.26	ND	ND
SMSMW07A															
	SMSMW07A	6/28/2012	2900	ND	ND	ND	5.6	ND	ND	2700	ND	18000	0.070 J,Q-2	3.6 J,CLP36,Q-2	ND
	SMSMW07AF	6/28/2012	650	ND	ND	ND	5.2	ND	23 J,Q-2	ND	ND	18000	0.055 J,Q-2	ND	ND
	SMSMW07A	8/27/2013	430	ND	4.1 J,CLP36,Q-2	ND	4.9 J,Q-2	ND	ND	100	ND	11000	ND	ND	ND
	SMSMW07A	11/13/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	42000	0.22	23	ND
	SMSMW07A	3/4/2014	ND	ND	ND	ND	ND	ND	30 J,Q-2	ND	ND	13000	ND	ND	19 J,CLP36,Q-2
	SMSMW07A	6/23/2014	990	ND	ND	ND	ND	ND	43	ND	ND	16000	0.036 J,Q-2	ND	ND
SMSMW07B															
	SMSMW07B	6/28/2012	200	ND	ND	ND	6.6	ND	ND	ND	ND	72000	0.91	4.6 J,CLP36,Q-2	ND
	SMSMW07B	8/27/2013	100 J,Q-2	ND	3.2 J,CLP36,Q-2	ND	3.7 J,Q-2	ND	ND	31 J,Q-2	ND	45000	0.049 J,Q-2	ND	ND
	SMSMW07B	11/13/2013	ND	ND	6.0	ND	3.1	ND	ND	ND	ND	18000	ND	33	ND
	SMSMW07B	3/4/2014	ND	ND	ND	ND	ND	ND	27 J,Q-2	ND	ND	42000	ND	30 J,CLP36,Q-2	47 J,CLP36,Q-2
	SMSMW07B	6/23/2014	82 J,Q-2	ND	ND	ND	ND	ND	9.7 J,Q-2	ND	ND	39000	0.13 J,Q-2	ND	ND
SMSMW08A															
	SMSMW08A	6/27/2012	13000	ND	10 CLP36	ND	ND	14	52	17000	30	2600	ND	ND	ND
	SMSMW08AF	6/27/2012	120 J,Q-2	ND	ND	ND	ND	ND	ND	ND	ND	390	ND	ND	ND
	SMSMW08A	8/29/2013	1500	ND	4.6 J,CLP36,Q-2	ND	0.19 J,Q-2	ND	58	2300	4.7 J,Q-2	330	ND	ND	ND
	SMSMW08A	11/13/2013	650	ND	ND	ND	ND	ND	ND	620	ND	240	ND	ND	ND
	SMSMW08A	3/5/2014	390 J,Q-2	ND	ND	ND	ND	ND	ND	400	ND	200	ND	ND	ND
	SMSMW08A	6/25/2014	420	ND	ND	ND	ND	ND	ND	ND	ND	210	ND	ND	ND
SMSMW10A															
	SMSMW10A	6/27/2012	200000	ND	51 CLP36	44	1400	22	680	4900	77	200000	9.6	ND	ND
	SMSMW10AF	6/27/2012	180000	ND	34 CLP36	39	1400	12	480	ND	64	200000	5.0	ND	ND
	SMSMW10A	6/3/2013	26000	ND	7.6 J,CLP36,Q-2	7.0	420	ND	ND	ND	ND	12000	5.7	ND	75 CLP36
	SMSMW10A	8/26/2013	29000	ND	11 CLP36	7.5	630	ND	29	ND	23	14000	8.0	ND	80 CLP36
	SMSMW910A*	8/26/2013	29000	ND	11 CLP36	7.0	560	ND	28	ND	18	14000	7.9	ND	72 CLP36
	SMSMW10A	3/3/2014	220000	ND	82 CLP36	54	570	15	270	ND	57	100000	8.1	77 CLP36	92 CLP36
	SMSMW910A*	3/3/2014	200000	ND	68 CLP36	49	490	15	260	120	49	94000	7.2	69 CLP36	88 CLP36
SMSMW10B															
	SMSMW10B	6/26/2012	1500	ND	ND	ND	ND	ND	ND	ND	ND	8000	ND	55 CLP36	ND
	SMSMW10B	12/12/2012	2100	ND	ND	1.1 J,Q-2	ND	ND	ND	130	ND	6600	ND	53 CLP36	ND
	SMSMW910B*	12/12/2012	2400	ND	ND	1.2 J,Q-2	ND	ND	2.7 J,Q-2	140	ND	7400	ND	60 CLP36	ND
	SMSMW10BF	12/12/2012	2200	ND	ND	1.2 J,Q-2	ND	ND	ND	ND	ND	7400	ND	58 CLP36	ND
	SMSMW910BF*	12/12/2012	2200	ND	ND	1.5 J,Q-2	ND	ND	3.8 J,Q-2	ND	ND	7400	ND	55 CLP36	ND
	SMSMW10B	8/26/2013	650	ND	ND	ND	1.2 J,Q-2	ND	ND	ND	ND	4100	ND	60 CLP36	ND
	SMSMW10B	11/12/2013	27000	ND	15	ND	1.9	31	ND	28000	13	7500	0.23	54	ND
	SMSMW10B	3/3/2014	840	ND	ND	ND	1.7 J,Q-2	ND	ND	220	ND	4700	ND	68 CLP36	8.8 J,CLP36,Q-2
	SMSMW10B	6/24/2014	2100	ND	ND	ND	ND	ND	ND	ND	ND	8000	ND	64 CLP36	ND
SMSMW11A															
	SMSMW11A	6/4/2013	ND	ND	9.4 J,CLP36,Q-2	ND	ND	ND	ND	340	ND	38	0.058 J,Q-2	ND	ND
	SMSMW11A	8/28/2013	330	ND	22 CLP36	ND	ND	ND	5.0 J,Q-2	260	ND	50	ND	ND	ND
	SMSMW11A	11/12/2013	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SMSMW11A	3/4/2014	2000	ND	ND	ND	ND	ND	ND	2100	ND	220	ND	ND	ND
	SMSMW11A	6/24/2014	280	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.8 J,CLP36,Q-2
SMSMW11B															
	SMSMW11B	6/5/2013	ND	ND	4.2 J,CLP36,Q-2	ND	ND	96	ND	440	ND	360	0.039 J,Q-2	ND	ND
	SMSMW911B*	6/5/2013	ND	ND	5.9 J,CLP36,Q-2	ND	ND	46	ND	ND	ND	400	0.038 J,Q-2	ND	ND
	SMSMW11B	8/28/2013	160 J,Q-2	ND	4.7 J,CLP36,Q-2	ND	ND	ND	4.2 J,Q-2	71 J,Q-2	ND	250	ND	4.4 J,CLP36,Q-2	ND
	SMSMW11B	11/12/2013	ND	ND	5.7	ND	ND	ND	ND	ND	ND	270	ND	ND	ND
	SMSMW11B	3/4/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	230	ND	ND	ND
	SMSMW11B	6/23/2014	240	ND	ND	ND	ND	ND	ND	ND	ND	210	ND	ND	ND
SMSMW12A															
	SMSMW12A	6/3/2013	ND	ND	ND	ND	ND	110	ND	520	ND	270	0.023 J,Q-2	ND	ND
	SMSMW12A	8/27/2013	43 J,Q-2	ND	ND	ND	ND	ND	ND	ND	ND	100	ND	ND	ND
	SMSMW12A	11/14/2013	5400	0.53	3.7	ND	ND	270	1700	8700	5.7	380	ND	ND	ND
	SMSMW12A	3/5/2014	160 J,Q-2	ND	ND	ND	ND	ND	3.3 J,Q-2	ND	ND	83	ND	ND	ND
	SMSMW12A	6/23/2014	94 J,Q-2	ND	ND	ND	ND	ND	61	740 J,CLP26	ND	91	ND	ND	ND

Table 5-11
Ground Water Exceeding MCLs for Metals
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

		Analyte Group	Metals												
		Analyte	Aluminum	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Selenium	Thallium
		Results Unit	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
		USEPA MCL[1]	200[a]	6	10	4	5	100	1300	300[a]	15	50[a]	2	50	2
Statio	Sample ID	Sample Date													
SMSMW12B															
	SMSMW12B	6/4/2013	ND	ND	ND	ND	ND	12	ND	ND	ND	130	0.026 J,Q-2	ND	ND
	SMSMW12B	8/27/2013	190 J,Q-2	ND	ND	ND	ND	ND	ND	110	ND	110	ND	ND	ND
	SMSMW12B	11/12/2013	3300	ND	2.4	ND	ND	6.1	ND	5800	2.6	250	ND	ND	ND
	SMSMW12B	3/4/2014	1200	ND	ND	ND	ND	ND	ND	860	1.6 J,Q-2	140	ND	ND	2.1 J,CLP36,Q-2
	SMSMW12B	6/23/2014	650	ND	ND	ND	ND	ND	ND	1100 J,CLP26	ND	120	ND	ND	ND
SMSMW13A															
	SMSMW13A	6/3/2013	1200	ND	ND	1.7 J,Q-2	14	52	86	ND	ND	3400	0.046 J,Q-2	23 J,CLP36,Q-2	ND
	SMSMW13A	3/4/2014	1800	ND	ND	ND	14	ND	74	ND	ND	3600	ND	22 J,CLP36,Q-2	6.4 J,CLP36,Q-2
SMSMW13B															
	SMSMW13B	6/3/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100	0.018 J,Q-2	ND	ND
	SMSMW13B	8/26/2013	49 J,Q-2	ND	ND	ND	1.5 J,Q-2	ND	ND	44 J,Q-2	ND	970	ND	ND	ND
	SMSMW13B	11/12/2013	250	ND	ND	ND	0.66	ND	ND	460	ND	1500	ND	5.3	ND
	SMSMW13B	3/4/2014	210	ND	ND	ND	1.7 J,Q-2	ND	13 J,Q-2	ND	ND	1300	ND	4.6 J,CLP36,Q-2	2.7 J,CLP36,Q-2
	SMSMW13B	6/25/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	1400	ND	6.5 J,Q-2,CLP36	ND
SMSJ08**															
	SMSGWJ08-21	5/9/2011	17000	ND	35 CLP36	ND	ND	13	190	3000	13	260	ND	ND	ND
SMSSV13**															
	SMSSVGW13	6/24/2014	4800	ND	ND	ND	ND	ND	11 J,Q-2	9300 J,CLP26	ND	1200	ND	ND	ND

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2009. National Primary Drinking Water Regulations, Maximum Contaminant Levels. http://water.epa.gov/drink/contaminants/

[a]USEPA. 2009. Secondary MCLs

*Denote duplicate sample

**Denote discrete groundwater sample

Analytical results exceeding National Primary and Secondary Drinking Water Standard

USEPA - United States Environmental Protection Agency

MCL - Maximum Contaminants Level

µg/L - microgram per liter

NE - Not Established

ND - Non Detect

Qualifiers

CLP01 - Concentration reported is less than the lowest standard on calibration curve

CLP36 - Identification/Concentration of analyte not confirmed by ICP-MS.

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

QS-3 - Surrogate recovery is lower than established control limits.

QS-5 - Surrogate recovery is higher than established control limits

Table 5-12
Ground Water Exceeding MCLs for SVOCs and VOCs
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

		Analyte Group	SVOCs		VOCs	
		Analyte	Bis(2-ethylhexyl) phthalate	Pentachlorophenol	Methylene Chloride	Tetrachloroethene
		Results Unit	µg/l	µg/l	µg/l	µg/l
		USEPA MCL[1]	6	1	5	5
Station ID	Sample ID	Sample Date				
SMSMW01A						
	SMSMW901A*	6/27/2012	17	ND	1.3	ND
SMSMW02A						
	SMSMW02A	6/26/2012	ND	ND	5.3 J,QS-5	18 J,QS-5
	SMSMW02A	6/5/2013	ND	ND	6.8	14
	SMSMW02A	8/26/2013	ND	ND	7.8	13
	SMSMW02A	11/13/2013	ND	4.0 J,Q-2	7.8	14
	SMSMW02A	3/5/2014	ND	ND	ND	11
	SMSMW02A	6/24/2014	ND	3.2 J,CLP01	8.3	13
	SMSMW902A	6/24/2014	ND	2.8 J,CLP01,QS-3	8.2	13
SMSMW07A						
	SMSMW07A	8/27/2013	ND	1.4 J,CLP01	ND	0.61 J,CLP01
SMSMW07B						
	SMSMW07B	11/13/2013	ND	1.1 J,Q-2	1.3	0.70
SMSMW08A						
	SMSMW08A	6/27/2012	23	ND	ND	ND
SMSMW10A						
	SMSMW10A	6/27/2012	7.3	ND	ND	ND
SMSMW10B						
	SMSMW10B	6/26/2012	67	ND	ND	ND
SMSMW11A						
	SMSMW11A	8/28/2013	ND	2.5 J,CLP01	ND	0.93 J,CLP01
	SMSMW11A	11/12/2013	ND	2.1 J,Q-2	0.37 J,Q-2	0.90
	SMSMW11A	6/24/2014	ND	2.3 J,CLP01	ND	0.64 J,CLP01
SMSMW11B						
	SMSMW11B	8/28/2013	ND	2.5 J,CLP01	ND	0.77 J,CLP01
	SMSMW11B	6/23/2014	ND	2.3 J,CLP01	ND	0.60 J,CLP01
SMSJ08**						
	SMSGWJ08-21	5/9/2011	ND	1.1 J,Q-2	0.44 J,Q-2	ND
SMSSV13**						
	SMSSVGW13	6/24/2014	ND	ND	ND	ND

Table 5-12
Ground Water Exceeding MCLs for SVOCs and VOCs
Smokey Mountain Smelter Site
Knoxville, Knox County, Tennessee

Notes

Data presented is a tabulation of sample locations where results exceed screening values.

[1]USEPA. 2009. National Primary Drinking Water Regulations, Maximum Contaminant Levels. http://water.epa.gov/drink/contaminants/

[a]USEPA. 2009. Secondary MCLs

*Denote duplicate sample

**Denote discrete groundwater sample

Analytical results exceeding National Primary and Secondary Drinking Water Standard

SVOCs - Semi volatile Organic Compounds

VOCs - Volatile Organic Compounds

USEPA - United States Environmental Protection Agency

MCL - Maximum Contaminants Level

µg/L - microgram per liter

NE - Not Established

ND - Non Detect

Qualifiers

CLP01 - Concentration reported is less than the lowest standard on calibration curve

J - The identification of the analyte is acceptable; the reported value is an estimate.

Q-2 - Result greater than MDL but less than MRL.

QS-3 - Surrogate recovery is lower than established control limits.

QS-5 - Surrogate recovery is higher than established control limits

Based on the analytical results, there does not appear to be an identified pathway between the soil gas and ground water.

6.0 Current and Potential Future Land and Water Uses

The SMS property is part of a suburb of south Knoxville, Tennessee. Figure 6-1 shows land use from the Knoxville Geographic Information System (KGIS, 2013). Current land use is a mixture of medium density industrial with immediately adjacent properties zoned as residential, commercial, and agricultural. To the east and northeast are the Montgomery Village Apartments, a low income housing complex. To the southeast is agricultural or estate land use. The area is supplied by a public water system but some residents may obtain water from private wells (ATSDR, 1998). Several well surveys and sampling events have been conducted by the state of Tennessee over the last several years and no site-related impact in drinking water supply wells has been detected. Current ground water use is drinking water. Surface water use designation is recreational.

The SMS property was developed in the early 1900s as an industrial site with construction of the Knoxville Fertilizer Company. Two active railroads border two sides of the property. To the east is the Norfolk Southern railway and to the west are tracks operated by CSX Transportation. The land use to the west, and including the railroad, is used as commercial property. The property bordering SMS to the north is residential. The property to the south and southwest has remained undeveloped. These zoning designations have not changed over the past 50 years and no significant development or plans for zoning changes are known to exist.

7.0 Summary of Site Risks

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site. The remedy selected in this ROD is necessary to protect public health or welfare, or the environment from actual or threatened releases of pollutants and hazardous substances into the environment. The human health and ecological risk summaries are presented below.

7.1 Human Health Risk Assessment

Preparation of a Human Health Risk Assessment (HHRA) is required by the NCP, which states that the lead agency for a Superfund site shall conduct a site-specific HHRA as part of the RI process (40 CFR §300.430). The data collected during the RI satisfied the data quality objectives of the project and were determined to be of adequate quality for use in the risk assessment.

The risk assessment estimates what risks the Site poses if no actions were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The site-specific HHRA was conducted to estimate the excess cancer risks and non-cancer hazards to human health associated with the current and future exposures to contaminants at the Site. The risk assessment included four parts: Data Collection and Evaluation, Exposure Assessment, Toxicity Assessment, and Risk Characterization. Each is described below.

7.1.1 Data Collection and Evaluation

The Data Collection and Evaluation step involved a review of available data, evaluation of the data usability and data validation, establishment of guidelines for data reduction, evaluation of data for use in the risk assessment, and culminated in the election of the COPCs. COPCs were selected according to EPA guidance as described in the HHRA (J.M. Waller, 2015a). Table 7-1 lists the soil COPCs.

Table 7-1. Soil COPCs

On-Site (Surface Soil)	Flenniken Branch (Surface Soil)	On-Site (Total Soil)	Flenniken Branch (Total Soil)
2,3,7,8-TCDD TEQ	Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene
Aluminum	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene
Arsenic	Benzo(b)fluoranthene	Benzo(b)fluoranthene	Benzo(b)fluoranthene
Chromium	Benzo(k)fluoranthene	Benzo(k)fluoranthene	Benzo(k)fluoranthene
Cobalt	Chrysene	Chrysene	Chrysene
Copper	2,3,7,8-TCDD TEQ	Indeno(1,2,3-cd)pyrene	2,3,7,8-TCDD TEQ
Iron	Aluminum	PCB-1232	Aluminum
Manganese	Arsenic	Aluminum	Arsenic
Vanadium	Chromium	Arsenic	Chromium
Thallium	Cobalt	Chromium	Cobalt
Zinc	Cyanide	Cobalt	Cyanide
	Iron	Copper	Iron
	Manganese	Iron	Manganese
	Thallium	Manganese	Thallium
		Thallium	
		Zinc	
		Vanadium	

Table 7-2 lists the ground water COPCs.

Table 7-2. Ground Water COPCs

1,2,4-Trimethylbenzene
2,4-Dinitrotoluene
4,4-DDD
Benzene
Bis(2-ethylhexyl)phthalate (BEHP)
Bromodichloromethane
Bromomethane
Chloroform
Dibenzofuran
Dieldrin
Ethylbenzene
Naphthalene
Pentachlorophenol
Phenol
Tetrachloroethene
Trichloroethene (TCE)
(m- and/or p-)Xylene
Aluminum
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Strontium
Thallium
Vanadium
Zinc

Table 7-3 lists the fish tissue COPCs.

Table 7-3. Fish Tissue COPCs

Carp	Largemouth Bass	All Species
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ
PCB Dioxin-Like Congener TEQ	PCB Dioxin-Like Congener TEQ	PCB Dioxin-Like Congener TEQ
PCB-1260	PCB-1260	PCB-1260
Arsenic	Chromium	Arsenic
Chromium	Mercury	Chromium
Lead		Lead
		Mercury

Table 7-4 lists soil gas COPCs.

Table 7-4. Soil Gas COPCs

1,1-Dichloroethane
1,2,4-Trimethylbenzene
1,2-Dichloroethane
Benzene
Chloroform
Chloromethane
Ethylbenzene

7.1.2 Exposure Assessment

In accordance with EPA and EPA Region 4 guidance, the HHRA evaluated risks based on current and reasonably anticipated future land and water uses. Potential receptors included an on-Site worker, a trespasser, a recreational user, a construction/utility worker, and a hypothetical future resident. The HHRA evaluated three separate exposure areas (EAs): the on-Site EA, Flenniken Branch, and Knob Creek Embayment. The primary exposure media of concern were waste (on-Site), sediment (on-Site, Flenniken Branch, and Knob Creek Embayment), ground water (on-Site), fish (Knob Creek Embayment), soil gas (on-Site), and surface water (on-Site, Flenniken Branch, and Knob Creek Embayment). See the HHRA (J.M. Waller, 2015a) for details.

7.1.3 Toxicity Assessment

Toxicity values for COPCs were obtained from the following hierarchy of sources in accordance with the EPA Office of Superfund Remediation and Technology Innovation (EPA, 2003):

- Tier 1 – Integrated Risk Information System (IRIS) (EPA, 2015).

- Tier 2 – Provisional Peer-Reviewed Toxicity Values (PPRTVs).
- Tier 3 – Other (Peer Reviewed) Values, including: Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), and Health Effects Assessment Summary Tables (HEAST) (EPA, 1997).

7.1.4 Risk Characterization

The HHRA concluded the following:

- The excess cancer risks for future on-Site workers and future lifetime residents exceeded EPA's generally accepted excess cancer risk range of 1E-06 to 1E-04 (one-in-one million to one-in-ten thousand). Potential ingestion exposure to arsenic and chromium in both shallow and deep ground water accounted for the majority of the excess cancer risk. The HHRA concluded that surface soil presented a hazard index (HI) greater than 1 for any future on-site child residents. As a result, future use will be limited to commercial and/or industrial uses.
- As measured by hazard indices (HIs) greater than 1, potential non-cancer hazards exceeded EPA's generally accepted HI threshold of 1 for future on-Site workers, future adult residents, and future child residents. Potential ingestion exposure to cobalt, manganese, and thallium in shallow ground water and manganese and thallium in deep ground water accounted for the majority of the potential non-cancer hazards.
- Excess cancer risks and non-cancer HIs associated with exposure to shallow and deep ground water are summarized in Table 7-5.

Table 7-5. Summary of Excess Cancer Risk and Non-Cancer Hazard Indices (HIs)

Potential Receptor	Shallow or Deep Ground Water	Excess Cancer Risks	Hazard Indices (HIs)
Future On-Site Worker	Shallow	3.1E-04	199
	Deep	2.7E-04	132
Future Lifetime Resident	Shallow	1.4E-03	NA
	Deep	1.7E-03	NA
Future Adult Resident	Shallow	NA	296
	Deep	NA	211
Future Child Resident	Shallow	NA	487
	Deep	NA	345

7.2 Ecological Risk Assessment

The Ecological Risk Assessment (ERA) documents the potential exposure and consequent risk to ecological receptors exposed primarily to contamination down gradient of the former SMS facility since this was the area historically impacted by the wastes at the Site and all of the wastes on site have been capped to prevent exposure. Areas and media evaluated in the ERA included: off-Site surface soils; surface water and sediments in Flenniken Branch; and surface water, sediment, and fish tissue collected from the Kolb Creek Embayment. In addition, the ERA included sediment toxicity testing and benthic community analysis for Flenniken Branch. The ecological risk results are summarized on a media-specific basis below.

7.2.1 Soil

Given the conservative assumptions used in the ERA, it was concluded that it is doubtful that Site-related contamination is having a negative impact on omnivorous birds or on omnivorous mammals within the study area.

Incremental risks for the American robin are limited to copper and zinc exposure primarily resulting from soil invertebrate ingestion. In Section 4.2 of the ERA, the results indicate that the only appreciable risks to receptors from exposure to the surface soils are from copper, and this to songbirds (Section 4.2.2.3, LOAEL HQ ~8). The calculated risks to the robin from other site contaminants and all calculated risks to the raccoon – the two model receptors used - are within acceptable limits.

The analytical data for copper in site surface soils were evaluated at to determine where the majority of the high copper risk may be coming from regarding the songbird risks from copper that were calculated. The data from the 47 copper samples that were used in the risk assessment were put into ProUCL to determine what samples might have to be remediated/ addressed in some form to bring the 95% UCL of the mean of the surface soil copper concentrations down to a point where the calculated copper risk to songbirds would be acceptable. Since the calculated HQ was roughly 8, and the current 95% UCL of the mean of the surface soil copper concentrations is 378 mg/kg, and the risk equations are linear (not exponential), it is determined that by reducing the 95% UCL of the mean copper concentrations to roughly 1/8 of 378 mg/kg, or roughly 50 mg/kg, doing so should adequately address the calculated risks of copper to the songbirds on the site. More risk assessment including collecting invertebrate tissue from the site to measure for copper concentrations to use in the risk assessment calculations instead of using the modeled copper concentrations as has been done is another option, and would reduce the uncertainty in the current risk estimates.

It was determined by EPA that if samples with copper concentrations above 140 mg/kg were addressed, this would reduce the 95% UCL of the mean surface soil copper concentration to 49.9 mg/kg, given the data currently available. As a result, the surface soil from locations H07, H05, J03, N05, N04, I04, F08, G06, M05, K04, and L04 (Figure 5-5) will be placed under the capped waste as an adaptive management measure of the remedy.

Addressing these surface soils by capping, removal or other means to reduce the copper concentrations in the surface soils should serve to eliminate the calculated unacceptable risk from copper to songbirds. Given the other information from the risk assessment and the planned site remediation to address metals moving off-site into the surface water of Flenniken Branch, this action as an adaptive management measure will adequately address all identified significant ecological risk on or associated with the site, given the current knowledge of the site and on-site/off-site conditions.

7.2.2 Surface Water

A comparison of surface water concentrations to benchmarks for Flenniken Branch and the Knob Creek Embayment identified iron, chloride, and nitrite in Flenniken Branch as potentially of ecological concern (Table 5-7). However, the areas potentially affected by iron, chloride, and nitrite are limited in extent (Figure 5-7). For this reason, although potential impacts to water-column biota cannot be definitively determined, it was concluded that any Site-related impacts would be minimal.

7.2.3 Sediment

While sediments in Flenniken Branch and the Knob Creek Embayment of the Tennessee River appear to be somewhat impacted, these impacts do not appear to be Site-related since the watersheds for Flenniken Branch and the Tennessee River have multiple larger sources of contamination due to the industrial nature of the area. The ERA concluded based on sediment analytical data (Tables 5-9 and 5-10) that it is doubtful that Site-related contamination is having a negative impact on piscivorous birds or piscivorous mammals within the study area.

7.2.4 General Conclusion

The ERA failed to show the presence or likelihood of substantial future ecological impairment associated with Site-related contamination.

8.0 Remedial Action Objectives

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish. Developing RAOs requires an understanding of the contaminants in their respective media and is based upon the evaluation of risk to human health and the environment, protection of ground water, federal and state Applicable or Relevant and Appropriate

Requirements (ARARs), and expected land use. RAOs provide the basis for the development of the remedial alternatives. The following RAOs were developed:

- Implement the final disposition of the waste material in a manner to minimize direct contact to human and ecological receptors.

- Reduce or eliminate the migration of the contaminants from the capped wastes that could cause adverse impacts to the ground water and Flenniken Branch.

- Prevent human exposure (direct contact, ingestion or inhalation) of ground water contaminated with COCs above levels that are protective for potable use.

- Restore contaminated ground water to beneficial use, drinking water purposes.

8.1 Cleanup Levels

Cleanup levels are concentrations of contaminants in environmental media that, when attained, are protective and achieve RAOs. Cleanup levels for response actions under CERCLA generally are based on Site-specific risk and ARARs. EPA typically uses the results of the HHRA to establish the basis for taking remedial action. Action is generally warranted for those impacted media at a Site when the baseline HHRA indicates that a cumulative risk exceeds an HI of 1 using reasonable maximum exposure assumptions for either current or future land use (EPA, 1991). At Sites where the excess cancer risk is less than 1E-04 and/or the non-carcinogenic HI is less than 1, action may still be warranted when a chemical-specific ARAR that defines acceptable risk is exceeded (e.g., state numeric water quality criteria promulgated under the Clean Water Act). Only those state standards that are promulgated and that are more stringent than federal requirements may be applicable or relevant and appropriate.

In addition to chemical-specific ARARs, other advisories, criteria, or guidance may be considered for a particular release if useful in developing Superfund remedies; see 40 CFR §300.400(g)(3). This "to-be-considered" (TBC) category consists of advisories, criteria, or guidance that were developed by EPA, other federal agencies, or states that may assist in determining, for example, health-based or ecological-risk based levels for a particular contaminant or medium for which there are no chemical-specific ARARs. TBCs are not considered legally enforceable and, therefore, are not considered to be applicable for a site but typically are evaluated along with chemical-specific ARARs as part of the risk assessment to determine protective cleanup levels.

No excess cancer risks or unacceptable non-cancer hazards to human receptors were identified in soil, surface water, or sediment, thus no cleanup levels were developed for these media. The engineered cap portion of the proposed remedy will eliminate the potential for rain water or surface water to come in contact with the waste material, preventing the generation of leachate. Periodic inspections of the cap will verify that it remains intact. If erosion or breaches

are observed, they will be repaired in accordance with the site's O&M plan. The Site-specific ground water cleanup levels are presented in Tables 8-1.

Table 8-1. Ground Water Chemicals of Concern and Cleanup Levels

Chemical of Concern	Maximum Detection (µg/L)	Cleanup Level (µg/L)	Basis for Cleanup Level
Aluminum	220,000	1,997	HQ=1
Ammonia	507,000	30,000	EPA Health Advisory
Arsenic	82	10	MCL
Chromium	270	100	MCL
Cobalt	2,600	0.6	HQ=1
Fluoride	330,000	4,000	MCL
Manganese	200,000	43	HQ=1
Mercury	9.6	2	MCL
Nickel	2,100	39	HQ=1
Nitrate/Nitrite	500,000	10,000	MCL
Pentachlorophenol	4	1	MCL
Thallium	92	2	MCL
Zinc	71,000	600	HQ=1

MCL is Maximum Contaminant Level

HQ=1 is Hazard Quotient (non-cancer hazard) equal to 1

9.0 Description of Alternatives

As a part of the FS, a variety of cleanup technologies were first screened by the methods described in the NCP at 40 CFR §300.430(e)(7) for their implementability and effectiveness in abating the identified risks at this Site. Details regarding the technology screening are presented in the FS.

In combining successfully screened technologies and process options into remedial alternatives, EPA recommends that a range of treatment alternatives should be developed, varying primarily in the extent to which they rely on long-term management of residuals and untreated wastes. The upper bound of the range would be an alternative that would eliminate, to the extent feasible, the need for any long-term management (including monitoring) at the site. The lower bound would consist of an alternative that involves treatment as a principal element (i.e., treatment is used to address the principal threats at the site), but some long-term management of portions of the site that did not constitute 'principal threats' would be required.

In addition, EPA includes a No Action alternative as a basis for comparison as required by the NCP (EPA, 1989).

A description of each alternative, along with estimated costs for capital, operation and maintenance (O&M), and total net present worth are provided below. The net present worth costs were calculated using an annual discount rate of 7%.

9.1 Alternative I: No Action

Estimated Capital Cost: *$0*
Estimated O&M Cost: *$0*
Estimated Present Worth Cost: *$0*
Estimated Time to Construct: N/A
Estimated Time to Achieve RAOs and Cleanup Levels: N/A

The No Action alternative maintains the Site as is. The No Action alternative does not address ground water contamination at the Site; however, it is retained to provide a baseline for comparison to other alternatives. There would be no reduction in toxicity, mobility, or volume of the contaminants other than what would result from natural biodegradation and other attenuation factors. The Site would not be available for unrestricted use.

The No Action alternative would result in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure. Therefore, the Five-Year Review cycle would be enacted as a consequence of this alternative. Five-Year Reviews performed over the course of a 30-year period result in a total of six (6) Five-Year Reviews. Optionally, the review can also include a minimal sampling and analysis task (e.g., ground water samples collected from existing monitoring wells) performed immediately prior to each Five-Year Review cycle to support the evaluation of Site conditions as part of the Site review process.

This alternative would not be protective of human health and the environment, and would not meet ARARs.

9.2 Alternative II: Capping, pH Adjustment for Ground Water Treatment, Ground Water Monitoring, and ICs

Estimated Capital Cost: *$3,365,000*
Estimated O&M Cost: *$901,000 (30 years)*
Estimated Present Worth Cost: *$3,741,000*
Estimated Time to Construct: *1-2 years*
Estimated Time to Achieve RAOs and Cleanup Levels: *3-7 years*

The remedy for Alternative II would involve installation of RCRA Subtitle C compliant engineered caps above areas of wastes initially capped during the 2010 time critical removal to

prevent any additional leaching of contaminants into the surficial aquifer and surface water. The ground water component for Alternative II would consist of injection of a pH amendment using direct-push technology (DPT) to treat contaminated ground water.

The components of Alternative II are as follows:

- Construction of a RCRA Subtitle C compliant cap over previously capped areas to prevent additional leaching of contaminants to ground water and surface water
- pH adjustment for ground water treatment.
- Monitoring of ground water contamination in the surficial aquifer to evaluate the progress of the remedy
- ICs to preserve the integrity of the cap, prevent disturbance of wastes beneath the cap, prevent use of contaminated ground water, and limit Site property use to commercial/industrial

Component 1: Capping

Areas over which the capping system would be installed are depicted on Figure 9-1. The estimated areas for capping are 171,500 ft^2 (3.9 acres) at Source No. 1 and 29,000 ft^2 (0.7 acres) at Source No. 2. For cost estimating purposes, it was assumed that a Resource Conservation and Recovery Act (RCRA) Type C cover would be used. It would consist of a gas collection layer (geonet), geosynthetic clay liner, high-density polyethylene liner, drainage layer, 18 inches of clean soil, six inches of top soil, and seed and mulch. Any waste excavated during cap installation would be placed under the cap as applicable. The cap would be inspected at least annually and repairs made immediately if needed. Vegetative caps are estimated to require maintenance and mowing every month. As required by CERCLA, a review of Site conditions and risks would be conducted every five years since contamination would remain on-Site above levels that allow for unlimited use and unrestricted exposure.

Component 2: pH Adjustment for Ground Water Treatment

The ground water treatment component of Alternative II consists of an adjustment of the pH to promote precipitation of metals contamination in ground water. A line of DPT points would be advanced between the former processing structure and the main Waste Area so that ground water would be treated as it flows toward the main Waste Area. This line of injection points would be located perpendicular to the shallow ground water flow direction within the main Waste Area. This shallow ground water within the main Waste Area is an isolated zone of ground water that is the most heavily impacted by contamination at the site. The ground water flow within this area is interpreted to be generally to the southwest, following the line of the creek bed that was buried under the main Waste Area. Assuming a line approximately 750 ft in

length, 50 DPT points would be required using a 15-foot spacing. The 15-foot spacing was selected based on the nature of the lithology at the Site being described as silty clay soils. Based on the observed contamination and depths of nearby wells, the depth of the points would be 40 ft, with a treatment zone of 30 to 40 ft bgs. Sodium bicarbonate solution would be injected into the DPT points to raise the pH to approximately 8. Approximately 700 pounds of sodium bicarbonate would be required based on a 7.5% solubility of sodium bicarbonate and an assumed porosity of 0.3.

Component 3: Ground Water Monitoring

Ground water samples would be collected from surficial aquifer monitoring wells for COCs and ground water parameters to evaluate the progress of metals precipitation. A ground water monitoring plan would be prepared during the remedial design specifying the number of wells to be sampled along with specific sampling parameters and sampling frequency. For cost estimating purposes, it was assumed that all monitor wells would be sampled at a frequency of quarterly for the first year, semi-annually for years two through four, and annually thereafter. Monitoring results would be evaluated with respect to the exit strategy decision flow charts that would be developed in the remedial design. If ground water remediation has progressed to a point that meets the decision point requirements, the monitoring program could be modified or discontinued, and a technical basis would be available for the removal of ICs.

Component 4: Institutional Controls

ICs would be required to preserve the integrity of the caps, prevent disturbance of waste beneath the caps, and prevent use of contaminated ground water. ICs would consist of restrictions on land use to eliminate or reduce the potential for unacceptable human health risks because of exposure to the capped wastes. In addition, installation of new water supply wells within the plume area would be prohibited. Inspections of the Site would be conducted to confirm compliance with IC objectives, and an annual compliance certificate would be prepared and provided to the EPA. Prior to any property conveyance, the EPA would be notified. The ICs would be maintained for as long as they are required to prevent unacceptable exposure to contaminated media and preserve the integrity of the remedy.

9.3 Alternative III: Capping and ICs

Estimated Capital Cost: *$2,687,000*
Estimated O&M Cost: *$901,000 (30 years)*
Estimated Present Worth Cost: *$3,359,000*
Estimated Time to Construct: *1-2 years*
Estimated Time to Achieve RAOs and Cleanup Levels: *30 years*

Alternative III is the same as Alternative II except that no pH adjustment of ground water would be performed. Ground water contamination would be monitored only.

9.4 Alternative IV: Excavation, On-site Containment Cells, Ground Water Monitoring, and ICs

Estimated Capital Cost: *$31,314,000*
Estimated O&M Cost: *$901,000 (30 years)*
Estimated Present Worth Cost: *$31,986,000*
Estimated Time to Construct: *1-2 years*
Estimated Time to Achieve RAOs and Cleanup Levels: *30 years*

The waste remedy for Alternative IV would consist of the following components: delineation of excavation areas, excavation, construction of two containment cells, and ICs. Excavation of wastes would be performed at Source No. 1 and Source No. 2. Excavated waste would be stockpiled on-Site during construction of the containment cells and disposed of on-Site, inside the containment cells.

The ground water remedy for Alternative IV would consist of monitoring and ICs. ICs would be implemented to restrict exposure to waste and ground water. As required by CERCLA, a review of Site conditions and risks would be conducted every five years since contamination would remain on-Site above levels that allow for unlimited use and unrestricted exposure.

The components of Alternative IV are as follows:

- Delineation of Source No. 1 and Source No. 2
- Excavation of Source No. 1 and Source No. 2
- Construction of containment cells for Source No. 1 and Source No. 2
- Monitoring of ground water contamination in the surficial aquifer to evaluate the progress of natural attenuation
- ICs to preserve the integrity of the containment cells, prevent disturbance of waste beneath the containment cells, and prevent use of contaminated ground water

Component 1: Delineation of Excavation Areas

No additional waste sampling would be required to delineate the areas requiring excavation. Previous waste sampling and analysis confirms the location of waste to be confined to the exterior waste pile and former process building areas.

Component 2: Excavation of Contaminated Areas

At a minimum, utility clearance would be conducted in the proposed excavation areas for water, communication, and electrical lines. Wastes in an estimated area of 171,500 ft^2 (3.9 acres) for Source No. 1 would be excavated, as determined by the delineation in Component 1, for

installation of the containment cell liner. Wastes at Source No. 2 would not be excavated, as the former process building's concrete foundation will serve as the liner for the containment cell at this location. A total of approximately 101,500 cubic yards would be excavated from Source No. 1.

Component 3: Containment Cells

Two containment cells would be created. One containment cell would be located within the footprint of Source No. 1. Waste would be excavated and stockpiled on-Site while a liner is installed. After the liner is installed, the excavated waste would be placed on top of the liner, and a cap installed over the waste. The other containment cell would be located within the footprint of Source No. 2. This area does not require installation of a liner because the concrete foundation of the former process building (which covers the entire area of Source No. 2) serves as an impermeable barrier. A cap would be installed on top. For cost estimating purposes, it was assumed that vegetative caps would be used consisting of 18 inches of clean soil, six inches of top soil, and seed and mulch. Any waste excavated during cap installation would be placed under the caps. The caps would be inspected at least annually and repairs made immediately if needed. Vegetative caps are estimated to require maintenance and mowing every month.

Component 4: Monitoring of the Ground Water

This component of the remedy is the same as described in Alternative II.

Component 5: Implementation of ICs

This component of the remedy is the same as described in Alternative II.

9.5 Alternative V: Solidification/Stabilization, Cap, Monitoring, and ICs

Estimated Capital Cost: *$22,708,000*
Estimated O&M Cost: *$901,000 (30 years)*
Estimated Present Worth Cost: *$23,380,000*
Estimated Time to Construct: *1-2 years*
Estimated Time to Achieve RAOs and Cleanup Levels: *30 years*

The waste remedy for Alternative V would consist of the following components: delineation of excavation areas, excavation, solidification and stabilization, on-Site disposal, cap configuration, and ICs. The remedial strategy for this alternative is to treat the contaminated waste, dispose of the treated waste on-Site, and install a capping system. Monitoring would be implemented as the ground water remediation remedy for Alternative V. ICs would be implemented to restrict exposure to waste and ground water. As required by CERCLA, a review of Site conditions and risks would be conducted every five years since contamination would remain on-Site above levels that allow for unlimited use and unrestricted exposure.

The components of Alternative V are as follows:

- For ex-situ treatment, partial excavation of Source No. 1 and Source No. 2
- Solidification and stabilization
    - Ex-situ treatment of excavated waste with solidification/stabilization reagent through a pug mill or backhoe; or
    - In-situ treatment of source area wastes with solidification/stabilization reagent via deep, in place waste mixing
- Capping of solidified and stabilized wastes
- Monitoring of ground water contamination in the surficial aquifer
- ICs to preserve the integrity of the containment cells, prevent disturbance of waste beneath the containment cells, and prevent use of contaminated ground water

Component 1: Excavation of Contaminated Areas

Utility clearance would be conducted in the proposed excavation and treatment areas for water, communication, and electrical lines. Wastes in an estimated area of 171,500 ft^2 (3.9 acres) for Source No. 1 and 29,000 ft^2 (0.7 acres) for Source No. 2 would be excavated, as determined by the delineation in Component 1. A total of approximately 113,500 cubic yards would be excavated from both source areas.

Component 2: Solidification and Stabilization

Stabilization refers to techniques that chemically reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms. The physical nature and handling characteristics of the waste are not necessarily changed by stabilization. Solidification refers to techniques that encapsulate the waste, forming a solid material, and does not necessarily involve a chemical interaction between the contaminants and the solidifying additives.

Waste excavated in Component 2 would be mixed with the solidification/stabilization reagent *ex situ* using a pug mill or backhoe and placed back on the original footprint from which it was excavated. Alternatively, wastes within the source areas may be treated *in situ* through deep waste mixing or in-place backhoeing. In either case, a treatability study would be required to select an appropriate additive and determine the optimum mix ratio.

Component 4: Capping

The type of cap installed over Source Nos. 1 and 2 will depend on the results of studies performed after solidification and stabilization measures are conducted. If the stabilized material is adequate, a simple soil/vegetation cap can be installed. If not, a RCRA-type cap will be necessary.

Component 5: Ground Water Monitoring

This component of the remedy is the same as described in Alternative II.

Component 6: Implementation of ICs

This component of the remedy is the same as described in Alternative II.

9.6 Common Elements of All Alternatives

With the exception of Alternative I: No Action, all of the individual alternatives evaluated would include a pre-design investigation prior to designing and implementing the remedy. The scope of the investigation would vary depending on the components of the remedy. Implementation of a ground water sampling and monitoring program, and ICs are common to all remedial alternatives except for the No Action alternative.

Since all remedial alternatives anticipate COC waste and/or COC impacted ground water will remain at the Site for an extended timeframe, Five-Year Reviews will be conducted to ensure the effectiveness of the Selected Remedy in protecting human health and the environment.

10.0 Summary of the Comparative Analysis of Alternatives

As required by the NCP at 40 CFR §300.430(e)(9)(ii), the FS used a comparative analysis to assess the relative performance of each alternative in relation to nine specific evaluation criteria (excluding the two modifying criteria, state acceptance and community acceptance). The purpose of this analysis was to identify the advantages and disadvantages of each alternative relative to the other alternatives.

The nine criteria are divided into three categories: two threshold criteria (Overall Protection of Human Health and the Environment and Compliance with ARARs); five primary balancing criteria (Long-term Effectiveness and Permanence; Reduction of Toxicity, Mobility, and Volume through Treatment; Short-term Effectiveness; Implementability; and Cost); and two modifying criteria (State and Community Acceptance). Below is a summary of the detailed comparative analysis of alternatives against the nine criteria, which is also presented in the FS report.

10.1 Overall Protection of Human Health and the Environment

The threshold criterion of overall protection of human health and the environment addresses whether the alternative provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

All alternatives evaluated in the FS except for Alternative I (No Action) would be protective of human health and the environment. Since Alternative I does not meet this threshold criterion, it was not carried through the remaining evaluation criteria. Alternatives II through V would protect the ground water from the wastes under the proposed improved caps. Risks posed to ground water by wastes under the caps would be eliminated with the addition of an improved cap system reducing the infiltration of storm water runoff through the waste material and leaching into the ground water (Alternatives II through V). Any ground water which may come in contact with the waste through fluctuations in the ground water elevation would be treated by the active ground water remedy as outlined in Alternatives II, IV and V. Therefore, these alternatives would achieve overall protection of human health and the environment. Alternative III, which relies solely on natural processes to treat the contaminated ground water, would also achieve overall protection of human health and the environment but over a longer timeframe.

10.2 Compliance with ARARs

Section 121(d) of CERCLA and the NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA Sites at least attain legally applicable or relevant and appropriate federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA §121(d)(4). Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA Site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA Site address problems or situations sufficiently similar to those encountered at the CERCLA Site that their use is well-suited to the particular Site. Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes or provides a basis for invoking a waiver.

Alternatives III, IV, and V rely solely on natural degradation processes to remediate the impacted ground water. For this reason, ground water RAOs (Chemical-specific ARARs which include SDWA MCLs) would not be achieved within a reasonable timeframe. Cleanup

timeframes for Alternatives II, IV, and V are estimated to be 30 years. By contrast, Alternative II includes active treatment to address the ground water thereby meeting the expectation for treatment and significantly reducing the overall cleanup timeframe to 3-7 years. Alternatives II and III would comply with relevant and appropriate closure and post-closure care standards for RCRA Subtitle C type landfill covers. Alternatives IV and V would utilize, at a minimum, 18 inch soil covers with 6 inch vegetation layer. Under Alternative V, the type of cover needed, simple soil or RCRA C type cover, would be determined based on the outcome of studies performed after soil solidification and stabilization measures are conducted. Implementation of any of these alternatives II, III, and V would comply with all Chemical- and Action-specific ARARs. Alternative IV would not comply with relevant and appropriate requirements for RCRA C type covers. No Location-specific ARARs were identified for any of the proposed alternatives.

10.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time until the cleanup levels are met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Alternatives II, IV, and V, which include active treatment for waste or ground water, would achieve the RAOs within a relatively short timeframe (3-7 years), and provide effectiveness and permanence over the long-term. In contrast, Alternative III, which relies solely on natural processes to remediate the contaminated ground water, would provide limited protectiveness and attainment of RAOs and cleanup goals would not be achieved within a reasonable timeframe (30 years).

10.4 Reduction in Toxicity, Mobility, and Volume

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives III, IV, and V primarily rely on natural degradation processes to remediate the Site. For Alternative II, active treatment would be utilized to treat the ground water, thereby reducing the toxicity and volume of the contamination. All alternatives reduce the mobility of contaminants in the wastes under the currently capped areas.

10.5 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

All alternatives would require specific additional institutional and administrative controls over the short-term to remain effective. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of waste could be minimized through the implementation of appropriate engineering controls (e.g., dust control, perimeter air monitoring, spill prevention procedures, etc.). Alternative II would achieve protectiveness in a very short time period after implementation.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Alternatives II through V consist of proven and well established technologies that are relatively comparable in implementability.

10.7 Costs

Cost estimates for all remedial alternatives were developed during the FS and are summarized in Table 10-1. Present worth costs were based on an effective discount rate of 7 percent (%) and O&M was estimated to last for 30 years.

Table 10-1. Remedial Alternative Cost Comparisons

Remedial Alternative	Estimated Capital Costs	Estimated Annual O&M Costs	Estimated Present Worth
I	$0	$0	$0
II	$3,365,000	$901,000	$ 3,741,000
III	$2,687,000	$901,000	$3,359,000
IV	$31,314,000	$901,000	$31,986,000
V	$22,708,000	$901,000	$23,380,000

10.8 State Acceptance

The state of Tennessee, as represented by TDEC, has expressed its support for the Selected Remedy, Alternative II.

10.9 Community Acceptance

The EPA and TDEC conducted a public meeting on August 13, 2015 to present the Proposed Plan to the public. The preferred alternative in the Proposed Plan and presented at the

public meeting was Alternative II. No written comments were received by EPA and no request for extension of the comment period was made.

11.0 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable (40 CFR §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. All of the principal threat wastes were addressed in the Time-Critical Removal Action and were disposed offsite. The capped wastes currently on the Site do not meet the definition of principal threat wastes. That is, these wastes are neither highly toxic nor highly mobile. For this reason, the referenced statutory preference for treatment does not apply.

12.0 Selected Remedy

Alternative II is the Selected Remedy. EPA believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria.

12.1 Summary and Rationale for the Selected Remedy

EPA expects the preferred alternative to satisfy the following statutory requirements of CERCLA 121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the statutory preference for treatment as a principal element to the extent practicable.

The preferred alternative was selected over the other alternatives because of its overall potential effectiveness and efficiency in addressing the Site contamination. The proposed remedy will provide for permanent long term risk reduction.

Based on the information currently available, EPA believes the preferred remedial alternative will be protective of human health and the environment. Because the preferred alternative will utilize active treatment technologies to address the ground water contamination, the remedy also meets the statutory preference for the selection of a remedy that involves treatment as a principal element.

12.2 Selected Remedy Cost

The estimated total net present worth cost for the Selected Remedy is $3,365,000. A detailed cost estimate for the Selected Remedy is included in Appendix A. The cost estimate is based on the available information regarding the anticipated scope of the remedial action. Changes in the cost elements are likely to occur as a result of new information and data collected during the remedial design phase. Major changes may be documented in the form of a memorandum to the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. The projected cost is based on an order-of-magnitude engineering cost estimate that is expected to be within +50 or -30 percent of the actual project cost. Costs are based on the conservative estimate of a 30-year timeframe until all cleanup levels are met. The previous EPA removal action in which some wastes were removed and other wastes were capped in place with between one and two feet of compacted clays provides short to mid-term protection of unacceptable potential direct exposures to humans and ecological receptors from hazardous wastes. In addition, the previous EPA removal action reduced the leaching of metals to ground water through the construction of the compacted clay cap. With the implementation of a RCRA subtitle C engineered cap as part of the Selected Remedy, leaching to ground water will be eliminated and unacceptable potential direct exposures to humans (in particular future construction workers) and ecological receptors from hazardous wastes will be eliminated on a long-term basis.

12.3 Expected Outcome of the Selected Remedy

The Selected Remedy will provide protection of human health and the environment by eliminating, reducing, or controlling risks at the Site through capping, *in situ* ground water treatment, monitoring, the implementation of minimal maintenance, and ICs. In addition, with the implementation of a RCRA subtitle C engineered cap as part of the Selected Remedy, leaching to ground water will be eliminated and unacceptable potential direct exposures to humans (in particular future construction workers) and ecological receptors from hazardous wastes will be eliminated on a long-term basis. Implementation of the Selected Remedy and achievement of the final cleanup levels will achieve the RAOs for the Site. The final cleanup levels selected for this remedy are shown in Table 8-1. The residual risks will be within EPA's acceptable risk range for commercial/industrial land use, thus the Site property can be used for any commercial/industrial purpose that is compatible with the ICs after the remedy has been implemented. Ground water will be suitable for consumption after the RAOs and cleanup levels are achieved.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment

technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against offsite disposal of untreated wastes.

Based on the information currently available, EPA believes the Preferred Alternative meets the Threshold Criteria and provides the best balance of tradeoffs among the other alternatives with respect to the Balancing and Modifying Criteria. EPA expects the Selected Remedy will satisfy the following statutory requirements of CERCLA Section 121(b):

- Be protective of human health and the environment.
- Comply with ARARs;
- Be cost effective; and
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

13.1 Protection of Human Health and the Environment

The Selected Remedy will provide protection of human health and the environment by eliminating, reducing, or controlling risks at the Site through the treatment of contaminated ground water to achieve Site-specific cleanup levels that are protective of human health and the environment. *In situ* treatment will reduce dissolved concentrations of COCs in ground water. Monitoring will protect human health and the environment by providing notice of plume migration and assisting in predicting when Chemical-specific ARARs will be achieved. Implementation of ICs will prevent human exposure to Site contaminants until cleanup goals are met. The remedial design will include specifications for meeting proper health and safety precautions during implementation of all the components of the Selected Remedy. No adverse cross-media impacts are expected from the Selected Remedy.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and the NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA Sites at least attain legally applicable or relevant and appropriate federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA §121(d)(4). *See also* 40 C.F.R. § 300.430(f)(1)(ii)(B). ARARs include only federal and state environmental or facility siting laws or regulations and do not include occupational safety or worker protection requirements. Compliance with OSHA standards is required by 40 C.F.R. § 300.150 and therefore the CERCLA requirement for compliance with or wavier of ARARs does not apply to OSHA standards.

Under CERCLA Section 121(e)(1), federal, state, or local permits are not required for the portion of any removal or remedial action conducted entirely "on-site" as defined in 40

C.F.R. § 300.5. *See also* 40 C.F.R. §§ 300.400(e)(1) & (2). Also, CERCLA response actions must only comply with the "substantive requirements," not the administrative requirements of a regulation or law. Administrative requirements include permit applications, reporting, record keeping, inspections, and consultation with administrative bodies. Although consultation with state and federal agencies responsible for issuing permits is not required, it is often recommended for determining compliance with certain requirements such as those typically identified as Location-Specific ARARs. *See* EPA, OSWER Directives No. 9234.1-01 and 9234.1-02, *CERCLA Compliance with Other Laws Manual: Parts 1 and Part II* (August 1988 and 1989).

Applicable requirements, as defined in 40 C.F.R. § 300.5, are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental of state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA Site. *Relevant and appropriate requirements, as defined in 40 C.F.R. § 300.5,* are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental of facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Per 40 C.F.R. § 300.400(g)(5), only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable or relevant and appropriate. For purposes of identification and notification of promulgated state standards, the term promulgated means that the standards are of general applicability and are legally enforceable. State ARARs are considered more stringent where there is no corresponding federal ARAR, where the State ARAR provides a more stringent concentration of a contaminant, or the where a State ARAR is broader in scope than a federal requirement. *See* EPA, OSWER Pub. No. 9234.2-05/FS, *CERCLA Compliance with State Requirements* (December 1989).

In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release that may be useful in developing Superfund remedies. *See* 40 C.F.R. § 300.400(g)(3). The "to-be-considered" (TBC) category consists of advisories, criteria, or guidance that were developed by EPA, other federal agencies, or states that may assist in determining, for example health-based levels for a particular contaminant for which there are no ARARs or the appropriate method for conducting an action. TBCs are not considered legally enforceable and, therefore, are not considered to be applicable for a site but typically are evaluated along with Chemical-specific ARARs as part of the risk assessment to determine protective cleanup levels. *See* EPA, OSWER Directives No. 9234.1-01 and 9234.1-02, *CERCLA Compliance with Other Laws Manual: Parts 1 and Part II* (August 1988 and 1989), Section 1.4.

The Selected Remedy is expected to comply with all ARARs. The Chemical-specific and Action-specific ARARs applicable to the Site are presented in Tables 13-1 and 13-2.

For purposes of ease of identification, the EPA has created three categories of ARARs: Chemical-, Location- and Action-specific. Under 40 C.F.R. § 300.400(g)(5), the lead and support agencies shall identify their specific ARARs for a particular site and notify each other in a timely manner as described in 40 C.F.R. § 300.515(d).

13.2.1 Action-Specific ARARs/TBC Guidance

Action-specific ARARs are usually technology-based or activity-based requirements or limitations that control actions taken at hazardous waste sites. Action-specific requirements often include performance, design and controls, or restrictions on particular kinds of activities related to management of hazardous substances. Action-specific ARARs are also triggered by the types of remedial activities and types of wastes that are generated, stored, treated, disposed, emitted, discharged, or otherwise managed.

The Action-specific ARARs, summarized in Table 13-1, for the Selected Remedy include applicable RCRA waste characterization, storage and disposal requirements, TDEC requirements for monitoring well construction and abandonment, TDEC requirements for underground injections of nutrients or other treatments for ground water, and underground injection well construction and abandonment standards. The capping system to be installed over the waste disposal areas will meet relevant and appropriate RCRA Subtitle C landfill cover design, construction and post-closure care requirements. EPA's Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments, EPA OSWER 530 – SW –89 –047 (July 1989) has been cited as TBC. In addition, Action-specific ARARs for land-disturbing activities that must be met during cap construction include TDEC requirements for controlling fugitive dust emissions and storm water management and runoff controls.

13.2.2 Chemical-Specific ARARs/TBC Guidance

Chemical-specific ARARs are usually health or risk based numerical values limiting the amount or concentration of a chemical that may be found in, or discharged to, the environment. The Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) at 40 C.F.R. Part 141 and the state or federal ambient water quality criteria established under Section 303 or 304 of the Clean Water Act are examples of Chemical-specific ARARs used to establish remediation levels for restoration of ground water that are current or potential sources of drinking water and restoration of surface water to meet its designated uses or classifications, respectively. See 40 C.F.R. §§ 300.430(e)(2)(i)(B), (C), & (E).

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
General construction standards – all land–disturbing activities (i.e., excavation, grading etc.)			
Activities causing fugitive dust emissions	Shall take reasonable precautions to prevent particulate matter from becoming airborne; reasonable precautions shall include, but are not limited to, the following: • use, where possible, of water or chemicals for control of dust, and • application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts;	Fugitive emissions from demolition, construction operations, grading, or the clearing of land —**applicable**	TDEC 1200-3-8-.01(1)(a)-(b)
	Shall not cause or allow fugitive dust to be emitted in such a manner as to exceed 5 minutes per hour or 20 minutes per day beyond property boundary lines on which emission originates.		TDEC 1200-3-8-.01(2)
Activities causing storm water runoff (e.g., clearing, grading, excavation)	Implement good construction management techniques (including sediment and erosion controls, vegetative controls, and structural controls) in accordance with the substantive requirements of *General Permit No. TNR100000* to ensure that storm water discharge:	Dewatering or storm water runoff discharges from land disturbed by construction activity— disturbance of ≥1 acre of total land —**applicable**	TCA 69-3-108(j) TDEC 0400-40-10-.03(2)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
	Design, install and maintain effective erosion prevention and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed and maintained to: (1) Control stormwater volume and velocity within the site to minimize soil erosion; (2) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion; (3) Minimize the amount of soil exposed during construction activity; (4) Minimize the disturbance of steep slopes; Tennessee General Permit No. TNR100000 Stormwater Discharges from Construction Activities (5) Eliminate (or minimize if complete elimination is not possible) sediment discharges from the site. The design, installation and maintenance of erosion prevention and sediment controls must address factors such as the design storm (see sub-section 3.5.3.3 above) and soil characteristics, including the range of soil particle sizes expected to be present on the site; (6) Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible (see section 4.1.2 below); and (7) Minimize soil compaction and, unless infeasible, preserve topsoil.	Storm water discharges from construction activities **–TBC**	*General Permit No. TNR100000* Section 4.1.1(1)-(7)
	(a) does not violate water quality criteria as stated in TDEC 1200-4-3-.03 including but not limited to prevention of discharges that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the state for any of the designated uses for that water body by TDEC 1200-4-4; (b) does not contain distinctly visible floating scum, oil, or other matter; (c) does not cause an objectionable color contrast in the receiving stream; and (d) results in no materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.	Storm water discharges from construction activities **–TBC**	*General Permit No. TNR100000* Section 5.3.2(a)-(d)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Underground Injection Well and Groundwater Monitoring Well Installation, Operation, and Abandonment			
Construction of groundwater monitoring well	All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole; this casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples; the annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater.	Construction of RCRA groundwater monitoring well—**relevant and appropriate**	40 CFR 264.97(c) TDEC 0400-12-01-.06(6)(h)(3)
Abandonment of groundwater monitoring well	Cased wells shall be plugged and sealed with cement grout or bentonite (as defined in subparagraph (c) of this paragraph) in accordance with the requirements in subparagraphs 2(b) and 2(c) of this paragraph.	Permanent plugging and abandonment of a well—**relevant and appropriate**	TDEC 0400-45-09-.16(2)
	Wells extending into more than one aquifer shall be filled and sealed in such a way that exchange of water from one aquifer to another is prevented.		TDEC 0400-45-09-.16(3)
Injection of nutrients (or other treatments) into groundwater	The use of any Class V injection well in such a manner as to cause any underground source of drinking water (USDW) to contain any substances that are toxic, carcinogenic, mutagenic, or teratogenic, other than those of natural origin, at levels and conditions which violate primary drinking water standards as given in Chapter 0400-45-01 or adversely affect the health of persons is prohibited.	Class V injection well (defined in 0400-45-06-.02) associated with remedial activity and/or innovative or experimental technologies as defined in TDEC 0400-45-06-.06(5)(g) and (j) —**applicable**	TDEC 0400-45-06-.14(1)(b)
	No injection activity can allow the movement of fluid containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of any primary drinking water standard, or other health based standards, or may otherwise adversely affect the health of persons. This prohibition applies to well construction, operation, maintenance, conversion, plugging, closure or any other injection activity.		TDEC 0400-45-06-.14(12)(a)1
Construction Standards for Class V injection wells	The variety of Class V well and their uses dictate a variety of construction designs consistent with those uses, and precludes specific construction standards. However, a well must be designed and constructed for its intended use, in accordance with good engineering practices, and the design and construction must be approved by the Commissioner. Class V wells shall be constructed so that their intended use does not violate the water quality standards.	Construction of Class V injection wells – **applicable**	TDEC 0400-45-06-.14(7)(a) and (b)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Operating Requirements for Class V injection wells	All Class V injection wells shall be operated in such a manner that they do not violate the provisions of TDEC 0400-45-06-.14(1) [i.e., prohibition against using UIC well in such a manner as to cause USDW to contain substances that are toxic, carcinogenic, mutagenic, or teratogenic at levels and conditions which violate primary drinking water standards].	Operation of Class V injection wells – **applicable**	TDEC 0400-45-06-.14(8)(a)
Monitoring Requirements for Class V Injection Systems	The Commissioner may require monitoring of Class V injection wells; the nature of which will be determined by the type of well, nature of the injected fluid, and water quality of the receiving aquifer. The Commissioner shall determine the extent and frequency of monitoring based on the type of injection well and the nature of the injected fluid. *Note: Monitoring of any injection wells will be conducted pursuant to a CERCLA Remedial Design or Remedial Action Work Plan after review by TDEC and approval by the EPA.*	Monitoring of Class V injection wells – **applicable**	TDEC 0400-45-06-.14(9)(a) and (b)
Plugging and abandonment of Class V injection wells	The owner/operator must close the well in a manner that complies with the prohibition of fluid movement in subparagraph (a) of this paragraph. Also, the owner/operator must dispose or otherwise manage any soil, gravel, sludge, liquids, or other materials removed from or adjacent to the well in accordance with all applicable Federal, State and local regulations and requirements.	Closure of a Class V injection well—**applicable**	TDEC 0400-45-06-.14(12)(b)
	A Class V injection well shall be plugged with cement in a manner which will not allow movement of fluids between underground sources of drinking water.		TDEC 0400-45-06-.14(11)(b)
	Any well that is to be permanently plugged and abandoned shall be completely filled and sealed in such a manner that vertical movement of fluid either into or between formation(s) containing USDWs through the bore hole is not allowed.		TDEC 0400-45-06-.09(6)(d)
	As a minimum, permanent seals must be placed in the bore hole opposite (1) the lowermost confining bed, and (2) each intermediate confining bed between successive formation(s) containing USDWs.		TDEC 0400-45-06-.09(6)(e)
	Seals intended to prevent vertical movement of water in a well bore hole shall be composed of cement, sand-and-cement, or concrete or other sealing materials demonstrated to the satisfaction of the Commissioner to be effective.		TDEC 0400-45-06-.09(6)(f)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
	The minimum length of a seal required in subparagraph (f), of this paragraph, shall be 20 feet.		TDEC 0400-45-06-.09(6)(g)
	The bore hole above the uppermost formation(s) containing a USDW shall be filled with materials less permeable than the surrounding undisturbed formations, the uppermost five (5) feet of the bore hole (at land surface) shall be filled with a material appropriate to the intended use of the land.		TDEC 0400-45-06-.09(6)(h)
	The materials used to fill spaces between well seals shall be filled with disinfected dimensionally stable materials, compacted mechanically if necessary to avoid later settlement except that cement, cement and sand, and concrete do not require disinfection. Disinfection of well filling materials shall be accomplished by using chlorine compounds such as sodium hypochlorite or calcium hypochlorite.		TDEC 0400-45-06-.09(6)(i)
Placement of sealing materials	Approved sealing materials used in abandonment operations shall be introduced at the bottom of the well or interval to be sealed and placed progressively upward to the top of the well. All such sealing materials shall be placed in such a way as to avoid segregation or dilution of the sealing materials.		TDEC 0400-45-06-.09(7)(a)
	Permanent seals shall be placed in wells or bore holes opposite confining beds between aquifers which are identifiable as, or are suspected of being, hydraulically separated under natural, undisturbed conditions. After the required seal has been installed, the remainder of the confining zone between formations containing USDWs may be filled with sand, sand and gravel, or other rock material acceptable to the Commissioner.		TDEC 0400-45-06-.09(7)(b)
Waste characterization and storage – primary wastes (e.g., contaminated soils and wastewaters) and secondary wastes (e.g., spent treatment media, etc.)			

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Characterization of *solid waste*	Must determine if solid waste is excluded from regulation under 40 CFR 261.4(b); and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) — **applicable**	40 CFR 262.11(a) TDEC 0400-12-01-.03(1)(b)(1)
	Must determine if waste is listed as hazardous waste under 40 CFR Part 261; or	Generation of solid waste which is not excluded under 40 CFR 261.4(a)—**applicable**	40 CFR 262.11(b) TDEC 0400-12-01-.03(1)(b)(2)
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR part 261by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an equivalent method approved by the Administrator under 40 CFR 260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.		40 CFR 262.11(c) TDEC 0400-12-01-.03(1)(b)(3)
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste	Generation of solid waste which is determined to be hazardous – **applicable**	40 CFR 262.11(d); TDEC 0400-12-01-.03(1)(b)(4)
Characterization of *hazardous waste* (all primary and secondary wastes)	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 264.13(a)(1)
Determinations for management of *hazardous waste*	Must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 *et seq*... *Note:* This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of RCRA hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) TDEC 0400-12-01-.10(1)(i)(1)

Table 13-1
Action-specific ARARs
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Action	Requirements	Prerequisite	Citation(s)
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal **– applicable**	40 CFR 268.9(a) TDEC 0400-12-01-.10(1)(i)(1)
	Must determine if the hazardous waste meets the treatment standards in 40 *CFR* 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. *Note:* This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) TDEC 0400-12-01-.10(1)(g)(1)(i)
Temporary storage of *hazardous waste* in containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173; and	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10—**applicable**	40 *CFR* 262.34(a); TDEC 0400-12-01-.03(4)(e) 40 *CFR* 262.34(a)(1)(i); TDEC 0400-12-01-.03(4)(e)(2)(i)(I)
	• the date upon which accumulation begins is clearly marked and visible for inspection on each container		40 *CFR* 262.34(a)(2); TDEC 0400-12-01-.03(4)(e)(2)(ii)
	• container is marked with the words "hazardous waste" or		40 CFR 264.34(a)(3) TDEC 0400-12-01-.03(4)(e)(2)(iii)
	• container may be marked with other words that identify the contents	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation—**applicable**	40 CFR 262.34(c)(1) TDEC 0400-12-01-.03(4)(e)(5)(i)(II)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Use and management of *hazardous waste* in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers—**applicable**	40 CFR 265.171 TDEC 0400-12-01-.05(9)(b)
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired.		40 CFR 265.172 TDEC 0400-12-01-.05(9)(c)
	Keep containers closed during storage, except to add/remove waste.		40 CFR 265.173(a) TDEC 0400-12-01-.05(9)(d)(1)
	Open, handle and store containers in a manner that will not cause containers to rupture or leak.		40 CFR 265.173(b) TDEC 0400-12-01-.05(9)(d)(2)
Storage of *hazardous waste* in container area	Area must have a containment system designed and operated in accordance with 40 *CFR* 264.175(b).	Storage of RCRA-hazardous waste in containers with free liquids—**applicable**	40 CFR 264.175(a) TDEC 0400-12-01-.06(9)(f)(1)
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA-hazardous waste in containers that do not contain free liquids **—applicable**	40 CFR 264.175(c) TDEC 0400-12-01-.06(9)(f)(3)
Treatment/disposal of wastes – primary (e.g., excavated soils and wastewaters) and secondary wastes (e.g., spent treatment media)			
Disposal of RCRA-*hazardous waste* in a land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste—**applicable**	40 CFR 268.40(a) TDEC 0400-12-01-.10(3)(a)
	Alternative LDR treatment standards for contaminated soils - Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils **—applicable**	40 CFR 268.49(b) TDEC 0400-12-01-.10(3)(j)(2)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Disposal of RCRA *hazardous wastewaters* into CWA wastewater treatment unit	Waste otherwise restricted under TDEC 0400-12-01-.10 are not prohibited from land disposal if the waste meet any of the following criteria, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40, or are D003 reactive cyanide: (I) The wastes are managed in a treatment system which subsequently discharges to waters of the U.S. pursuant to a permit issued under section 402 of the Clean Water Act; or (II) The wastes are treated for purposes of the pretreatment requirements of section 307 of the Clean Water Act; or (III) The wastes are managed in a zero discharge system engaged in Clean Water Act-equivalent treatment as defined in part (2)(h)1 of this rule; or (IV) The wastes no longer exhibit a prohibited characteristic at the point of land disposal.	Restricted RCRA characteristic hazardous wastewaters managed in a wastewater treatment system —**applicable**	40 CFR 268.1(c)(4)(iv) TDEC 0400-12-01-.10(1)(a)(3)(iv)
Pretreatment standards for discharges into POTW	General prohibitions: A user may not introduce into a POTW any pollutants which cause pass through or interference, as defined in 40 CFR 403.3 (TDEC 0400-40-14.03).	Discharge of pollutants into or transported by truck or rail or otherwise introduced into POTW, as defined in 40 CFR 403.3 (TDEC 0400-40-14-.03), by industrial user—**applicable**	40 CFR 403.5(a)(1) TDEC 0400-40-14.05(1)(a)

Table 13-1
Action-specific ARARs
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Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
	Specific prohibitions. The following pollutants shall not be introduced into a POTW: (1) pollutants which create a fire or explosion hazard, including, waste streams with a closed cup flashpoint of < 140 °F or 60 °C, using test methods specified in 40 §CFR 261.21; (2) pollutants which will cause corrosive structural damage, but in no case discharges with pH < 5.0, unless POTW is designed to accommodate such discharges; (3) solid or viscous pollutants in amounts which will cause obstruction to flow resulting in interference; (4) any pollutant, including oxygen demanding pollutants (BOD) released in a discharge at flow rate and/or pollutant concentration which will cause interference; (5) heat in amounts which will inhibit biological activity resulting in interference, but in no case heat in quantities causing temperature at POTW to exceed 40°C (104°F) unless alternate temperature limits approved by POTW; (6) petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through; (7) pollutants which result in presence of toxic gases, vapors, or fumes within POTW in quantity that may cause acute worker health and safety problems; and (8) any trucked or hauled pollutants, except at discharge points designated by the POTW.		40 CFR 403.5(b)(1)-(8) TDEC 0400-40-14.05(2)(a)-(h)
Landfill closure performance standard	Must close the unit in a manner that: • minimizes the need for further maintenance; and • controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, post–closure escape of hazardous waste, hazardous constituents, leachate, contaminated run–off, or hazardous waste decomposition products to ground or surface waters or to the atmosphere; and • complies with the closure requirements of 40 CFR 264.310	Closure of a RCRA hazardous waste management facility **– relevant and appropriate**	40 CFR 264.111(a) thru (c) TDEC 0400-12-01–.06(7)(b)(1) thru (3)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
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Action	Requirements	Prerequisite	Citation(s)
Landfill cover design and construction	Must cover the landfill or cell with a final cover designed and constructed to: • provide long–term minimization of migration of liquids through the closed landfill; • function with minimum maintenance; • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	Closure of a RCRA hazardous waste management facility –**relevant and appropriate**	40 CFR 264.310(a)(1) thru (5) TDEC 0400-12-01–.06(14)(k)(1)(i) thru (v)
	This document recommends and describes a design for landfill covers that will meet the requirements of RCRA regulations. It is a multilayered system consisting, from the top down, of: • a top layer of at least 60 cm of soil, either vegetated or armored at the surface; • a granular or geosynthetic drainage layer with a hydraulic transmissivity no less than 3 x 10~5 cm /sec; and • a two–component low permeability layer comprised of (1) a flexible membrane liner installed directly on (2) a compacted soil component with an hydraulic conductivity no greater than 1 x 10~7 cm/sec. Optional layers may be added, e.g., a biotic barrier layer or a gas vent layer, depending on the need.	Construction of a RCRA hazardous waste landfill final cover – **TBC**	*EPA Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments*, EPA OSWER 530 – SW –89 –047 (July 1989)
Run–on/run-off control systems for closed landfill	Run–*on* control system must be capable of preventing flow onto the active portion of the landfill during peak discharge from a 25–year storm event.	Construction of a RCRA landfill – **relevant and appropriate**	40 CFR 264.301(g) TDEC 0400-12-01–.06(14)(b)(7)
	Run–*off* management system must be able to collect and control the water volume from a runoff resulting from a 24–hour, 25–year storm event.		40 CFR 264.301(h) TDEC 0400-12-01–.06(14)(b)(8)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Post–Closure Care of Closed Landfill			
General post–closure care for closed landfill	Owner or operator must: • maintain the effectiveness and integrity of the final cover including making repairs to the cap as necessary to correct effects of settling, erosion, etc.; • prevent run–on and run–off from eroding or otherwise damaging final cover; and • protect and maintain surveyed benchmarks used to locate waste cells.	Closure of a RCRA landfill – **relevant and appropriate**	40 CFR 264.310(b)(1), (5) and (6) TDEC 0400-12-01–.06(14)(k)(2) (i), (v) and (vi)
Survey plat for closed landfill	Must submit to the local zoning authority or the authority with jurisdiction over local land use, a survey plot indicating the location and dimensions of landfill cells, with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed which states the owner/operator obligation to restrict disturbance of the landfill.	Closure of a RCRA landfill – r**elevant and appropriate**	40 CFR 264.116 TDEC 0400-12-01–.06(7)(g)
Protection of closed landfill	Post–closure use of property must never be allowed to disturb the integrity of the final cover, liners, or any other components of the containment system or the facility's monitoring system unless necessary to reduce a threat to human health or the environment.	Closure of a RCRA landfill – **relevant and appropriate**	40 CFR 264.117(c) TDEC 0400-12-01–.06(7)(h)(3)
Post–closure notices for closed landfill	Must submit to the local zoning authority a record of the type, location, and quantity of hazardous wastes disposed of within each cell of the unit.	Closure of a RCRA landfill – **relevant and appropriate**	40 CFR 264.119(a) TDEC 0400-12-01–.06(7)(j)(1)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)
Post–closure notices for closed landfill	Must record, in accordance with State law, a notation on the deed to the facility property – or on some other instrument which is normally examined during a title search – that will in perpetuity notify any potential purchaser of the property that: • land has been used to manage hazardous wastes; • its use is restricted under 40 CFR Part 264 Subpart G regulations; and • the survey plat and record of the type, location, and quantity of hazardous wastes disposed within each cell or other hazardous waste disposal unit of the facility required by Sections 264.116 and 264.119(a) have been filed with the local zoning authority and with the EPA Regional Administrator.	Closure of a RCRA landfill – **relevant and appropriate**	40 CFR 264.119(b)(1)(i) thru (iii) TDEC 0400-12-01–.06(7)(j)(2)(i)(I) thru (III)
Transportation of Wastes – Primary and Secondary Wastes			
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material —**applicable**	49 CFR 171.1(c)
Transportation of hazardous waste *off-site*	Must comply with the generator requirements of 40 CFR 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding and Sect. 262.40, 262.41(a) for record keeping requirements and Sect. 262.12 to obtain EPA ID number.	Preparation and initiation of shipment of RCRA hazardous waste off-site**—applicable**	40 CFR 262.10(h) TDEC 0400-12-01-.03(1)(a)(8)

Table 13-1
Action-specific ARARs
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Action	Requirements	Prerequisite	Citation(s)
Transportation of hazardous waste *on-site*	The generator manifesting requirements of 40 CFR 262.20–262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way – **applicable**	40 CFR 262.20(f)
Management of samples (i.e. contaminated soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when:	Generation of samples of hazardous waste for purpose of conducting testing to determine its characteristics or composition--- **applicable**	40 CFR 261.4(d)(1)
	• The sample is being transported to a laboratory for the purpose of testing;		40 CFR 261.4(d)(1)((i)
	• The sample is being transported back to the sample collector after testing; and		40 CFR 261.4(d)(1)(ii)
	• The sample collector ships samples to a laboratory in compliance with U.S. Department of Transportation, U.S. Postal Service, or any other applicable shipping requirements, including packing the sample so that it does not leak, spill or vaporize from its packaging.		40 CFR 261.4(d)(2)
Waste left in place	Institutional controls are required and shall include, at a minimum, deed restrictions for sale and use of property, and securing the area to prevent human contact with hazardous substances which pose or may pose a threat to human health or safety.	Hazardous substances left in place that may pose an unreasonable threat to public health, safety, or the environment—**TBC**	TDEC 0400-15-01-.08(10)

Table 13-1
Action-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action	Requirements	Prerequisite	Citation(s)

ARAR = applicable or relevant and appropriate requirement

CFR = Code of Federal Regulations

CWA = Clean Water Act of 1972

NPDES = National Pollutant Discharge Elimination System

DOT = U.S. Department of Transportation

EPA = U.S. Environmental Protection Agency

RCRA = Resource Conservation and Recovery Act of 1976

HMR = Hazardous Materials Regulations

HMTA = Hazardous Materials Transportation Act

POTW = Publicly Owned Treatment Works

TBC = to be considered

TCA = Tennessee Code Annotated

TDEC = Rules of the Tennessee Department of Environment and Conservation, Chapter noted

UTS = Universal Treatment Standard

USDW = Underground Source of Drinking Water

IDW = Investigation Derived Waste

Table 13-2
Chemical-specific ARARs
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Action/Media	Requirements	Prerequisite	Citation(s)
Classification of ground water	Except for ground water in areas that have been designated as Special Source Water, Site Specific Impaired Ground Water, or meet the definition of Unusable Ground Water, all Tennessee ground water is designated General Use (GU) Ground Water.	Ground water classification in the State of Tennessee – **applicable**	TDEC 0400-40-03-.07(4)(b)
Restoration of contaminated ground water	Except for naturally occurring levels, General Use (GU) Ground Water: (a) shall not contain constituents that exceed those levels specified in subparagraphs (1)(j) and (k) of TDEC 0400-40-03-.03, for the site related contaminants of concern: Arsenic 10 µg/L Chromium 100 µg/L Mercury 2 µg/L Thallium 2 µg/L and (b) shall contain no other constituents at levels and conditions which pose an unreasonable risk to the public health or the environment.	Class GU ground waters with contaminant(s) exceeding standards listed in TDEC 0400-40-03.03 - **relevant and appropriate**	TDEC 0400-40-03-.08(2)
	The waters shall not contain toxic substances, whether alone or in combination with other substances, which will produce toxic conditions that materially affect the health and safety of man or animals, or impair the safety of conventionally treated water supplies. Available references include, but are not limited to: Quality Criteria for Water (Section 304(a) of Public Law 92-500 as amended); Federal Regulations under Section 307 of Public Law 92-500 as amended; and Federal Regulations under Section 1412 of the Public Health Service Act as amended by the Safe Drinking Water Act, (Public Law 93-523).		TDEC 0400-40-03-.03(1)(j)

Table 13-2
Chemical-specific ARARs
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	The waters shall not contain other pollutants in quantities that may be detrimental to public health or impair the usefulness of the water as a source of domestic water supply.		TDEC 0400-40-03-.03(1)(k)
Maximum Contaminant Levels (MCLs)	Shall not exceed the Safe Drinking Water Act National Primary Drinking Water Regulations maximum contaminant levels (MCLs) for inorganic site related contaminants of concerns; specified in 40 CFR 141.62(b) Arsenic 10 µg/L Chromium 100 µg/L Mercury 2 µg/L Thallium 2 µg/L	Class GU ground waters which are an existing or potential drinking water source - **relevant and appropriate**	TDEC 0400-45-01-.06(1)(b) 40 CFR 141.62(b)

Table 13-2 lists Chemical-specific ARARs for the Selected Remedy, which includes SDWA MCLs and TDEC standards for Class GU ground water (TDEC 0400-40-03-.03(1)(j) and (k)) for arsenic, chromium, mercury and thallium. In the absence of an MCL or other promulgated Chemical-specific ARARs, site-specific risk-based remedial goals were developed for the following ground water COCs: aluminum, cobalt, manganese, molybdenum, nickel, and zinc. (See also Table 8-1. Ground Water Chemicals of Concern and Cleanup Levels).

13.2.3 Location-Specific ARARs/TBC Guidance

Location-Specific requirements establish restrictions on permissible concentrations of hazardous substances or establish requirements for how activities will be conducted because they are in special locations (e.g., wetlands, floodplains, critical habitats, streams). There are no Location-Specific ARARs/TBC guidance for the Selected Remedy.

13.2.4 Requirements Applicable to Off-Site Activities

Any remediation wastes that are generated on-Site (e.g., excavated soils or well purge water) and subsequently transferred off-Site or transported in commerce along public right-of-ways must meet any applicable requirements (including administrative portions) such as those for packaging, labeling, marking, manifesting, and placarding requirements for hazardous materials. In addition, CERCLA Section 121(d)(3) provides that the off-Site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be sent to a treatment, storage, or disposal facility that is in compliance with applicable federal and state laws and has been approved by EPA for acceptance of CERCLA waste. See also 40 C.F.R. § 300.440 (so called "Off-Site Rule"). ARARs for off-Site transport of samples and wastes are included in Table 13-1.

13.3 Cost-Effectiveness

In EPA's judgment, the Selected Remedy is cost-effective. In making this determination, the following definition was used: A remedy shall be cost-effective if its "costs are proportional to its overall effectiveness." (40 CFR §300.430(f)(1)(ii)(D)). EPA evaluated the overall effectiveness of those alternatives that satisfied the threshold criteria (were both protective of human health and the environment and ARAR-compliant) by assessing three (3) of the five (5) balancing criteria in combination. Those three criteria are long term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent. The estimated present worth total cost of the Selected Remedy is $3,365,000.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against off-Site treatment and disposal, and considering state and community acceptance.

The Selected Remedy satisfies the criteria for long-term effectiveness by treating the COC-contaminated ground water at the Site. *In situ* treatment and ground water monitoring will effectively and permanently reduce COC concentrations in the ground water and control residual risk. The Selected Remedy does not present short-term risks different from the other treatment alternatives. There are no special implementability issues that set the Selected Remedy apart from any of the other alternatives evaluated.

13.5 Preference for Treatment as a Principal Element

Because the preferred alternative will utilize an active treatment technology to address the ground water contamination, the remedy also meets the statutory preference for the selection of a remedy that involves treatment as a principal element.

13.6 Five-Year Review Requirements

Section 121(c) of CERCLA and the NCP §300.430(f)(5)(iii)(C) provide the statutory and legal bases for conducting five-year reviews. This remedy is not expected to result in hazardous substances, pollutants, or contaminants permanently remaining on-Site above levels that allow for unlimited use and unrestricted exposure; however it is expected to take more than five years to achieve remedial action objectives and cleanup levels. Because the remedy includes capped areas, a statutory review will be conducted within five years of construction completion for the Site to ensure that the remedy is, or will be, protective of human health and the environment. Permanent ICs and continuous Five-Year Reviews will be required since there will be waste left at the Site.

14.0 Documentation of Significant Changes

To fulfill CERCLA §117(b) and NCP §300.430(f)(5)(iii)(B) and §300.430(f)(3)(ii)(A), the ROD must document and discuss the reasons for any significant changes made to the Selected Remedy from the time the Proposed Plan was released for public comment to the final selection of the remedy. The final remedy selected for the Site in this ROD is the same as the preferred remedy released in the Proposed Plan for public comment with no changes.

15.0 References

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PART 3: RESPONSIVENESS SUMMARY

This Responsiveness Summary for the Smokey Mountain Smelters Superfund Site was prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP), 40 CFR §300.430(f). The Responsiveness Summary documents, for the public record, EPA's response to comments received on the Proposed Plan during the public comment period.

The Proposed Plan for the Site was issued on August 6, 2015. A public meeting was held on August 13, 2015 at the Montgomery Village Housing Complex, Knoxville, Tennessee. A written transcript from the meeting is included Appendix B of this ROD and in the Administrative Record file. The 30-day public comment period started on August 6, 2015 and ended on September 8, 2015. No written comments were received by EPA and no request for extension of the comment period was made. A number of questions were asked at the public meeting by the attendees after EPA's presentation, and EPA's responses to these questions are documented in the meeting transcript in Appendix B.

FIGURES

Path: Y:\EPA RAC II LiteTO 19 Smokey Mountain Smelters\GIS\Figure 1 Site Location (ROD).mxd Date: 5/8/2015 User: hcoats

Legend

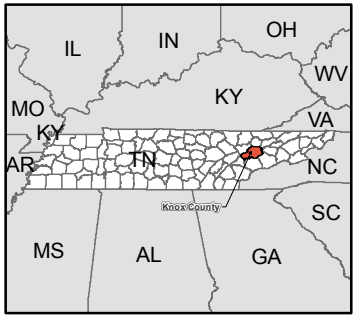
- Watershed Boundary
- Approximate Site Boundary

N

Miles

0 0.75 1.5

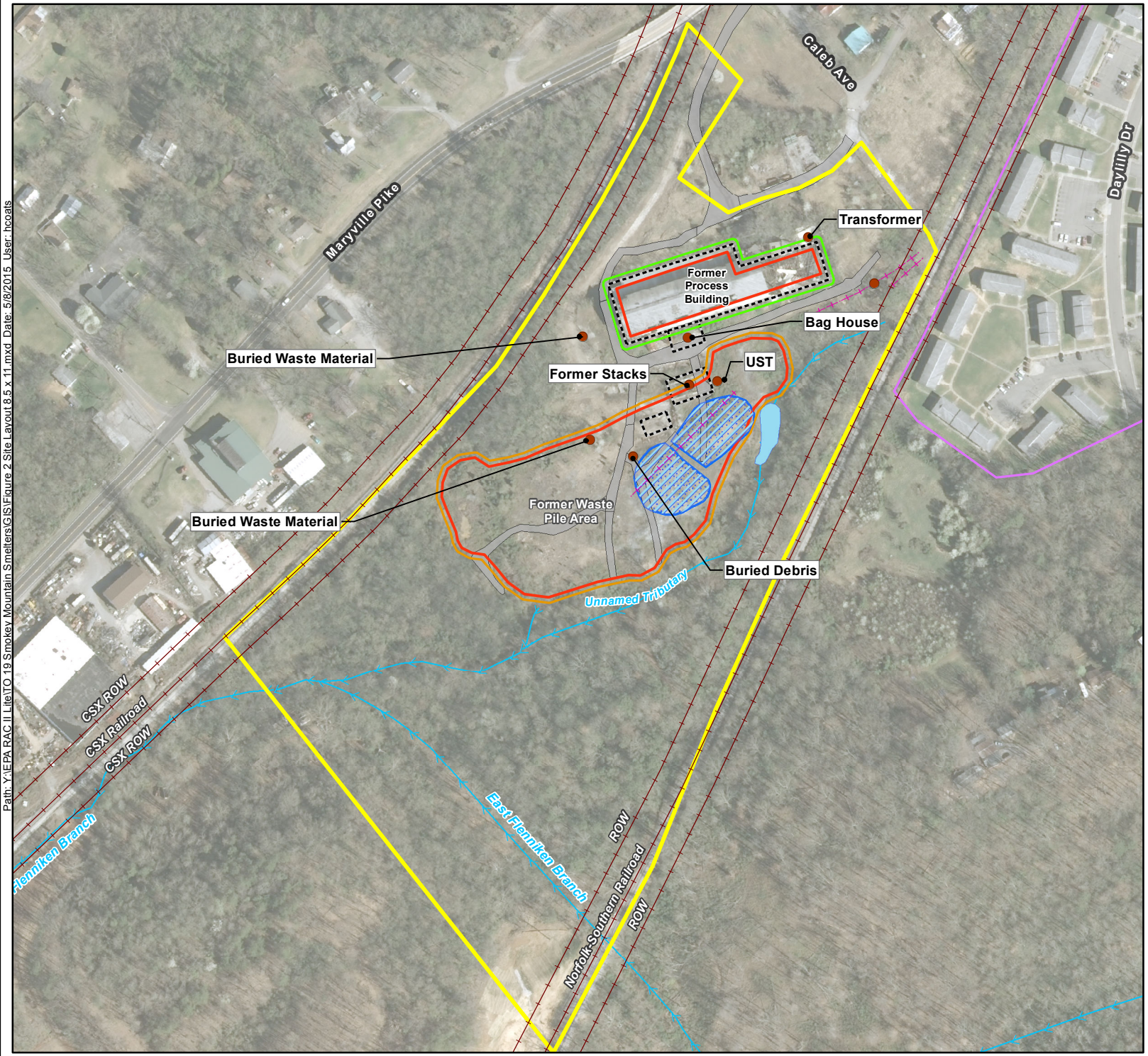
WGS84



SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY,
TENNESSEE

FIGURE 1-1
SITE LOCATION

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS



Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 2 Site Layout 8.5 x 11.mxd Date: 5/8/2015 User: hcoats

Legend

- SMS Site Features Points
- Railroad Tracks
- Abandoned Railroad Spur
- Montgomery Village Apts.
- Historic Surface Water Areas
- SMS CAP Area (Footprint of former process building)
- SMS CAP Area 2 (Footprint of the former waste area)
- Former Structure
- Waste Pile
- SMS Approx Site Boundary
- Temporary Gravel Road
- Former Settling Ponds
- Pond
- Surface Water Pathway

N

0 75 150 300
Feet

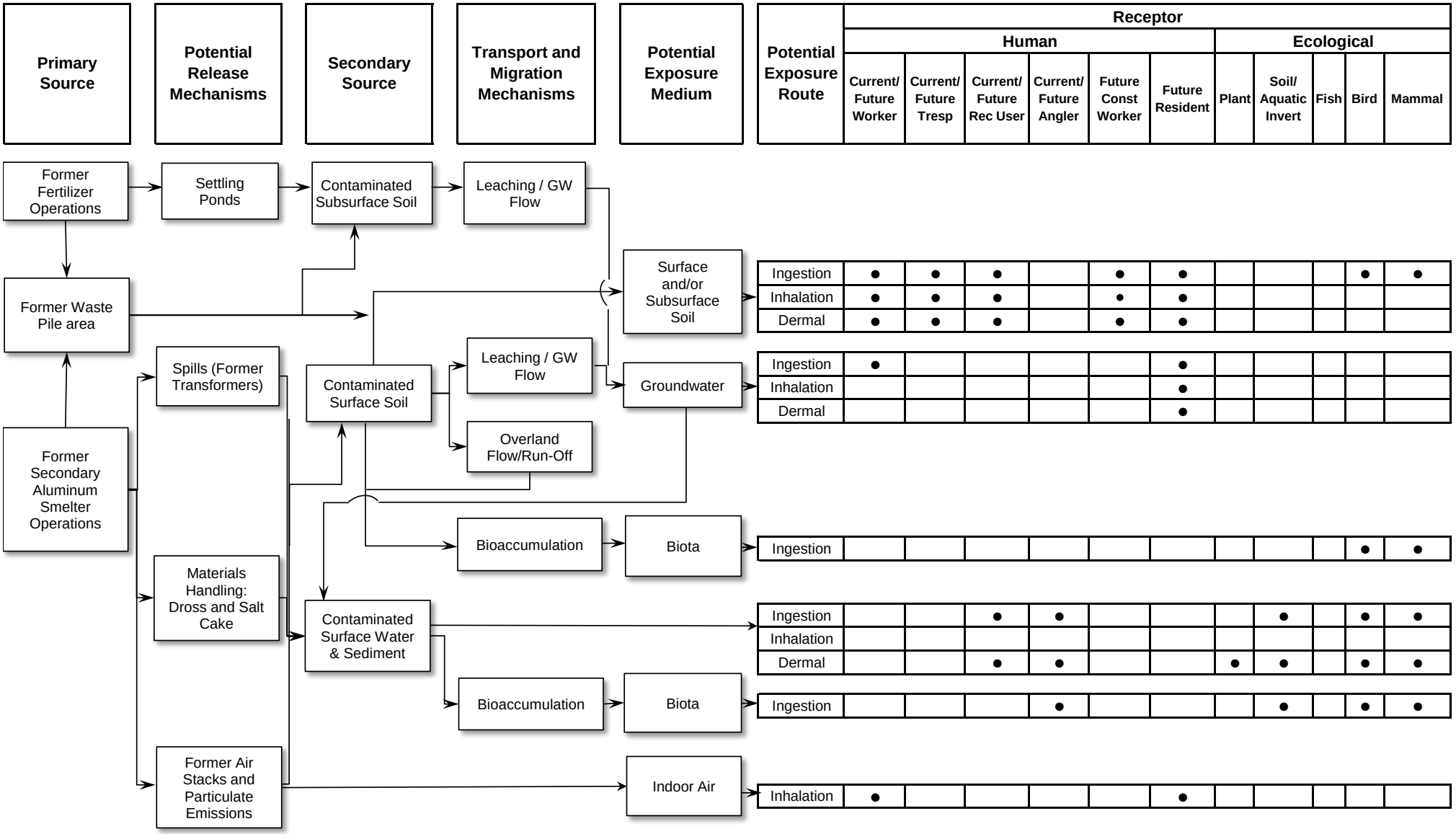
WGS84

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY,
TENNESSEE

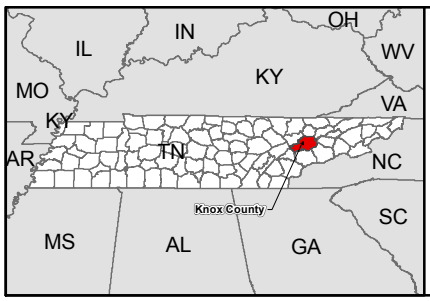
FIGURE 1-2
SITE LAYOUT

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Figure 5-1
Conceptual Site Model



Note: 1. ● - Indicates a potentially complete exposure pathway.



WGS84

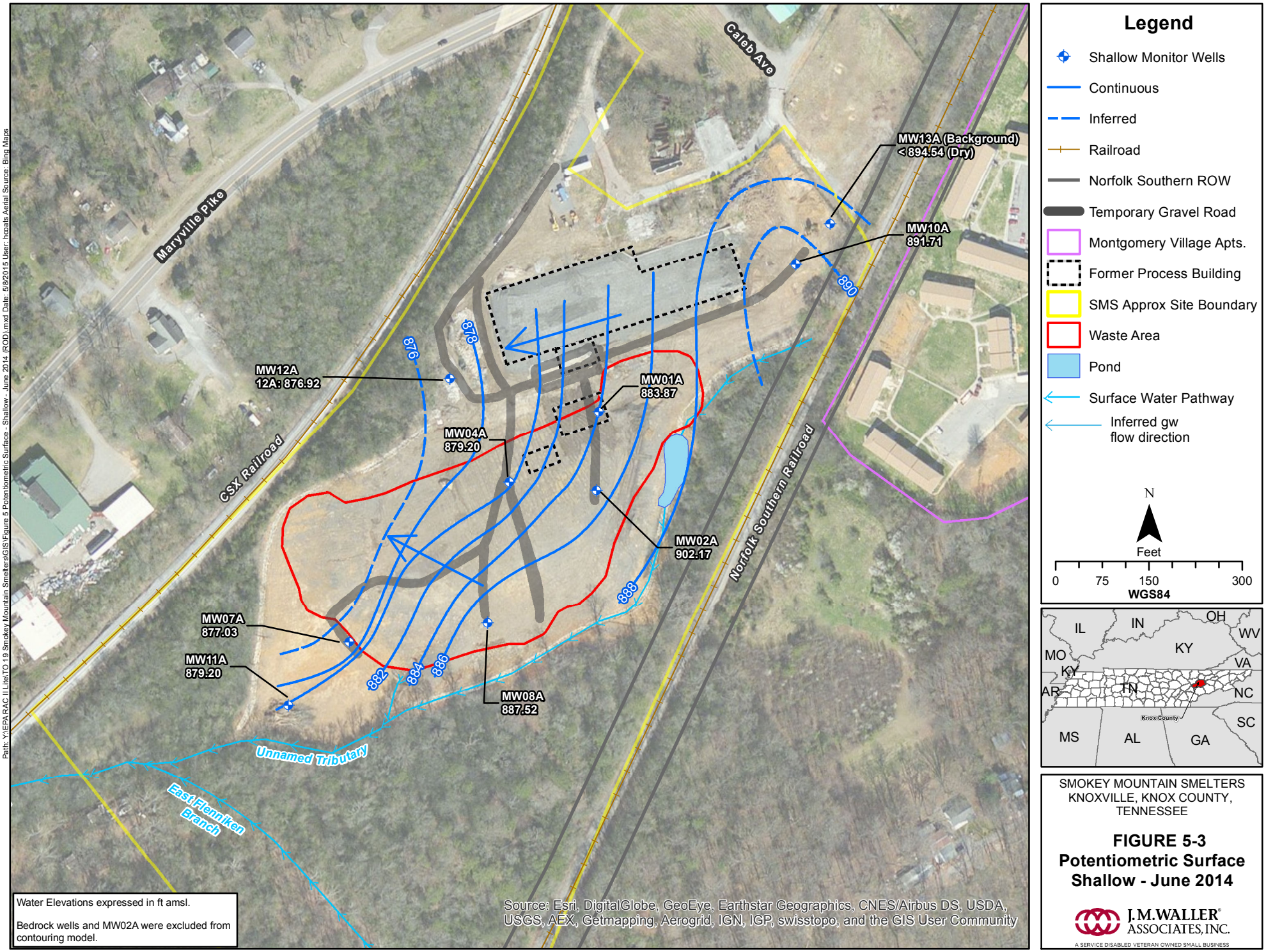
Survey completed by Benchmark and Associates

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY,
TENNESSEE

FIGURE 5-2
Topographic Survey

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 3 Topographic Survey (ROD).mxd Date: 5/8/2015 User: hcoats

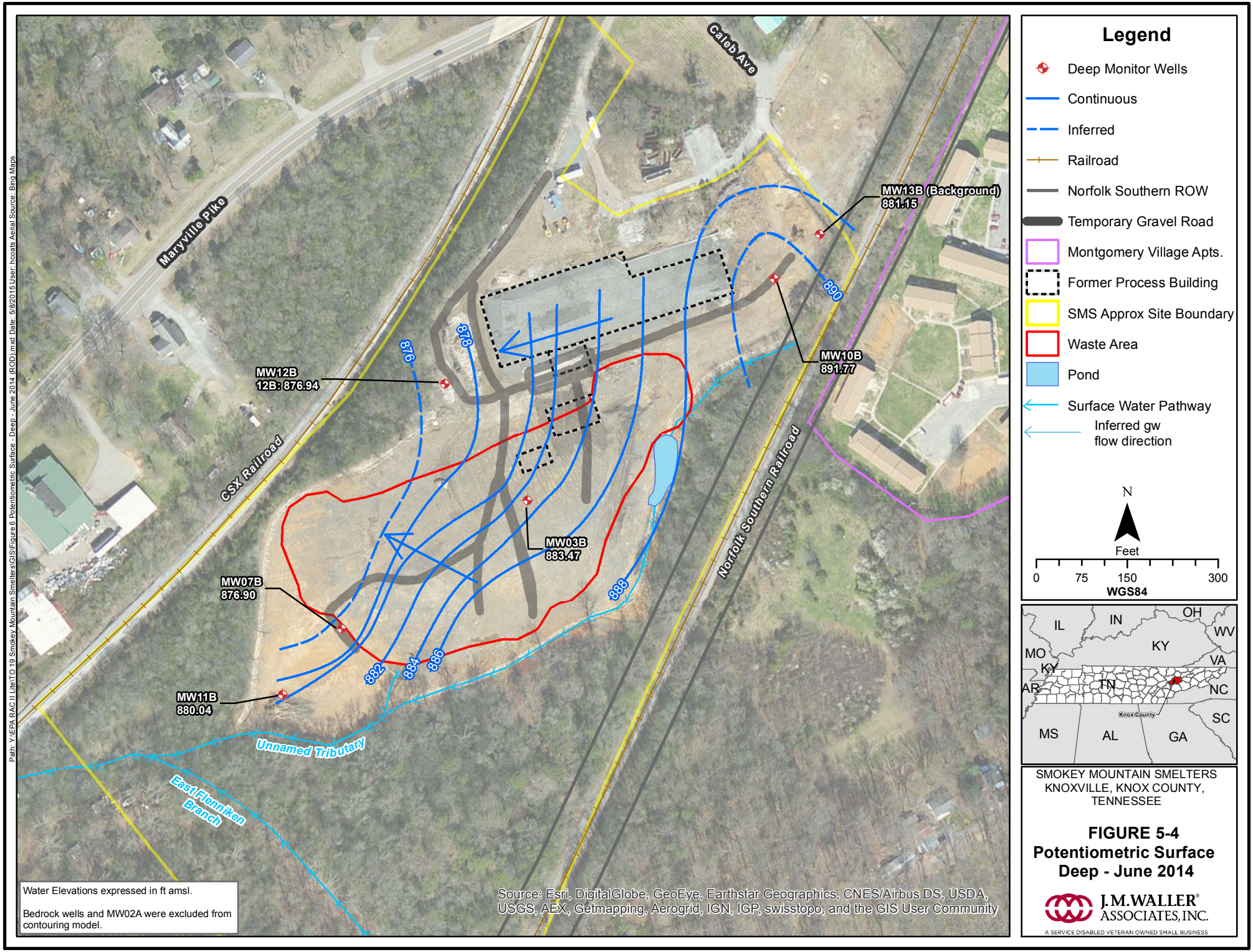


Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 5 Potentiometric Surface - Shallow - June 2014 (ROD).mxd Date: 5/8/2015 User: hoaks Aerial Source: Bing Maps

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 5-3
Potentiometric Surface Shallow - June 2014

J.M. WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS


Caleb Ave
Maryville Pike
CSX Railroad
Norfolk Southern Railroad
MW13B (Background)
881.15
MW10B
891.77
MW12B
12B: 876.94
MW03B
883.47
MW07B
876.90
MW11B
880.04
876
878
880
882
884
886
888
890
Unnamed Tributary
East Fleniken Branch
Water Elevations expressed in ft amsl.
Bedrock wells and MW02A were excluded from contouring model.
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 6 Potentiometric Surface - Deep - June 2014 (ROD).mxd Date: 6/8/2015 User: hcoats Aerial Source: Bing Maps
Legend
Deep Monitor Wells
Continuous
Inferred
Railroad
Norfolk Southern ROW
Temporary Gravel Road
Montgomery Village Apts.
Former Process Building
SMS Approx Site Boundary
Waste Area
Pond
Surface Water Pathway
Inferred gw flow direction
N
Feet
0
75
150
300
WGS84
IL
IN
OH
WV
KY
MO
VA
KY
TN
AR
NC
SC
MS
AL
GA
Knox County
SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE
FIGURE 5-4
Potentiometric Surface
Deep - June 2014
J.M.WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA\RAC II\Task 19 Smokey Mountain Smelters\GIS\Figure 5-1 Onsite Sample Locations (2011).mxd Date: 3/26/2015 Aerial Source: USGS - NAIP 2013 Viewer (Knox County 2009) User: rcoats

Maryville Pike
Caleb Ave
Norfolk-Southern Railroad
Daylilly Dr
Former Process Building
Former Waste Pile Area
See Figure 3-2
Unnamed Tributary
SMSSW02
SMSSDSW03
CSX Railroad
Flenniken Branch
East Flenniken Branch

Legend

- Sediment
- Co-Located Sample
- Surface Water
- Soil & Groundwater
- Subsurface Soil
- Railroad Tracks
- Montgomery Village Apts.
- Proposed Limits of Cap (Footprint of former process building)
- Proposed Limits of Cap (Footprint of the former waste area)

SMS Site Features

- Former Structure
- Waste Pile

GRIDS

- Sampled — *(Surface soil samples were collected at the centroid of each grid from 0 to 1 foot below ground surface)*
- Not Sampled
- Site Boundary
- Former Settling Ponds
- Pond
- Surface Water Pathway
- Surface Water Body

Feet
0 100 200 400
WGS84

N

Historical Site Features

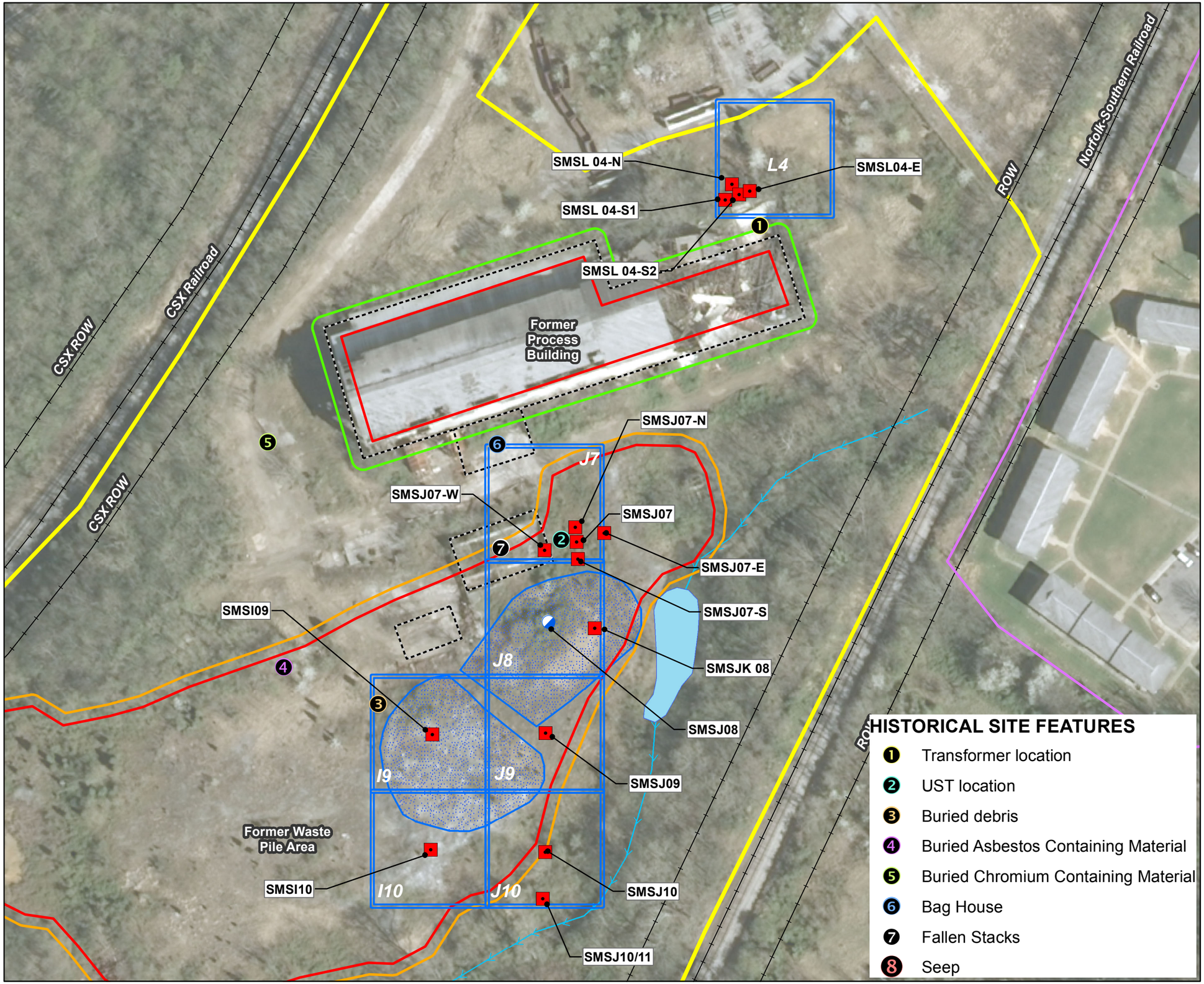
1. Transformer location
2. UST location
3. Buried debris
4. Buried Asbestos Containing Material
5. Buried Chromium Containing Material
6. Bag House
7. Fallen Stacks
8. Seep

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 5-5
Onsite Sample Locations
(2011)

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 4-2 Soil Boring & Groundwater Locations (2011).mxd Date: 3/26/2015 User: hoats Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)



HISTORICAL SITE FEATURES

1. Transformer location
2. UST location
3. Buried debris
4. Buried Asbestos Containing Material
5. Buried Chromium Containing Material
6. Bag House
7. Fallen Stacks
8. Seep

Legend

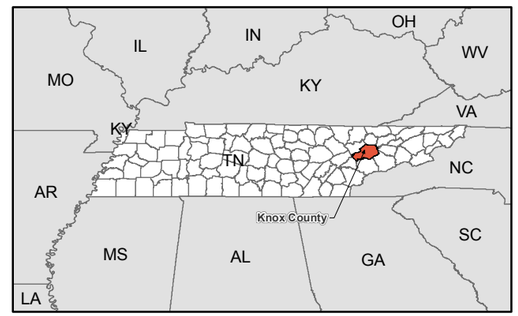
- Soil Boring
- Soil Boring & Groundwater
- Soil Boring Grids
- Montgomery Village Apts.
- Site Boundary
- Proposed Limits of Cap (Footprint of former process building)
- Proposed Limits of Cap (Footprint of the former waste area)
- Former Structure
- Waste Pile
- Former Settling Ponds
- Pond
- Railroad Tracks
- Surface Water Pathway

N

Feet

0 50 100 150 200

WGS84



SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 5-6
Soil Boring and Ground Water Locations (2011)

J.M.WALLER® ASSOCIATES, INC.

A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II LiteTO 19 Smokey Mountain Smelters\GIS\Fig 4-3 Surface Water Sediment Sample Locations.mxd Date: 3/26/2015 User: hcoats Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)

SMSSDSW03
SMSSDSW02
SMSSDSW01
SMSSDSW12
SMSSDSW04
SMSSDSW
SMSSW08-SPRING
SMSSW09-SPRING
SMSSDSW08
SMSSDSW11
SMSSDSW09
SMSSDSW13
SMSSDSW14
SMSSDSW15
SMSSDSW06
SMSSDSW16
SMSSDSW17
SMSSDSW05
SMSKCE01
SMSSDSW18
SMSKCE02
SMSSDSW10
SMSSDSW19
SMSSDSW20
SMSSDSW07
CSX Railroad
Norfolk-Southern Railroad
Flennniken Branch
Knob Creek
Knob Creek Embayment
Wetland Area 1
Wetland Area 2

Legend

Sample Locations

- Surface Water
- Co-Located
- Fish Tissue
- Surface Water/Sediment/Benthic
- Railroad Tracks
- Wetland Areas
- Surface Water Pathway
- SMS Approx Site Boundary
- Watershed Boundary

N

Feet

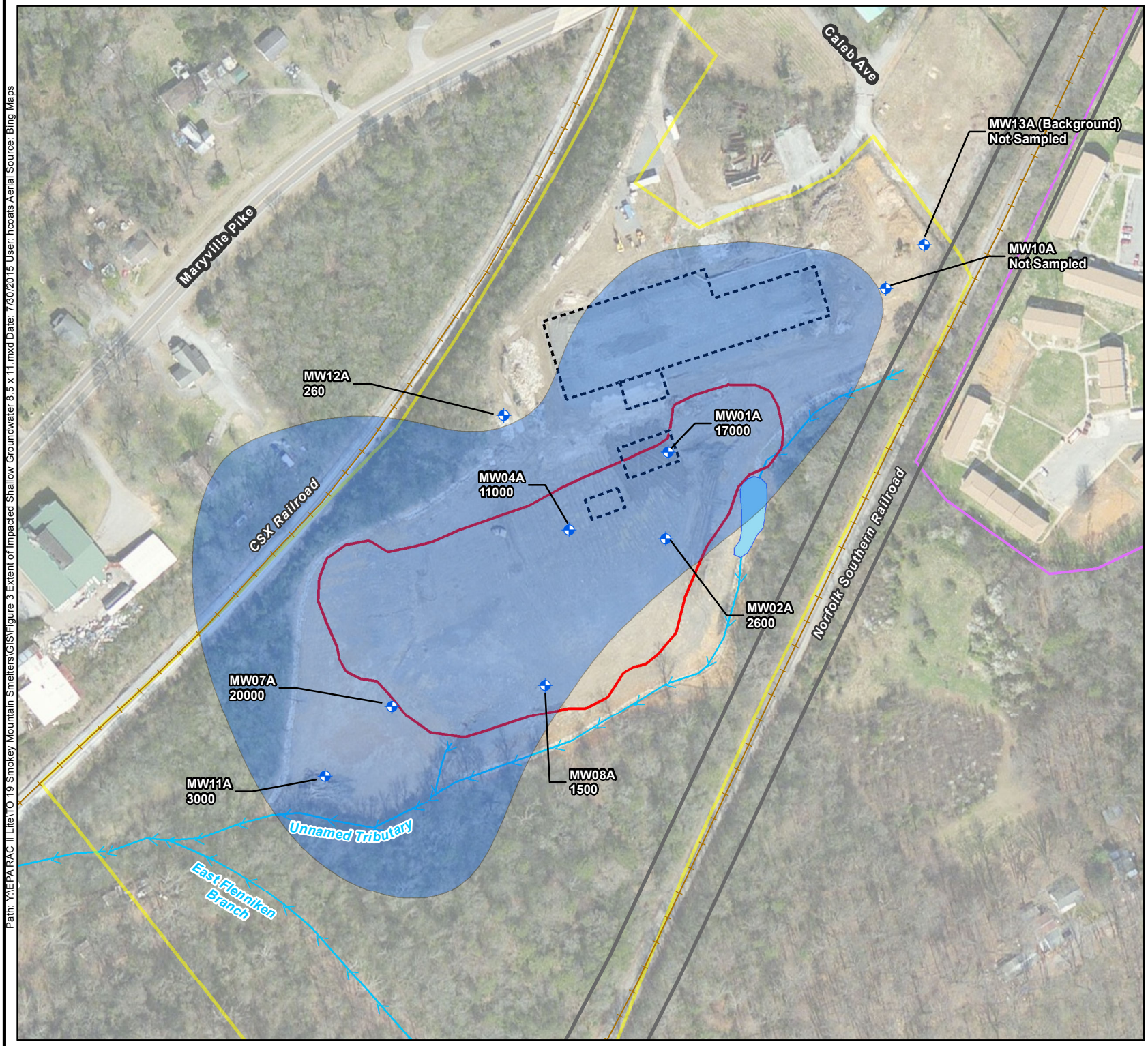
0 500 1,000 2,000

WGS84

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 5-7
Surface Water/Sediment Sample Locations

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS



Legend

- Shallow Monitor Wells
- Railroad
- Norfolk Southern ROW
- Extent of Impacted Shallow Groundwater
- Montgomery Village Apts.
- Former Processing Sturcture
- SMS Approx Site Boundary
- Waste Area
- Pond (Ephemeral)
- Surface Water Pathway (Ephemeral)

MW10A 17000 Monitor Well ID, Chloride Concentration (mg/L)

Extent of Impacted Shallow Groundwater Area: 490732.68 square feet

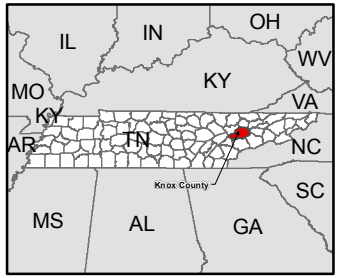
Chloride was used as an indicator to demonstrate the extent of the groundwater contamination for all contaminants of concern (COCs) as shown in Table 1 Remedial Cleanup Goals on page 11 of the Proposed Plan.

N

Feet

0 62.5 125 250

WGS84

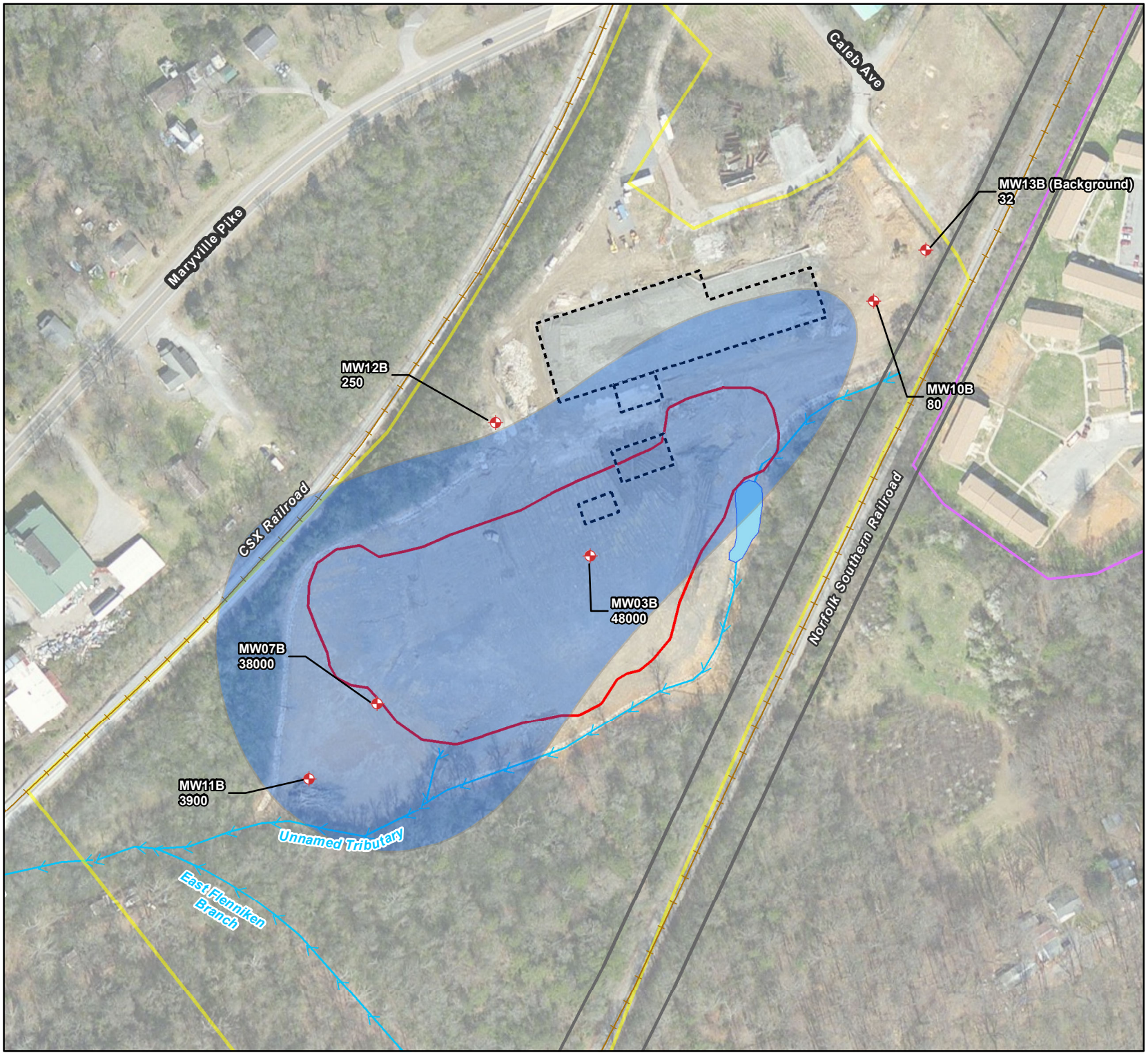


SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 5-8
Extent of Impacted Shallow Groundwater

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 3 Extent of Impacted Shallow Groundwater 8.5 x 11.mxd Date: 7/30/2015 User: hcoats Aerial Source: Bing Maps



Legend

- Deep Monitor Wells
- Railroad
- Norfolk Southern ROW
- Extent of Impacted Deep Groundwater
- Montgomery Village Apts.
- Former Processing Sturcture
- SMS Approx Site Boundary
- Waste Area
- Pond (Ephemeral)
- Surface Water Pathway (Ephemeral)

MW10B
80
Monitor Well ID
Chloride Concentration (mg/L)

Extent of Impacted Deep Groundwater Area: 379241.10 square feet

Chloride was used as an indicator to demonstrate the extent of the ground-water contamination for all contaminants of concern (COCs) as shown in Table 1 Remedial Cleanup Goals on page 11 of the Proposed Plan.

N

Feet

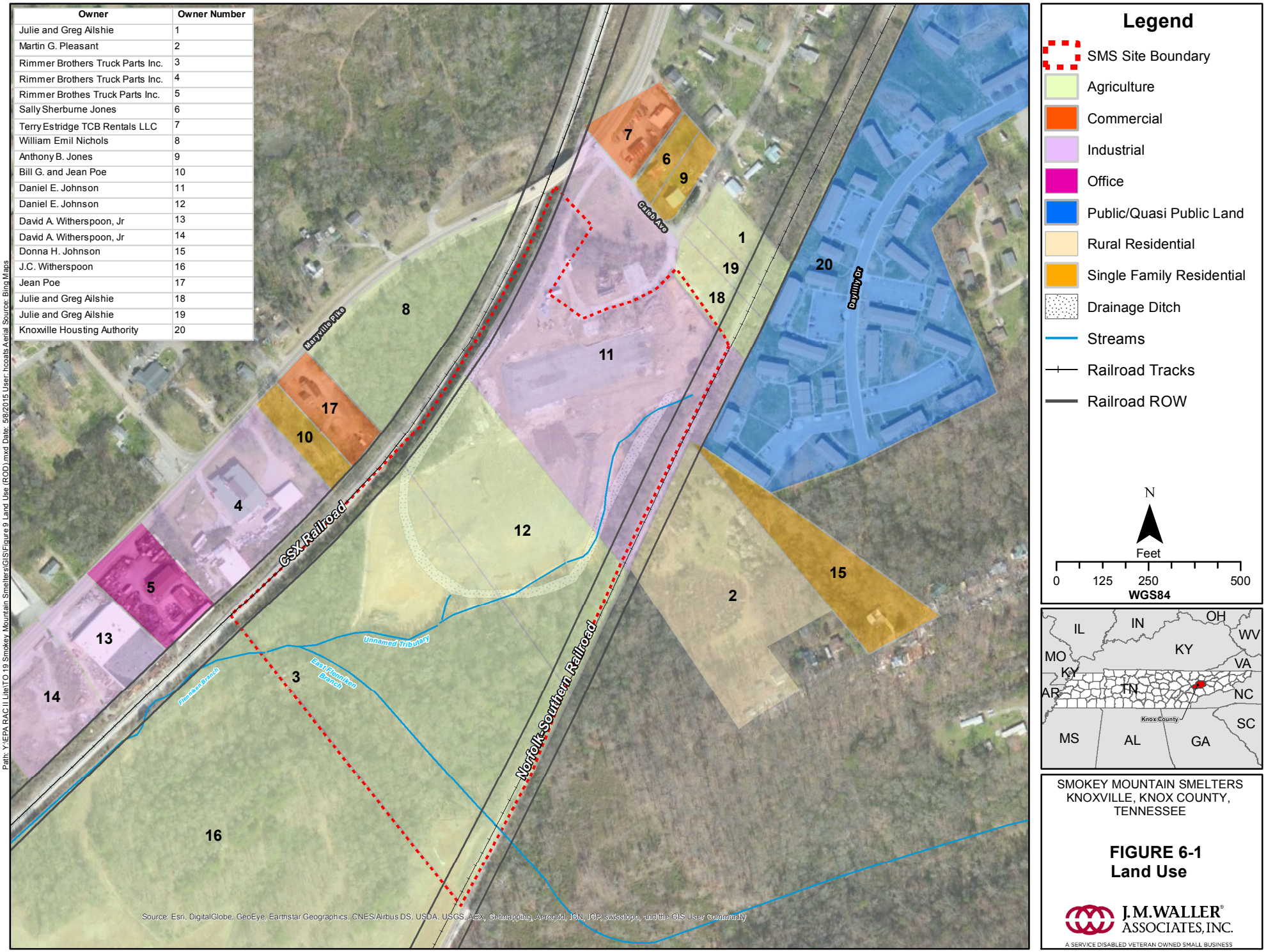
0 62.5 125 250

WGS84

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

Figure 5-9
Extent of Impacted Deep Groundwater

J.M. WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS



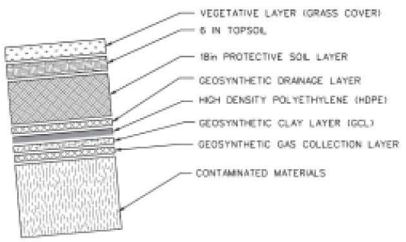
SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 6-1
Land Use

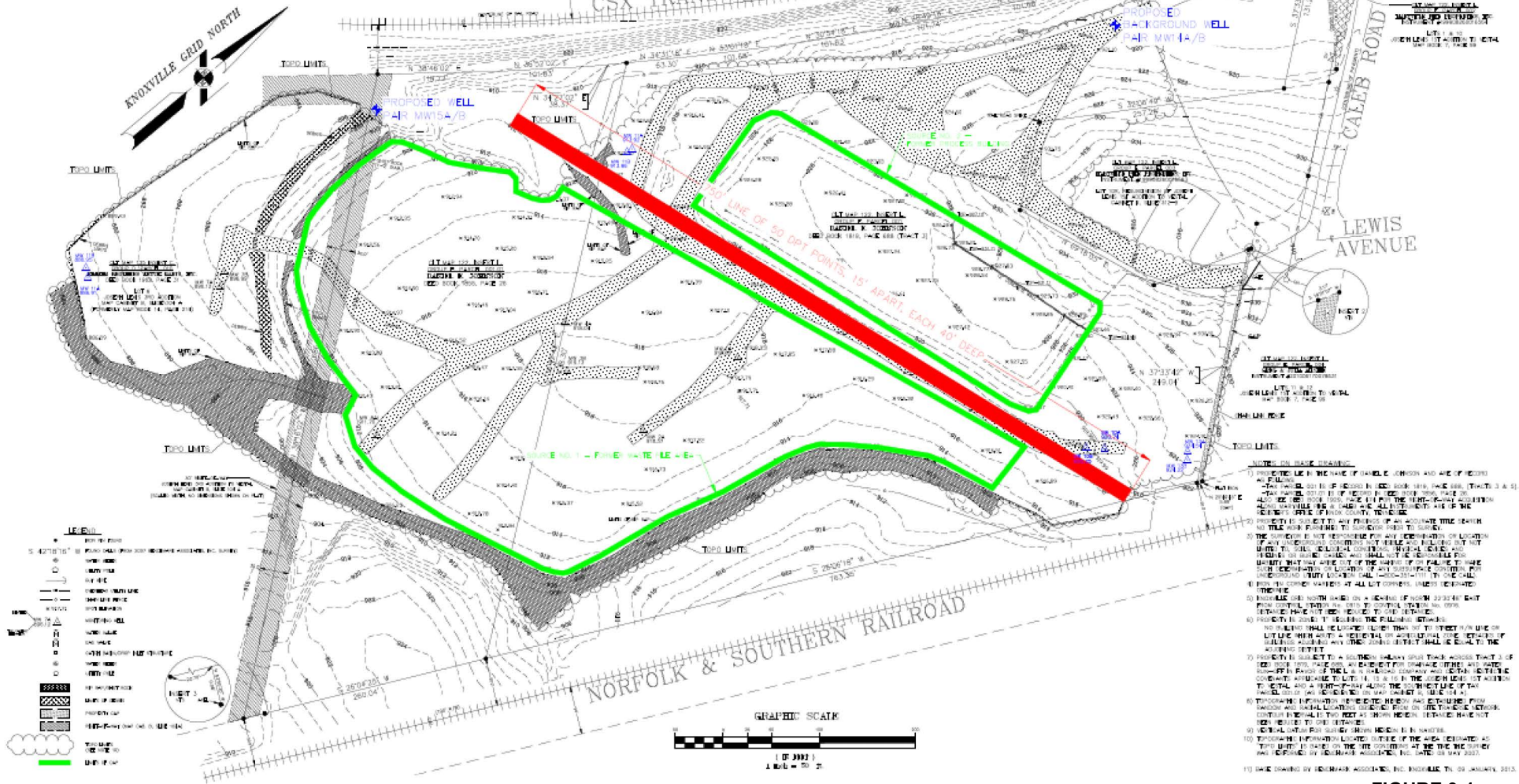
J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

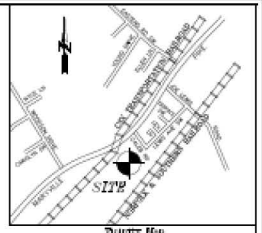
Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 10 Preferred Remedial Alternative (ROD).mxd Date: 5/8/2015 User: hcoats

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY,
TENNESSEE



CONTAINMENT CELL CAP DETAIL 2
NOT TO SCALE





J.M. WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

FIGURE 9-1
Preferred Remedial Alernative

APPENDIX A:

SELECTED REMEDY COST ESTIMATE

Smokey Mountain Smelter
Knoxville, TN
Preliminary Alternativ
Alternative II: Capping, pH Amendment using DPT One-Time Injectic
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATIOI											
2.1 Site Support Facilities (trailers, phone, electric, etc	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Suppor	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintenden	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearanc	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pac	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallor	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallor	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 DPT Rig, 50 points at 40 feet deep	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.3 Inject Pumps/Equipmen	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.4 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.5 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.6 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.7 Monitoring Wells, 2 wells	80	lf	$40.00				$3,200	$0	$0	$0	$3,200
5.8 Monitorng Wells Heads	2	ea	$200.00				$400	$0	$0	$0	$400
6 CAPPING							$0	$0	$0	$0	$0
6.1 Moilization/Demoilization of Capping Contractor	1	ls		$16,000.00			$0	$16,000	$0	$0	$16,000
6.2 Site Setup/Erosion Controls	1					$13,000.00	$0	$0	$0	$13,000	$13,000
6.3 Remove/Stockpile Existing Clay Materials	7,420	cy		$15.31			$0	$113,600	$0	$0	$113,600
6.4 Gas Venting System	200,314	sf		$1.19			$0	$238,374	$0	$0	$238,374
6.5 Geosynthetic Liner	200,314	sf		$1.31			$0	$262,411	$0	$0	$262,411
6.6 60-mil HDPE	200,314	sf		$0.99			$0	$198,311	$0	$0	$198,311
6.7 Place/Compact Soil Layer	11,130	cy		$24.52			$0	$272,908	$0	$0	$272,908
6.8 Construct Access Roads	1	ls	$73,000.00				$73,000	$0	$0	$0	$73,000
6.9 Seed/Mulch	7	ac		$3,980.93			$0	$27,867	$0	$0	$27,867
7 POST CONSTRUCTION COST											
7.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$198,985	$1,140,084	$89,239	$38,523	$1,466,831
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$19,899	$114,008	$8,924	$3,852	$146,683
Tax on Materials and Equipment Cost @ 6.25%								$71,255		$2,408	$73,663
Total Direct Cost							$218,884	$1,325,348	$124,934	$44,783	$1,713,948
Indirects on Total Direct Cost @ 25%											$428,487
Profit on Total Direct Cost @ 10%											$171,395
Subtotal											$2,313,830
Health & Safety Monitoring @ 2%											$46,277
Total Field Cost											$2,360,107
Engineering on Total Field Cost @ 10%											$236,011
Contingency on Total Field Cost @ 20%											$472,021
TOTAL CAPITAL COST											**$3,068,139**

Smokey Mountain Smelters
Knoxville, TN
Preliminary Alternative
Alternative II: Capping, pH Amendment using DPT One-Time Injection
O & M Cost: Reinjection - 2-Year intervals

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilizatior	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$56,235	$6,118	$37,579	$21,564	$121,496
15											
Overhead on Labor Cost @ 30%									$11,274		$11,274
& A on Labor, Material, Equipment, & Subs Cost @ 10%							$5,624	$612	$3,758	$2,156	$12,150
Tax on Materials and Equipment Cost @ 6.25%								$382		$1,348	$1,730
Total Direct Cost							$61,859	$7,112	$52,610	$25,068	$146,649
Indirects on Total Direct Cost @ 25%											$36,662
Profit on Total Direct Cost @ 10%											$14,665
Subtotal											$197,976
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$197,976
Engineering on Total Field Cost @ 25%											$49,494
Contingency on Total Field Cost @ 25%											$49,494
TOTAL CAPITAL COST											**$296,964**

Smokey Mountain Smelters
Knoxville, TN
Preliminary Alternative
Alternative II: Capping, pH Amendment using DPT One-Time Injection
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Cap Maintenance			$12,000		$12000 per year for monthly mowing and miscellaneous fence/cap repairs
Subtotal	$0	$0	$27,300	$0	
Contingency @ 10%	$0	$0	$2,730	$0	
TOTAL	**$0**	**$0**	**$30,030**	**$0**	

Smokey Mountain Smelters
Preliminary Alternative
Knoxville, TN

Alternative II: Capping, pH Amendment using DPT One-Time Injection
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$3,068,139			$3,068,139	1.000	$3,068,139
1			$30,030	$30,030	0.980	$29,441
2			$30,030	$30,030	0.961	$28,864
3			$30,030	$30,030	0.942	$28,298
4			$30,030	$30,030	0.924	$27,743
5			$30,030	$30,030	0.906	$27,199
6			$30,030	$30,030	0.888	$26,666
7			$30,030	$30,030	0.871	$26,143
8			$30,030	$30,030	0.853	$25,630
9			$30,030	$30,030	0.837	$25,128
10			$30,030	$30,030	0.820	$24,635
11			$30,030	$30,030	0.804	$24,152
12			$30,030	$30,030	0.788	$23,678
13			$30,030	$30,030	0.773	$23,214
14			$30,030	$30,030	0.758	$22,759
15			$30,030	$30,030	0.743	$22,313
16			$30,030	$30,030	0.728	$21,875
17			$30,030	$30,030	0.714	$21,446
18			$30,030	$30,030	0.700	$21,026
19			$30,030	$30,030	0.686	$20,614
20			$30,030	$30,030	0.673	$20,209
21			$30,030	$30,030	0.660	$19,813
22			$30,030	$30,030	0.647	$19,425
23			$30,030	$30,030	0.634	$19,044
24			$30,030	$30,030	0.622	$18,670
25			$30,030	$30,030	0.610	$18,304
26			$30,030	$30,030	0.598	$17,945
27			$30,030	$30,030	0.586	$17,593
28			$30,030	$30,030	0.574	$17,248
29			$30,030	$30,030	0.563	$16,910
30			$30,030	$30,030	0.552	$16,579
				TOTAL PRESENT WORTH		**$3,740,705**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIA
Alternative: Injection Barrier using DPT One-Time Injection
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 DPT Rig, 50 points at 40 feet deep	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.3 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.4 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.5 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.6 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.7 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.8 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$140,785	$10,614	$89,239	$25,523	$266,161
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$14,079	$1,061	$8,924	$2,552	$26,616
Tax on Materials and Equipment Cost @ 6.25%								$663		$1,595	$2,259
Total Direct Cost							$154,864	$12,339	$124,934	$29,670	$321,807

Smokey Mountain Smelters
Knoxville, TN
Alternative IIA
Alternative: Injection Barrier using DPT One-Time Injection
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$80,452
Profit on Total Direct Cost @ 10%											$32,181
Subtotal											$434,439
Health & Safety Monitoring @ 2%											$8,689
Total Field Cost											$443,128
Engineering on Total Field Cost @ 10%											$44,313
Contingency on Total Field Cost @ 20%											$88,626
TOTAL CAPITAL COST											**$576,066**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIA
Alternative: Injection Barrier using DPT One-Time Injection
O & M Cost: Reinjection - 2-Year intervals

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$56,235	$6,118	$37,579	$21,564	$121,496
Overhead on Labor Cost @ 30%	15								$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$5,624	$612	$3,758	$2,156	$12,150
Tax on Materials and Equipment Cost @ 6.25%								$382		$1,348	$1,730
Total Direct Cost							$61,859	$7,112	$52,610	$25,068	$146,649
Indirects on Total Direct Cost @ 25%											$36,662
Profit on Total Direct Cost @ 10%											$14,665
Subtotal											$197,976
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$197,976
Engineering on Total Field Cost @ 25%											$49,494
Contingency on Total Field Cost @ 25%											$49,494
TOTAL CAPITAL COST											**$296,964**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIA
Alternative: Injection Barrier using DPT One-Time Injection
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIA
Knoxville, TN
Alternative: Injection Barrier using DPT One-Time Injection
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$576,066			$576,066	1.000	$576,066
1			$16,830	$16,830	0.980	$16,500
2			$16,830	$16,830	0.961	$16,176
3			$16,830	$16,830	0.942	$15,859
4			$16,830	$16,830	0.924	$15,548
5			$16,830	$16,830	0.906	$15,243
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$952,999**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-10X
Alternative: Injection Barrier using DPT One-Time Injection, 10X Chemical Cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 DPT Rig, 50 points at 40 feet deep	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.3 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.4 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.5 Sodium Bicarbonate	7,000	lb		$0.30			$0	$2,100	$0	$0	$2,100
5.6 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.7 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.8 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$140,785	$12,504	$89,239	$25,523	$268,051
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$14,079	$1,250	$8,924	$2,552	$26,805
Tax on Materials and Equipment Cost @ 6.25%								$782		$1,595	$2,377
Total Direct Cost							$154,864	$14,536	$124,934	$29,670	$324,004

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-10X
Alternative: Injection Barrier using DPT One-Time Injection, 10X Chemical Cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$81,001
Profit on Total Direct Cost @ 10%											$32,400
Subtotal											$437,405
Health & Safety Monitoring @ 2%											$8,748
Total Field Cost											$446,153
Engineering on Total Field Cost @ 10%											$44,615
Contingency on Total Field Cost @ 20%											$89,231
TOTAL CAPITAL COST											**$579,999**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-10X
Alternative: Injection Barrier using DPT One-Time Injection, 10X Chemical Cost
O & M Cost: Reinjection - 2-Year intervals

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$56,235	$6,118	$37,579	$21,564	$121,496
Overhead on Labor Cost @ 30%	15								$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$5,624	$612	$3,758	$2,156	$12,150
Tax on Materials and Equipment Cost @ 6.25%								$382		$1,348	$1,730
Total Direct Cost							$61,859	$7,112	$52,610	$25,068	$146,649
Indirects on Total Direct Cost @ 25%											$36,662
Profit on Total Direct Cost @ 10%											$14,665
Subtotal											$197,976
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$197,976
Engineering on Total Field Cost @ 25%											$49,494
Contingency on Total Field Cost @ 25%											$49,494
TOTAL CAPITAL COST											**$296,964**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-10X
Alternative: Injection Barrier using DPT One-Time Injection, 10X Chemical Cost
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIB-10X
Knoxville, TN
Alternative: Injection Barrier using DPT One-Time Injection, 10X Chemical Cost
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$579,999			$579,999	1.000	$579,999
1			$16,830	$16,830	0.980	$16,500
2			$16,830	$16,830	0.961	$16,176
3			$16,830	$16,830	0.942	$15,859
4			$16,830	$16,830	0.924	$15,548
5			$16,830	$16,830	0.906	$15,243
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$956,932**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-100X
Alternative: Injection Barrier using DPT One-Time Injection, 100X Chemical Cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 DPT Rig, 50 points at 40 feet deep	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.3 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.4 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.5 Sodium Bicarbonate	70,000	lb		$0.30			$0	$21,000	$0	$0	$21,000
5.6 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.7 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.8 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$140,785	$31,404	$89,239	$25,523	$286,951
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$14,079	$3,140	$8,924	$2,552	$28,695
Tax on Materials and Equipment Cost @ 6.25%								$1,963		$1,595	$3,558
Total Direct Cost							$154,864	$36,507	$124,934	$29,670	$345,975

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-100X
Alternative: Injection Barrier using DPT One-Time Injection, 100X Chemical Cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$86,494
Profit on Total Direct Cost @ 10%											$34,598
Subtotal											$467,066
Health & Safety Monitoring @ 2%											$9,341
Total Field Cost											$476,408
Engineering on Total Field Cost @ 10%											$47,641
Contingency on Total Field Cost @ 20%											$95,282
TOTAL CAPITAL COST											**$619,330**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-100X
Alternative: Injection Barrier using DPT One-Time Injection, 100X Chemical Cost
O & M Cost: Reinjection - 2-Year intervals

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	17	day	$2,000.00				$34,000	$0	$0	$0	$34,000
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$56,235	$6,118	$37,579	$21,564	$121,496
Overhead on Labor Cost @ 30%	15								$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$5,624	$612	$3,758	$2,156	$12,150
Tax on Materials and Equipment Cost @ 6.25%								$382		$1,348	$1,730
Total Direct Cost							$61,859	$7,112	$52,610	$25,068	$146,649
Indirects on Total Direct Cost @ 25%											$36,662
Profit on Total Direct Cost @ 10%											$14,665
Subtotal											$197,976
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$197,976
Engineering on Total Field Cost @ 25%											$49,494
Contingency on Total Field Cost @ 25%											$49,494
TOTAL CAPITAL COST											**$296,964**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIB-100X
Alternative: Injection Barrier using DPT One-Time Injection, 100X Chemical Cost
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIB-100X
Knoxville, TN
Alternative: Injection Barrier using DPT One-Time Injection, 100X Chemical Cost
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$619,330			$619,330	1.000	$619,330
1			$16,830	$16,830	0.980	$16,500
2			$16,830	$16,830	0.961	$16,176
3			$16,830	$16,830	0.942	$15,859
4			$16,830	$16,830	0.924	$15,548
5			$16,830	$16,830	0.906	$15,243
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$996,263**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 Injection wells 50, at 40' each	2,000	feet	$40.00				$80,000	$0	$0	$0	$80,000
5.2 Injection well heads, 50 wells	50	each	$200.00				$10,000	$0	$0	$0	$10,000
5.3 IDW for wells (3 drums per well)	150	each	$125.00				$18,750	$0	$0	$0	$18,750
5.4 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.5 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.6 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.7 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.8 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.9 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$215,535	$10,614	$89,239	$25,523	$340,911
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$21,554	$1,061	$8,924	$2,552	$34,091
Tax on Materials and Equipment Cost @ 6.25%								$663		$1,595	$2,259
Total Direct Cost							$237,089	$12,339	$124,934	$29,670	$404,032

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$101,008
Profit on Total Direct Cost @ 10%											$40,403
Subtotal											$545,443
Health & Safety Monitoring @ 2%											$10,909
Total Field Cost											$556,352
Engineering on Total Field Cost @ 10%											$55,635
Contingency on Total Field Cost @ 20%											$111,270
TOTAL CAPITAL COST											**$723,257**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years
O & M Cost: Reinjection

Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	0	day	$2,000.00				$0	$0	$0	$0	$0
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	700	lb		$0.30			$0	$210	$0	$0	$210
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$22,235	$6,118	$37,579	$21,564	$87,496
15											
Overhead on Labor Cost @ 30%									$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$2,224	$612	$3,758	$2,156	$8,750
Tax on Materials and Equipment Cost @ 6.25%								$382		$1,348	$1,730
Total Direct Cost							$24,459	$7,112	$52,610	$25,068	$109,249
Indirects on Total Direct Cost @ 25%											$27,312
Profit on Total Direct Cost @ 10%											$10,925
Subtotal											$147,486
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$147,486
Engineering on Total Field Cost @ 25%											$36,871
Contingency on Total Field Cost @ 25%											$36,871
TOTAL CAPITAL COST											**$221,229**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIC
Knoxville, TN
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$723,257			$723,257	1.000	$723,257
1		$221,229	$16,830	$238,059	0.980	$233,391
2		$221,229	$16,830	$238,059	0.961	$228,815
3		$221,229	$16,830	$238,059	0.942	$224,328
4		$221,229	$16,830	$238,059	0.924	$219,930
5		$221,229	$16,830	$238,059	0.906	$215,617
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$2,142,943**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 10X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 10X chemical cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 Injection wells 50, at 40' each	2,000	feet	$40.00				$80,000	$0	$0	$0	$80,000
5.2 Injection well heads, 50 wells	50	each	$200.00				$10,000	$0	$0	$0	$10,000
5.3 IDW for wells (3 drums per well)	150	each	$125.00				$18,750	$0	$0	$0	$18,750
5.4 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.5 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.6 Sodium Bicarbonate	7,000	lb		$0.30			$0	$2,100	$0	$0	$2,100
5.7 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.8 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.9 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$215,535	$12,504	$89,239	$25,523	$342,801
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$21,554	$1,250	$8,924	$2,552	$34,280
Tax on Materials and Equipment Cost @ 6.25%								$782		$1,595	$2,377
Total Direct Cost							$237,089	$14,536	$124,934	$29,670	$406,229

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 10X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 10X chemical cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$101,557
Profit on Total Direct Cost @ 10%											$40,623
Subtotal											$548,409
Health & Safety Monitoring @ 2%											$10,968
Total Field Cost											$559,377
Engineering on Total Field Cost @ 10%											$55,938
Contingency on Total Field Cost @ 20%											$111,875
TOTAL CAPITAL COST											**$727,190**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 10X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 10X chemical cost
O & M Cost: Reinjection

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	0	day	$2,000.00				$0	$0	$0	$0	$0
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	7,000	lb		$0.30			$0	$2,100	$0	$0	$2,100
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$22,235	$8,008	$37,579	$21,564	$89,386
Overhead on Labor Cost @ 30% (15)									$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$2,224	$801	$3,758	$2,156	$8,939
Tax on Materials and Equipment Cost @ 6.25%								$501		$1,348	$1,848
Total Direct Cost							$24,459	$9,309	$52,610	$25,068	$111,446
Indirects on Total Direct Cost @ 25%											$27,861
Profit on Total Direct Cost @ 10%											$11,145
Subtotal											$150,452
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$150,452
Engineering on Total Field Cost @ 25%											$37,613
Contingency on Total Field Cost @ 25%											$37,613
TOTAL CAPITAL COST											**$225,678**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 10X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 10X chemical cost
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIC - 10X
Knoxville, TN
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 10X chemical cost
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$727,190			$727,190	1.000	$727,190
1		$225,678	$16,830	$242,508	0.980	$237,753
2		$225,678	$16,830	$242,508	0.961	$233,091
3		$225,678	$16,830	$242,508	0.942	$228,521
4		$225,678	$16,830	$242,508	0.924	$224,040
5		$225,678	$16,830	$242,508	0.906	$219,647
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$2,167,847**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 100X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 100X chemical cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	500	hr			$60.00		$0	$0	$30,000	$0	$30,000
1.2 Prepare LTM Plans	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
1.3 Treatability study	1	ls	$60,000.00				$60,000	$0	$0	$0	$60,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	1	mo				$365.00	$0	$0	$0	$365	$365
3.2 Field Office Equipment, Utilities, & Support	1	mo		$508.00			$0	$508	$0	$0	$508
3.3 Storage Trailer	1	mo				$94.00	$0	$0	$0	$94	$94
3.4 Survey Support	1	day	$1,150.00				$1,150	$0	$0	$0	$1,150
3.5 Site Superintendent	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
3.6 Site Health & Safety and QA/QC	18	day		$166.00	$370.00		$0	$2,988	$6,660	$0	$9,648
3.7 Underground Utility Clearance	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 INJECTION											
5.1 Injection wells 50, at 40' each	2,000	feet	$40.00				$80,000	$0	$0	$0	$80,000
5.2 Injection well heads, 50 wells	50	each	$200.00				$10,000	$0	$0	$0	$10,000
5.3 IDW for wells (3 drums per well)	150	each	$125.00				$18,750	$0	$0	$0	$18,750
5.4 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.5 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.6 Sodium Bicarbonate	70,000	lb		$0.30			$0	$21,000	$0	$0	$21,000
5.7 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
5.8 Monitoring Wells, 4 at 40', 4 at 65'	420	lf	$40.00				$16,800	$0	$0	$0	$16,800
5.9 Monitorng Wells Heads	8	ea	$200.00				$1,600	$0	$0	$0	$1,600
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	300	hr			$60.00		$0	$0	$18,000	$0	$18,000
Subtotal							$215,535	$31,404	$89,239	$25,523	$361,701
Overhead on Labor Cost @ 30%									$26,772		$26,772
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$21,554	$3,140	$8,924	$2,552	$36,170
Tax on Materials and Equipment Cost @ 6.25%								$1,963		$1,595	$3,558
Total Direct Cost							$237,089	$36,507	$124,934	$29,670	$428,200

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 100X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 100X chemical cost
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Cost @ 25%											$107,050
Profit on Total Direct Cost @ 10%											$42,820
Subtotal											$578,070
Health & Safety Monitoring @ 2%											$11,561
Total Field Cost											$589,632
Engineering on Total Field Cost @ 10%											$58,963
Contingency on Total Field Cost @ 20%											$117,926
TOTAL CAPITAL COST											**$766,521**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 100X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 100X chemical cost
O & M Cost: Reinjection

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	150	hr			$60.00		$0	$0	$9,000	$0	$9,000
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Equipment Mobilization/Demobilization	1	ea				$1,000.00	$0	$0	$0	$1,000	$1,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Storage Trailer	0	mo				$94.00	$0	$0	$0	$0	$0
3.2 Site Superintendent and QA/QC	18	day		$166.00	$420.00		$0	$2,988	$7,560	$0	$10,548
4 DECONTAMINATION											
4.1 Decontamination Services	1	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
4.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$300	$3,800
4.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
4.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$813.00	$0	$0	$0	$813	$813
4.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$731.00	$0	$0	$0	$731	$731
4.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
5 REINJECTION											
5.1 DPT Rig, 50 injection points	0	day	$2,000.00				$0	$0	$0	$0	$0
5.2 Inject Pumps/Equipment	17	day				$525.00	$0	$0	$0	$8,925	$8,925
5.3 Injection Crew	17	day	$1,250.00		$280.80		$21,250	$0	$4,774	$0	$26,024
5.4 Sodium Bicarbonate	70,000	lb		$0.30			$0	$21,000	$0	$0	$21,000
5.5 Water Tank Truck	17	day				$485.00	$0	$0	$0	$8,245	$8,245
6 POST CONSTRUCTION COST											
6.1 Contractor Completion Report	200	hr			$60.00		$0	$0	$12,000	$0	$12,000
Subtotal							$22,235	$26,908	$37,579	$21,564	$108,286
Overhead on Labor Cost @ 30%	15								$11,274		$11,274
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$2,224	$2,691	$3,758	$2,156	$10,829
Tax on Materials and Equipment Cost @ 6.25%								$1,682		$1,348	$3,030
Total Direct Cost							$24,459	$31,281	$52,610	$25,068	$133,417
Indirects on Total Direct Cost @ 25%											$33,354
Profit on Total Direct Cost @ 10%											$13,342
Subtotal											$180,113
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$180,113
Engineering on Total Field Cost @ 25%											$45,028
Contingency on Total Field Cost @ 25%											$45,028
TOTAL CAPITAL COST											**$270,170**

Smokey Mountain Smelters
Knoxville, TN
Alternative IIC - 100X
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 100X chemical cost
Annual Cost

Item	Item Cost year 1	Item Cost years 2 - 3	Item Cost years 1 - 30	Item Cost every 5 years	Notes
Groundwater Sampling			$3,000		Labor and supplies to collect samples from 2 wells, annually
Analysis: Groundwater			$300		Analyze groundwater samples for metals
Sampling Report			$12,000		
Five Year Site Review					NA for this estimate
Subtotal	$0	$0	$15,300	$0	
Contingency @ 10%	$0	$0	$1,530	$0	
TOTAL	**$0**	**$0**	**$16,830**	**$0**	

Smokey Mountain Smelters
Alternative IIC - 100X
Knoxville, TN
Alternative: Injection Barrier using Wells - Re-injection at annual intervals, first 5 years; 100X chemical cost
Present Worth Analysis

Year	Capital Cost	Operation & Maintenance Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$766,521			$766,521	1.000	$766,521
1		$270,170	$16,830	$287,000	0.980	$281,372
2		$270,170	$16,830	$287,000	0.961	$275,855
3		$270,170	$16,830	$287,000	0.942	$270,446
4		$270,170	$16,830	$287,000	0.924	$265,144
5		$270,170	$16,830	$287,000	0.906	$259,945
6			$16,830	$16,830	0.888	$14,945
7			$16,830	$16,830	0.871	$14,652
8			$16,830	$16,830	0.853	$14,364
9			$16,830	$16,830	0.837	$14,083
10			$16,830	$16,830	0.820	$13,806
11			$16,830	$16,830	0.804	$13,536
12			$16,830	$16,830	0.788	$13,270
13			$16,830	$16,830	0.773	$13,010
14			$16,830	$16,830	0.758	$12,755
15			$16,830	$16,830	0.743	$12,505
16			$16,830	$16,830	0.728	$12,260
17			$16,830	$16,830	0.714	$12,019
18			$16,830	$16,830	0.700	$11,784
19			$16,830	$16,830	0.686	$11,553
20			$16,830	$16,830	0.673	$11,326
21			$16,830	$16,830	0.660	$11,104
22			$16,830	$16,830	0.647	$10,886
23			$16,830	$16,830	0.634	$10,673
24			$16,830	$16,830	0.622	$10,464
25			$16,830	$16,830	0.610	$10,258
26			$16,830	$16,830	0.598	$10,057
27			$16,830	$16,830	0.586	$9,860
28			$16,830	$16,830	0.574	$9,667
29			$16,830	$16,830	0.563	$9,477
30			$16,830	$16,830	0.552	$9,291
				TOTAL PRESENT WORTH		**$2,416,888**

APPENDIX B:

PROPOSED PLAN PUBLIC MEETING TRANSCRIPT

IN RE: SMOKEY MOUNATIN SMELTERS SUPERFUND SITE

PUBLIC MEETING

August 13, 2015

Elite Reporting Services
Kristin E. Burke, LCR
Associate Reporter

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U.S. ENVIRONMENTAL PROTECTION AGENCY

PUBLIC MEETING
SMOKEY MOUNTAIN SMELTERS SUPERFUND SITE

August 13, 2015

MONTGOMERY VILLAGE BOYS and GIRLS CLUB
4530 JOE LEWIS ROAD #1
KNOXVILLE, TENNESSEE

TRANSCRIPT OF PUBLIC MEETING and CITIZEN COMMENTS

Commencing at 6:00 p.m.

Elite Reporting Services
www.elitereportingservices.com
Kristin E. Burke, LCR
Associate Reporter
Knoxville, Tennessee
(865)329-9919

* * *

MR. BRYANT: Good evening. 17:47:58

First of all, my name is Kyle Bryant. 17:56:46

I'm the Community Involvement Coordinator from EPA Region 4 and, of course, tonight we're having our proposed plan meeting for the Smokey Mountain Smelter site. 17:56:47 17:56:49 17:56:52 17:56:55

I think I know most people by face or who they represent. We have the state represented. We have a tenants association represented. 17:56:58 17:57:01 17:57:06

Is someone here representing the county health department or something like that? They were at our last public availability session. 17:57:09 17:57:12 17:57:14

Okay. Well, we're going to have a presentation by Rusty Kestle, who is the project manager for this site, the remedial project manager. He is transitioning this site over to Scott Miller, who I think maybe you met at the last public availability session. 17:57:28 17:57:31 17:57:36 17:57:39 17:57:42 17:57:46

Just to fill you in on what my role is once again for the community's concern is that community involvement coordination person, the person who engages the agency on behalf of the community to find out, you know, where to get the solution for what your questions are. If there is a 17:57:49 17:57:51 17:57:55 17:57:58 17:58:04 17:58:09

solution to be had, I do the troubleshooting for you and I give you some ideas about the agency's resources, the grants we have available if you want to find out about how to get into the pipeline of agency funding or anything related to helping build the capacity of the community and to understand what is going on here. That is what I'm here for. 17:58:12 17:58:16 17:58:19 17:58:21 17:58:24 17:58:27 17:58:30

I guess from that point, I will introduce Rusty Kestle, the RPM, for the presentation. 17:58:35 17:58:36 17:58:41

MR. KESTLE: Okay. Like Kyle said, my name is Rusty Kestle and I work with EPA Region 4 out of Atlanta. We manage all of the sites within the Southeastern United States, eight states, out of the Atlanta office. I'm the project manager for the superfund program for this site. 17:58:42 17:58:44 17:58:50 17:58:55 17:58:58 17:59:02

I have been working on this site for about five years now. We did some removal actions back in 2010/2011 where we addressed a lot of the immediate threats to public health a while ago. I'll get into that later, but -- 17:59:05 17:59:07 17:59:11 17:59:15 17:59:17

Next slide, please. 17:59:24

We all know that the description of it. It's Maryville Pike just across the railroad tracks from here. It's about 13 acres. It has Montgomery 17:59:26 17:59:28 17:59:33

Village apartment complex here to the east, it's wooded to the south, and then there's some residential areas on the west side over on Maryville Pike. Then we have the active railroad lines on the east and west side of the site. 17:59:36 17:59:41 17:59:45 17:59:48 17:59:52

Next slide. 17:59:57

The site goes back to 1922 when it was first constructed by the Knoxville Fertilizer Company and they manufactured phosphate fertilizers. During World War II, that was also used to make munitions for the war. They had a railroad spur to bring the raw materials in and send materials out. It was the longest railroad track that separates Montgomery Village from the site. 17:59:57 18:00:00 18:00:02 18:00:07 18:00:10 18:00:15 18:00:18 18:00:20

They did some pesticide blending and packaging when it was a fertilizer plant from 1922 to 1965, and that was when operated under Knoxville Fertilizer. Then it was shut down and it operated under various entities until 1979 and then was shut down as a fertilizer factory. 18:00:25 18:00:27 18:00:28 18:00:33 18:00:37 18:00:42

Next slide, please. 18:00:46

Here we are (indicating). We're basically over in this area, although, you can't see the resolution too well, but this is the site. Outlined in blue is basically where all the streams 18:00:49 18:00:50 18:00:55 18:00:57

flow in the area that goes down to IC King Park where Flenniken Branch runs into the Tennessee River. There was a lot of surface water impacts here with a lot of concern for the environmental impact. 18:01:01 18:01:06 18:01:10 18:01:13 18:01:16

Next slide, please. 18:01:17

The actual Smokey Mountain Smelters itself, it was converted from a fertilizer manufacturing plant and they put a smelter there operating between 1979 and 1995. What they did was they took aluminum dross from the primary aluminum smelters and refined it to recover more aluminum. It was a secondary aluminum smelter. They also accepted scrap aluminum. They smelted it with chloride and some salts to prevent oxidation and the final product was aluminum ingots. 18:01:18 18:01:23 18:01:26 18:01:30 18:01:33 18:01:39 18:01:41 18:01:42 18:01:49 18:01:50

They generated a lot of what is called salt-cake, which was mostly aluminum -- a little bit of aluminum in there, mostly potassium, and sodium chloride. Table salt, which is sodium chloride, and potassium chloride, which is also used in food. 18:01:54 18:01:56 18:02:00 18:02:05 18:02:07

Next, please. 18:02:12

This was an aerial photograph of what it looked like before. As you can see on the right-hand side is the western part of Montgomery 18:02:16 18:02:21 18:02:23

Village apartment complex. This is when the process building was still there. That's the main building where the fertilizing manufacturing went on and then later, the secondary aluminum smelting. The outside waste pits -- I don't know if you can read that very well -- were located within this white line here (indicating). 18:02:25 18:02:30 18:02:33 18:02:35 18:02:42 18:02:43 18:02:46

We're not really sure -- we know that a lot of the waste were from the secondary aluminum smelting process, but we did find scrap tires in the pile. We did find a lot of construction debris, construction demolition debris, such as concrete, wood, metal, rebar. So we don't really know exactly everything that was put in there, but we're pretty sure it was mostly construction demolition debris and stuff that was nonrecyclable in the waste they generated on site during their waste operation. 18:02:47 18:02:50 18:02:52 18:02:57 18:03:01 18:03:06 18:03:12 18:03:15 18:03:19 18:03:21

Also, when this operated as an aluminum -- before it operated as an aluminum smelting facility, when it was operating as the fertilizer factory, they had wastewater ponds that were located approximately in this area (indicating). This is actually a stream that went down through here and continues down through the bottom as a tributary of Flenniken Branch, which 18:03:24 18:03:26 18:03:30 18:03:33 18:03:37 18:03:39 18:03:43 18:03:46

flows into the Tennessee River (indicating). 18:03:51

There was a lagoon up here because this 18:03:53

basically dammed up the stream; so there was a 18:03:56

lagoon of mostly storm water here (indicating). We 18:03:59

have since drained that lagoon and it goes around 18:04:04

the waste pile. We diverted all the storm water 18:04:06

around the waste pile to eliminate the surface water 18:04:09

contamination problem. When they filled in the 18:04:14

lagoons from the fertilizer manufacturing process, 18:04:19

we don't really know how they were abandoned. 18:04:23

Probably whatever contaminants were still in those 18:04:27

lagoons were left in place. 18:04:30

Next, please. 18:04:33

This is kind of hard to see, but I just 18:04:35

wanted to give you an idea of what it looked like 18:04:36

when it was the fertilizer manufacturing plant and 18:04:39

before all the waste filled into this valley. This 18:04:42

is a small river valley here that is now where the 18:04:45

waste pile is. There was an intermittent stream 18:04:48

that went down through here and hooked up with 18:04:50

Flenniken Branch and went down to the Tennessee 18:04:51

River. Here is Montgomery Village and here is where 18:04:55

the plant was (indicating). 18:05:00

Next, please. 18:05:02

Like I said, we started removal 18:05:04

activities back in 2010 through 2011. We demolished all the buildings that were on site because some were collapsing and there was evidence that people had been going on site and going inside the buildings, which was dangerous as far as a physical hazard. When it had some heavy snows, the roofs collapsed and it was -- you know, it needed to be torn down; so we did all of that. 18:05:06 18:05:11 18:05:13 18:05:17 18:05:20 18:05:23 18:05:25 18:05:30

We recycled as much as we could of the material that was torn down. We eliminated all the pits and drop-offs and we hauled all of the recyclable materials and we stabilized the site from wind and water erosion. 18:05:31 18:05:35 18:05:39 18:05:40 18:05:45

Go to the next one, please. 18:05:47

Our objectives, what we plan on doing with the final disposition of this site, is to, you know, treat it in a manner to minimize direct contact to human health and ecological receptors to the environment and reduce and eliminate migration that was impacting groundwater and Flenniken Branch. Like I said, surface water was the most contaminated, but there was also a little bit of groundwater contamination we found when we put in groundwater monitoring wells. 18:05:49 18:05:53 18:05:59 18:06:04 18:06:09 18:06:14 18:06:18 18:06:19 18:06:20 18:06:20

UNIDENTIFIED SPEAKER: I'm sorry. Could 18:06:22

you say that again? I'm having a hard time hearing you. 18:06:22

MR. KESTLE: There was a little bit of groundwater contamination, but I'll get into that further later in the presentation about the groundwater contamination. 18:06:22 18:06:27 18:06:31 18:06:33

Next slide, please. 18:06:34

The nature and extent of the contamination to surface soils had some chromium above background, but there was no impacts off site. It was all on-site soils. These are the uncapped areas. We capped the area with a clay cap, 12 inches of compacted clay with topsoil and vegetation. That is what stabilized it. 18:06:36 18:06:37 18:06:42 18:06:47 18:06:51 18:06:56 18:07:00

What we couldn't remove -- because we didn't have the time or money to remove everything, we removed what we could, and then we ran out of money basically. Now we've staged it for our next step, which is what this presentation is all about. 18:07:04 18:07:06 18:07:09 18:07:13 18:07:16

The groundwater had aluminum, obviously, because it was mainly an aluminum site. In this list of metals here, most of these are secondary drinking water MCLs, but there were some primary, like mercury and arsenic. I'll get into those later. 18:07:20 18:07:21 18:07:23 18:07:29 18:07:34 18:07:46

Next slide, please. 18:07:46

Here is a slide that represents the 18:07:47

extent of the shallow groundwater contamination. 18:07:49

The blue dots are monitoring wells that we've put in 18:07:53

over the past few years and we've monitored over the 18:07:56

past few years to see what the levels are like, if 18:08:00

they are going up or down. Since we've capped the 18:08:03

waste and diverted the storm water around it, we 18:08:10

have a lot less water in the waste pile itself. We 18:08:15

basically dried up the waste pile; so we don't have 18:08:20

as much groundwater contamination because we've 18:08:23

dried up that water that was in the waste pile. 18:08:28

Next slide. 18:08:31

ARARs, Applicable -- I can never 18:08:32

remember what ARAR stands for, but it's basically 18:08:32

the state and federal requirements on top of what we 18:08:32

deal with in EPA. Like how we dispose of the waste, 18:08:44

the state levels and the federal levels of 18:08:51

contamination that are permissible in groundwater 18:08:55

soils and sediments and the maximums that we have to 18:08:57

clean up to to say that the site is clean. 18:09:02

The regional screening levels, that's 18:09:05

what "RSL" stands for, we adjusted those for 18:09:08

background. The background levels of metals, metals 18:09:11

are naturally occurring in the environment, but 18:09:14

there were elevated levels. 18:09:19

The groundwater surface water, we're going to clean up to MCLs for metals in the groundwater and surface water. It's maximum contaminate limits, which are health-based drinking water MCLs. In the health index, less than 1 for non-MCL metals, metals that don't have an established maximum contaminant level for drinking water that are secondary. They mostly affect the taste and the color and the smell of the water, but they're not harmful to your health in relatively low forms. 18:09:21 18:09:23 18:09:25 18:09:27 18:09:30 18:09:35 18:09:38 18:09:43 18:09:45 18:09:48 18:09:50

Next, please. 18:09:52

This is a table that we're required to put in there. It's hard to understand. Basically, it's the risk table. They have the health index and they have the cancer risk. These are the scenarios that we considered when we came up with this remedy. 18:09:54 18:09:56 18:09:59 18:10:02 18:10:06

For future on-site workers, we want to clean up to this cancer risk level and this health index level for non-cancer causing materials (indicating). 18:10:10 18:10:13 18:10:15 18:10:19

For a future lifetime resident, these are the levels for cancer and for health index -- well, it's nonapplicable. 18:10:20 18:10:23 18:10:26

Future adult residents -- I mean, these are all for exposures to shallow or deep groundwater. I mean, this is assuming that somebody is drinking the water, which we're going to put limits on wells that are installed and nobody will be drinking this water. Because there's public water available, there's no reason for wells to be installed, drinking water wells to be installed. This is assuming that somebody somehow will be drinking the water, which through what we call "institutional controls and restrictive covenants", we won't allow. 18:10:30 18:10:33 18:10:36 18:10:38 18:10:39 18:10:43 18:10:46 18:10:49 18:10:52 18:10:55 18:10:58 18:11:02

Next slide, please. 18:11:04

The ecological risk assessment, we went out and looked at that whole watershed to see if we could see any particular impact on the aquatic life in those creeks. We found no unacceptable risk in Flenniken Branch and contributories in the surface water and sediments. We conducted laboratory tests on the sediments and toxicity tests. It confirmed that it wasn't killing the life in the creek. I know there's a lot of fish that people catch downstream at IC King Park. We did fish sampling down there also to see what was in the fish. 18:11:04 18:11:09 18:11:12 18:11:17 18:11:24 18:11:28 18:11:31 18:11:37 18:11:41 18:11:42 18:11:49

We found what we think were not site 18:11:52

relatable poly -- PCBs, you know, they used to be used in transformer oils and they don't break down in the environment very easily. They are very persistent and they do bioaccumulate in fish, especially the larger bottom feeders like large catfish. There have been signs put at IC King Park in the past -- they keep disappearing -- telling people not to eat the larger bottom feeding fish because of the bioaccumulation of metals and PCBs, but that isn't necessarily because of the Smokey Mountain Smelters. There are a lot of other sources within the Tennessee River watershed because the fish come and go out of that area and pick up contamination from wherever they swim. 18:11:55 18:12:00 18:12:04 18:12:09 18:12:12 18:12:15 18:12:21 18:12:22 18:12:25 18:12:28 18:12:31 18:12:36 18:12:39 18:12:42

Next. 18:12:46

These are our cleanup levels that we're going to have for the metals in the shallow groundwater and the metals in the deep groundwater. We're going to be doing treatment of the groundwater to reach these cleanup levels, and they are all based on the risk assessment work that was done. I have a copy of the risk assessment. If anybody really wants to get into the details of this, there's a copy at the table up front you can look through. There also is a copy of the full remedial 18:12:51 18:12:54 18:12:57 18:13:01 18:13:03 18:13:07 18:13:09 18:13:12 18:13:13 18:13:17

investigation and feasibility study. 18:13:19

Remedial investigation is what we do to 18:13:23

determine the nature and extent of the contamination 18:13:23

in all media: in surface water, groundwater, 18:13:26

sediments, soil, air. We did air sampling out here 18:13:30

and we didn't find anything in the air because that 18:13:36

was after we capped. We didn't expect to find 18:13:38

anything in the air, but we just wanted to confirm 18:13:38

that there was no air contamination coming from the 18:13:40

site. 18:13:44

Next, please. 18:13:44

Here are all of our alternatives that we 18:13:46

considered when we prepared this proposed plan for 18:13:50

cleaning up the site: 18:13:54

Number I, we have to consider a no 18:13:55

action remedy. That's not what we're going to do, 18:13:58

but that is something that is required. That would 18:14:01

be basically leaving the site as it is. As you can 18:14:04

see, that wouldn't cost anything. Although, it 18:14:06

wouldn't be the best thing to do, you know, by costs 18:14:08

in terms of people's health. 18:14:11

In Remedy II, we're talking about 18:14:14

improving the cap. The cap we put on there now, 18:14:18

it's an engineered cap, but it's not what we call a 18:14:20

cap for a hazardous waste landfill. This waste, 18:14:25

it's not necessarily hazardous, but it's not just regular solid waste. It would have to have what we call a RCRA Subtitle C type of cap, which is a composite cap which consists not only of clay but a geomembrane that is basically like a liner, like a plastic liner to help keep that water from going into the waste. And also, so nobody can dig down into there, they would get the liner. They wouldn't just hit clay, they would also hit that plastic liner, and they wouldn't be able to dig any deeper unless they got heavy equipment. We're assuming it would be mostly just trespassers. Children going to play on the site wouldn't be digging into this. 18:14:30 18:14:33 18:14:35 18:14:40 18:14:44 18:14:49 18:14:55 18:14:59 18:15:02 18:15:02 18:15:06 18:15:08 18:15:13

Then we would do pH adjustment for the groundwater to treat the metals and we would monitor the metals to make sure that we get to those cleanup goals that were in that previous table, and then we would have institutional controls. Institutional controls basically determine what the future uses of the site can be. 18:15:16 18:15:19 18:15:19 18:15:25 18:15:27 18:15:28 18:15:32

It definitely won't be used for residential. It's not good for anybody living on it. 18:15:33 18:15:36 18:15:39

Industrial, it's possible, but we don't want anybody recontaminating the site with 18:15:40 18:15:42

industrial redevelopment. 18:15:43

Commercial, maybe. 18:15:45

Recreational, possibly, but that would depend on the institutional controls. We would have to have certain ones like no digging, no drinking water wells, that type of thing. 18:15:46 18:15:49 18:15:51 18:15:55

And then we looked at just capping and not treating the groundwater and put those institutional controls in place. 18:15:58 18:16:00 18:16:04

The various project costs is just how much it would be to construct the remedy. 18:16:06 18:16:08

The operation and maintenance costs would be how much it would take to keep that remedy working for 30 years. 18:16:11 18:16:14 18:16:16

Then the present worth is how much that is in today's dollars. 18:16:18 18:16:20

The remedy Number IV was excavating all the waste out, lining the bottom, and then putting the waste back in and lining the top. That would, as you can see, be more than ten times more expensive to do that then Remedy II or III. 18:16:25 18:16:27 18:16:31 18:16:34 18:16:39

Then the excavation cap and MNA. The ESGS is a type of treatment where we do ex situ. We take it out, we geostabilize it, and we put it back in. We don't put a bottom liner. That also would 18:16:46 18:16:52 18:16:59 18:17:03

be ten times more expensive and not necessarily get you much better protection. 18:17:07 18:17:11

We didn't even look at digging it up and hauling it off and disposing it in another landfill because that would not only be cost prohibited, but it also wouldn't really be very green, as we call it, because there would be a lot of trucks having to come in and out and there would be a lot of traffic and there would be a lot of dust. It would create more of an exposure really than it would prevent with all of the exhaust from the trucks and that type of thing and all the noise. 18:17:15 18:17:17 18:17:21 18:17:22 18:17:24 18:17:27 18:17:29 18:17:32 18:17:36 18:17:39

Next slide, please. 18:17:41

This is the preferred remedy we're proposing on this proposed plan in trying to get public comment. It's Alternative II, constructing the RCRA cover system I described over both -- well, we have what we call a secondary source area where we staged some of the waste that we thought could be recycled in the future. We separated it out because it had a higher aluminum content. So that might be able to be mined and recovered, recycled with future technologies. For the current technologies and the current price of aluminum, it's cost effective right now, but we separated that out because that was a 18:17:44 18:17:46 18:17:48 18:17:57 18:17:59 18:17:59 18:18:02 18:18:04 18:18:08 18:18:13 18:18:15 18:18:18

higher aluminum content. 18:18:20

Right now, we're looking at just capping it again with the RCRA cover system, both of the resource areas. It has a gas collection layer, a geonet, for gas venting -- just in case there is gas generated, it won't flow off site -- a clay liner, and a high density polyethylene liner, a plastic liner. It's a composite liner, basically. It has several components to it. Then we would do the in situ, the groundwater injections where we would adjust the pH so that the metals would not be dissolved anymore. They would fall out and solidify with the soils or the waste that is in place so they wouldn't be flowing in the groundwater or the surface water off site. The metals would stay on site underneath the cap. 18:18:22 18:18:23 18:18:28 18:18:34 18:18:39 18:18:43 18:18:47 18:18:50 18:18:52 18:18:57 18:19:01 18:19:05 18:19:10 18:19:12 18:19:15

We would do that as often as it needed. We would monitor the effectiveness until we reached those groundwater cleanup levels that were in that previous table. 18:19:17 18:19:20 18:19:23 18:19:27

Next slide, please. 18:19:29

Here is the visual representation of what we're proposing. Again, here is Montgomery Village, and we would have a line of injection points along this red line (indicating). 18:19:30 18:19:34 18:19:37 18:19:41

Groundwater would flow through the waste with this pH adjustment, the metals would fall out, and they would stay on site. There wouldn't be any metals in groundwater or surface water flowing off site. 18:19:43 18:19:48 18:19:53 18:19:56

Next slide, please. 18:20:00

Now this potential redevelopment is something I included in here. This is basically up to whoever own the site. Right now, it has no owner. It's in legal limbo. The last owner is deceased and his estate has not claimed it or paid taxes on it, but the city and the county haven't claimed it for taxes. Who gets it in the future is still up in the air. 18:20:02 18:20:07 18:20:11 18:20:12 18:20:16 18:20:20 18:20:24 18:20:29

Regardless of who gets it, these are potential redevelopments that I've discussed and just listed here. 18:20:31 18:20:34 18:20:36

Green space. Just some open space for playing or for wildlife. I've already seen wildlife out there, flocks of wild turkeys. The wildlife is coming back. The plants and the wildlife are coming back, which I think is a good sign that we've cleaned it up pretty well and there's no exposure. 18:20:37 18:20:40 18:20:44 18:20:46 18:20:47 18:20:51

Like I said, with the restrictions on it, it could be used as a public pack with paths or a sports field complex of some kind, ballparks of 18:20:55 18:20:58 18:21:02

some kind; a recycling center; commercial development; or a combination of all of these. One part can be used for one thing and the other part can be used for another. 18:21:05 18:21:08 18:21:11 18:21:15

Next slide, please. 18:21:17

However, any redevelopment cannot disturb the cap or the waste under the cap. Like I said, we would have these restrictions on how you could redevelop it. 18:21:18 18:21:21 18:21:24 18:21:27

I can't spend any of my money that I'm using to do this work for any redevelopment work. Like, I can't spend money to build ballparks. But you can apply for federal grant money and that money can be used for redevelopment. 18:21:30 18:21:31 18:21:34 18:21:38 18:21:43

I think that is the last slide. 18:21:45

MR. BRYANT: That's it. 18:21:48

MR. KESTLE: All right. Any questions? 18:21:50

MR. MASSEY: I have a question. 18:21:53

I think you talked about the fact it's important that this doesn't become residential and nobody disturbs the cap. Do you file stuff with the Clerk's Office that puts restrictions on the property so that anybody going in is going to find that -- the city is going to find that if somebody applies for redevelopment -- I work for the City. 18:21:56 18:22:00 18:22:04 18:22:10 18:22:13 18:22:16 18:22:19

We're going to find that -- 18:22:23

MR. KESTLE: Yes. 18:22:26

MR. MASSEY: And that's the control? 18:22:26

MR. KESTLE: Exactly. It's a legal control. We used to just put deed notices, but those weren't really strong enough. Now we have what we call "restrictive covenant", which the property owner has to sign agreeing to these certain restrictions. It's a covenant. It's more than just a notice. 18:22:30 18:22:31 18:22:31 18:22:35 18:22:39 18:22:42 18:22:45

MR. MASSEY: If there's no property owner, how do you handle that? 18:22:46 18:22:48

MR. KESTLE: Well, there's going to have to be a property owner eventually. Somebody is going to be owning this property. I can't predict whether the city will want to take it or the county will want to take it or if somebody will want to buy it. If somebody buys it, they have to pay for the cleanup costs. 18:22:51 18:22:51 18:22:53 18:22:55 18:22:58 18:23:01 18:23:02

We are doing a, what we call, "potential responsible party search" looking for other companies that operated over the years. It started in 1922. I'm not a lawyer, but we have what is called "joint and several liability". That means anybody who operated during that period of time is 18:23:04 18:23:07 18:23:11 18:23:14 18:23:19 18:23:21

liable legally for the contamination that is on the site. 18:23:24 18:23:28

MR. MASSEY: I was going to ask about that. 18:23:30 18:23:30

MR. KESTLE: Yeah. 18:23:30

MR. MASSEY: What happened to SMS? Did they go out of business? 18:23:30 18:23:32

MR. KESTLE: Yes. 18:23:34

MR. MASSEY: Did they own the property or did somebody else own the property? 18:23:34 18:23:38

MR. KESTLE: Dan Johnson owned the property. He was the proprietor/owner of SMS. When he died, his family wouldn't claim it, the state wouldn't claim it, and they didn't pay the taxes on it. They had not taken it as their own or done anything on the site since his death. 18:23:41 18:23:42 18:23:42 18:23:50 18:23:52 18:23:56

MR. BRYANT: Before we get to the next question, can I ask that everybody please give your name because we're getting this recorded for transcription purposes. If you will just state your name and who you are representing before posing your comment or question, that would be a big help for us. 18:23:59 18:24:02 18:24:05 18:24:08 18:24:11 18:24:13 18:24:16

MR. MASSEY: I'm David Massey and I'm with the Office Neighborhoods for the City of 18:24:17 18:24:17

Knoxville. 18:24:17

MR. THOMPSON: My name is Ronnie Thompson. I'm President of the Residents Association here in Montgomery Village. 18:24:17 18:24:17 18:24:28

My question was: The guy that owned that property, did he ever own property down there that got cleaned up with waste on it on the left-hand side, the Witherspoon site? Are they related? 18:24:30 18:24:33 18:24:37 18:24:39 18:24:41

MR. KESTLE: I don't know that for sure. I know that they're right next to each other geographically, and we were concerned that some of the radioactive waste perhaps had been disposed of on site. We did have Geiger counters. Whenever we were digging the holes, we went in with the Geiger counters to check and see if there was any radiation. We had the workers who were working on site wear radiation badges to see if they were being exposed, and we didn't find anything that was related to the Oak Ridge facility. 18:24:45 18:24:46 18:24:49 18:24:52 18:24:56 18:24:59 18:25:02 18:25:04 18:25:04 18:25:08 18:25:11

The phosphate manufacturing, phosphate fertilizer naturally has radioactivity. We did find a little bit of background radioactivity from the phosphate fertilizer. That was mostly on that rail spur where they loaded and unloaded the phosphates. 18:25:16 18:25:16 18:25:20 18:25:21 18:25:25

That was just spillage from the railcars probably. 18:25:28

Anybody else have any comment? 18:25:31

MS. COFFEY: My name is Janice Coffey, a resident of Montgomery Village. I was just wondering about the contamination of the Tennessee River. You were talking about the fish in the river. 18:25:37 18:25:37 18:25:37 18:25:43 18:25:46

MR. KESTLE: Well, I mean that definitely is being taken care of, not necessarily by me on this project. I was just trying to see what the impact of this project was near the site that was contaminated, if it was a source of major contamination on the Tennessee River. We really didn't draw any conclusions that the PCBs that were cutting it -- with transformer oils, if those transformer oils made it all the way down. 18:25:52 18:25:54 18:25:58 18:26:02 18:26:04 18:26:07 18:26:11 18:26:14 18:26:14

The Tennessee River, lots of studies have been done on them to try and do away with the sources. Like I said, the PCBs are persistent in the environment, but the metals don't break down at all. So historically, the sources getting into the Tennessee River -- there are a lot of tributaries. The Tennessee River is a big river; so there's a lot of water flowing into it and break off sediments. 18:26:25 18:26:28 18:26:35 18:26:40 18:26:45 18:26:50 18:26:50 18:26:53

I know that the health department, 18:26:54

Tennessee Department of Health, has worked to make people aware of contamination on the fish and contamination in the water, and they have posted signs in several locations. I haven't seen any signs up there lately. I don't know if somebody keeps stealing them or what happened. I know there were signs up. We have asked the Department of Health to make people aware of the bigger bottom feeder fish because the bigger the fish, the more contamination you have. 18:27:02 18:27:08 18:27:11 18:27:15 18:27:18 18:27:20 18:27:22 18:27:25 18:27:30 18:27:34

MS. COFFEY: We need the fish there. They're probably there for a reason. I was just wondering about plants and the swamp areas absorption. 18:27:39 18:27:40 18:27:42 18:27:50

MR. KESTLE: I don't know about -- you mean, the wetlands kind of thing, like they're doing with the Everglades down in Florida? 18:27:59 18:27:59 18:28:03

MS. COFFEY: Yeah. 18:28:06

MR. KESTLE: Right. I don't know. You know, that is a whole different thing. 18:28:06 18:28:10

MR. BRYANT: Could you-all speak up, please, so the reporter can get those comments? 18:28:16 18:28:16

MR. KESTLE: Sure. I'm sorry. 18:28:16

MS. COFFEY: (Inaudible.) 18:28:16

MR. KESTLE: Yes. I mean, that 18:28:48

information is available on the web with the Department of Health. I don't have any particular answers on that. It probably would be part of a redevelopment, put in some sort of wetlands to make it look nicer, plus it would help the ecosystem rebound with the fish and plants and potentially the water impacted by contaminated surface water on the site. 18:28:49 18:28:52 18:28:58 18:29:02 18:29:06 18:29:11 18:29:14 18:29:19

MR. BRYANT: If I may add something to that conversation. With regards to concerns about the river and its aquatic health and things like that, there are a number of grants and things that are available from outside of the EPA. I would assume there's some river keeper organization that functions to look over aspects of the Tennessee River and the tributaries that drain into it. I know there are foundations that fund towards that. 18:29:21 18:29:23 18:29:26 18:29:31 18:29:34 18:29:38 18:29:42 18:29:46 18:29:50

Also, I would recommend maybe if there isn't one, I think since that's a major river, there should be some sort of river advisory council or something that either is working with UT to get wildlife studies and repairing kind of things, street bank restoration studies. I would look into that, maybe looking into departments of wetlands or ecosystem studies at UT to find out who are the 18:29:52 18:29:53 18:29:58 18:30:01 18:30:05 18:30:07 18:30:16 18:30:20

players in the area that perhaps are involved with that. 18:30:25 18:30:27

It seems like you know. 18:30:27

MR. MASSEY: Well, I'm not sure about that last part. 18:30:31 18:30:31

I'm David Massey, again, from the City. 18:30:31

There is an organization here in Knoxville called the Tennessee Clean Water Network. You can get online. I think it's tc -- whatever that acronym is. It's the Tennessee Clean Water -- it's tcwn.org. 18:30:33 18:30:35 18:30:39 18:30:46 18:30:47

Anyway, if you just look for Tennessee Clean Water Network, they do a lot of work in the Knoxville area on water quality. They might be able to address some of the concerns. 18:30:48 18:30:55 18:31:00 18:31:06

MS. COFFEY: I was just kind of concerned because you said it was a lagoon method and with down water -- what eucalyptus does, it absorbs water when it falls. Like lemongrass kills mosquitoes, so I was -- 18:31:11 18:31:11 18:31:11 18:31:11 18:31:19

MR. KESTLE: Well, we changed the draining pattern and effectively drained that lagoon; so there's no standing water anymore. You don't want standing water there anyway because it breeds mosquitoes, West Nile virus and there's all 18:31:22 18:31:24 18:31:26 18:31:30 18:31:30

kinds of problems with that. We have the drainage set up now so there isn't any standing water there. 18:31:35 18:31:39

I was thinking there might be some wetlands left behind. It did drain really well; so there's really not any wetlands, except for maybe down at the base where the creek is. Putting some plants in there might help. It would beautify the area. 18:31:44 18:31:47 18:31:49 18:31:49 18:31:54 18:31:58

MS. COFFEY: Also, they had a Save the Eagle project that our governor did, Alexander. He got some eagles and it keeps the city clean. Putting them birds back in there might be a good idea, owls and stuff like that. We have got some (inaudible) too. 18:31:58 18:32:01 18:32:06 18:32:11 18:32:16 18:32:19

MR. KESTLE: This is a relatively small area. The ecosystem is really not going to support a whole lot of wildlife. I have seen turkeys out there. They go other places, too. They wander around in the woods out there -- 18:32:21 18:32:24 18:32:27 18:32:29 18:32:33

MR. THOMPSON: I can tell you about them turkeys. November is coming near. 18:32:33 18:32:33

MR. KESTLE: The public comment period opened earlier this month, and it is open until next month, the beginning of next month. If you think of any other comments that you would like to make or 18:32:42 18:32:43 18:32:47 18:32:50

questions, you can either mail in the mailer or you can e-mail me or call me. My e-mail address and my phone number is on the proposed plan. 18:32:54 18:32:58 18:33:02

MR. THOMPSON: I'm Ronnie Thompson. 18:33:05

The next step in cleanup, are they going back in on that site? 18:33:09 18:33:12

MR. KESTLE: I'm sorry? 18:33:17

MR. THOMPSON: Are they going to come back in? Is there a time period they're going to come back in and do more work on the problem? 18:33:17 18:33:19 18:33:24

MR. KESTLE: Yes. 18:33:28

MR. THOMPSON: That was my question. 18:33:28

MR. KESTLE: Yes. That's why we do this because this is what we're legally required to do. There is a whole superfund process and we have to do a public meeting to present this proposed plan before we can move forward and get any comments. We need comments so we can address those comments. 18:33:29 18:33:30 18:33:33 18:33:36 18:33:40 18:33:41

MR. THOMPSON: By bringing this attention to it, do you think it will speed up the process to get us some funding, to move it up the list or anything? 18:33:45 18:33:47 18:33:51 18:33:54

MR. KESTLE: Oh. You mean, your grants? 18:33:56

MR. THOMPSON: No. On clean up, the next step of the cleanup, is it funded already? 18:33:57 18:34:01

MR. KESTLE: There's a prioritization panel. If this stays as trust fund -- the superfund really isn't all that super anymore because we don't get money. It used to be -- it started out in 1980 and we used to get money from taxes on the oil industry and the chemical industry, federal taxes. When those taxes were up for renewal, the oil companies and them decided they didn't want to be taxed anymore; so we don't get money from them. We get money from the General Fund. It's part of the budget; so it varies from year to year, and the budget has been pretty tight lately.

It's prioritized by how big of a threat it is. We've eliminated a lot of the immediate treats. That's why we're looking to get a responsible party to pay for the rest of it and pay for what we've already paid for. The polluter pays. The polluter pays. I mean, they contaminated it. They ought to pay for it to be cleaned up. They made money off contaminating it. They saved money by not properly disposing of the waste in an industrial landfill. They created their own illegal industrial landfill in that creek.

MR. THOMPSON: Exactly.

MR. MASSEY: David Massey, again.

I'm curious. The smelter went in in '79. 18:35:11 18:35:12

MR. KESTLE: Yes, sir. 18:35:15

MR. MASSEY: Montgomery Village was already here. How did that get that in here? 18:35:16 18:35:16

MR. KESTLE: Zoning. The City -- it was zoned industrial already -- 18:35:21 18:35:24

MR. MASSEY: Right. 18:35:28

MR. KESTLE: -- because they had that fertilizer manufacturing plant. 18:35:30 18:35:31

MR. BRYANT: The rule of thumb, the underlying fact on that, public housing is usually built on undesirable land or on the outskirts of town in almost every major city. You will find that, historically, the politically correct logic behind it is that the property value is cheaper to zone something industrial in the same area where you're going to put public housing in some of the vacant spaces. Unfortunately, that is what our society has decided is an acceptable risk. 18:35:32 18:35:34 18:35:37 18:35:43 18:35:46 18:35:53 18:35:57 18:36:00 18:36:03 18:36:08

MR. MASSEY: I know there is a high correlation. 18:36:14 18:36:17

MR. THOMPSON: On that said, I lived outside of here before this was ever built. I caught the bus right here at these woods to go to 18:36:18 18:36:18 18:36:18

school. I lived on P Avenue down there. This was grazing land, good solid property. Evidently, public housing purchased it and put this here. 18:36:21 18:36:24 18:36:28

When I was a kid, this was vacant. Mules, cows and horses grazed right here, which that property has always been there. 18:36:34 18:36:36 18:36:42

MR. KESTLE: Did you have a question? 18:36:44

MS. JENNINGS: My name is Amanda Shell Jennings. I work for Moxley Carmichael. 18:36:49 18:36:49

My question was just about the timelines. Assuming that this goes through and is approved, would there be a definite timeline at that point or would that be dependent upon funding and the budget? 18:36:50 18:36:54 18:36:57 18:37:02 18:37:05

MR. KESTLE: It would depend on if we could get this to be paid for by some responsible parties, also. 18:37:07 18:37:09 18:37:12

MS. JENNINGS: So you would be waiting on identifying funding solutions? 18:37:14 18:37:16

MR. KESTLE: Right. I think there is going to be a legal process. Some of the responsible parties might step forward because there are some large companies that we've identified that had an operation down there, historically. You know, hopefully, we will get funding from them to 18:37:17 18:37:17 18:37:21 18:37:25 18:37:28 18:37:33

move forward as quickly as possible. 18:37:38

MS. JENNINGS: So approving the plan is 18:37:39
Step 1 and Step 2 would be finding funding. 18:37:39

MR. KESTLE: Right. We're going ahead 18:37:44
with remedial design. We're asking for money to do 18:37:44
the design work. We're not just stopping all 18:37:47
together. We are going to go ahead and do the 18:37:50
design work. That won't be the actual construction. 18:37:52
It will be more paperwork. We hire consultants, we 18:37:55
hire engineers and people smarter than me to 18:37:58
actually design this stuff. This is a rough sketch 18:38:04
of what we're planning. There are going to have to 18:38:06
be engineering plans for it. 18:38:07

MR. THOMPSON: So I won't have to worry 18:38:10
about dust flying over there for a little while 18:38:12
until you come back in? 18:38:15

MR. KESTLE: Well, hopefully, we will 18:38:18
keep the dust down to a minimum through dust 18:38:18
control. 18:38:19

MR. THOMPSON: I lived here during the 18:38:21
last time. 18:38:21

MR. KESTLE: It was a lot of dust? We 18:38:21
tried the best we could. Well, there was a drought, 18:38:22
too. There was a drought then. 18:38:24

Yes. 18:38:25

MS. COFFEY: Janice Coffey. 18:38:25

I was wondering about the bids for 18:38:24

construction. If you're interested in trying to 18:38:34

design it for non-profit or industrial, there may be 18:38:34

a case of where a cap could be worked in in this 18:38:42

area, the industrial zoning, or something like that, 18:38:48

if you would give us a time frame as far as bids. 18:38:50

MR. KESTLE: Kyle, I think, would know 18:38:57

more how we try to use local companies for that type 18:38:58

of thing. We have our prime contractors, but they 18:39:02

can subcontract out to local companies. 18:39:05

MR. BRYANT: Right. The contractors 18:39:09

that do the main work on a site have all sorts of 18:39:10

certifications and things. They are already bid 18:39:14

into a contract process from a list that EPA chooses 18:39:18

from to cover certain regions or who is available 18:39:22

and all this. We highly encourage each of those 18:39:25

contractors who have already made our certification 18:39:29

list to hire locals for things that they can do. 18:39:30

Like, in many communities, they would 18:39:35

subcontract out the fencing or some of the fence 18:39:37

posting or the posting of signage and things like 18:39:41

that for the sites and whatever skill sets can 18:39:48

handle. 18:39:51

We have a couple of grant opportunities 18:39:51

that also increase the community's capacity. This is where I'm more of a service provider for the communities in that if I find that there's a lot of people in the community that are interested in work, and that is a critical need in many of the communities we serve, then we find out what the skill sets are that are needed for entry level jobs with that contract and then try to pair those up. 18:39:51 18:39:55 18:40:00 18:40:02 18:40:05 18:40:07 18:40:11 18:40:15

We have what we call a contract called TASC, which is Technical Assistance to Support Communities, it's out of headquarters, where we have an actively engaged community that wants to get into the workforce and perhaps work to help remediate the site. That is not only a feel good story for the agency, but it's also an economic benefit for that community. 18:40:18 18:40:19 18:40:23 18:40:26 18:40:30 18:40:34 18:40:37 18:40:40

If we have that contract, we help bring in intermediaries. It can be the local community college or just hiring a training company to come and get people, like, their OSHA 40-hour hazardous waste emergency response certificate so you can work on a hazardous waste site. There are certain credentials you have to have. You just can't knock on the trailer and say, "Are you hiring today?" 18:40:41 18:40:43 18:40:46 18:40:51 18:40:56 18:40:59 18:41:02 18:41:04

Because we understand that, we educate 18:41:07

the community on the steps you have to go through and then work with you to find out you have people that are willing and able to do this. Some people have done that successfully and they've done such a good job that they got hired on and they travel with these companies to other cleanup sites. I'm glad to hear that there is an interest. I would be the person you would contact about specific interests like that. 18:41:08 18:41:12 18:41:13 18:41:16 18:41:20 18:41:21 18:41:26 18:41:30 18:41:33

From the City's perspective in terms of redevelopment, I would add that now is the time, since there is no clear owner of the site, to start thinking big picture ideas. Like I do with all of the communities that I engage, I talk about not only the superfund redevelopment dollars that are available through grants, but brownfield grants. You know, the term "brownfield" is such a loosely translated term that, you know, you can justify going out there -- we have four different types of brownfield grants -- to look at redevelopment and think about not just what this community might need, but what would fit nicely on this side of town that currently does not exist. Whether that's green space -- you know, what is trending now are fitness trails and bike paths, to create a higher property 18:41:34 18:41:34 18:41:37 18:41:39 18:41:43 18:41:47 18:41:49 18:41:52 18:41:57 18:42:01 18:42:04 18:42:07 18:42:10 18:42:14 18:42:15 18:42:20

value for this part of town to take away maybe some of the industrial aspects of it and focus on revitalizing this community in 10, 20 years from now and what would be a nice showpiece for that. 18:42:26 18:42:29 18:42:32 18:42:37

A lot of people are interested in playgrounds and things like that. We know of not only federal agencies' funding, but we also know of foundations. KaBOOM! is one foundation that I'm working with with another similar size community in South Georgia that has a cleanup site near a chicken processing plant. KaBOOM! is a foundation that funds for major athletic fields and for playgrounds. If you've seen playgrounds at city parks and things like that, they give grants for the development of like the giant jumbo gyms and swing set things and soccer fields elevated over cleanup sites. 18:42:39 18:42:40 18:42:43 18:42:47 18:42:51 18:42:54 18:43:00 18:43:04 18:43:08 18:43:13 18:43:15 18:43:19

Those things can work hand-in-hand with a redevelopment plan, but now is the time to start thinking and discussing with your city officials, get a community panel together and maybe coming up with an idea of what would be a nice fit for maybe redeveloping this community into something different that is probably unique for this quadrant of town. 18:43:22 18:43:27 18:43:30 18:43:31 18:43:36 18:43:41 18:43:44

Just something to think about. One of the things I had as a community involvement person, 18:43:49 18:43:51

like I said in our public availability session, is I can teach grant writing. I'm a certified grant writing instructor and I review six of the agency's grants; so I can tell you specifically how to write a fundable proposal that has a better chance of competing. 18:43:52 18:43:55 18:43:59 18:44:03 18:44:09 18:44:13

If that is something that either someone in economic development at the city level or the county or the community wants to have a tailored workshop for their prospective through the lens that you're interested in, then that's one of the things I can assist you with. 18:44:14 18:44:14 18:44:17 18:44:21 18:44:26 18:44:27

Yes, ma'am. 18:44:27

MS. COFFEY: Is Alcoa involved in this in any way, the Alcoa Refinery? 18:44:28 18:44:32

MR. BRYANT: No. 18:44:36

MS. COFFEY: What about possibly to have the transit station relocated to South Knoxville that would be central for Seymour or Maryville, to develop that as far as the government funds? 18:44:41 18:44:41 18:44:45 18:44:48

MR. BRYANT: I'm not familiar with that. Are you saying a private industry to use government funds to make a for-profit entity with that property? 18:44:57 18:44:58 18:45:02 18:45:04

MS. COFFEY: Knoxville Transportation 18:45:05

Authority has been looking for property to develop a bus station in South Knoxville so that they could go on farther south like to Seymour. If it were on this side of town, it could go down Chapman Highway. If it were on this side, industrial Knoxville and Maryville would be accessible. 18:45:09 18:45:13 18:45:15 18:45:20 18:45:23 18:45:27

MR. BRYANT: As a community person, my only concern with a bus terminal or transfer station is that there has been a lot of research on diesel emissions from these stations. Actually, a lot of communities, particularly in urban cities up north, have fought to get these kinds of facilities out of their communities because they produce a lot of diesel exhaust and they don't require a lot of people to operate and that might create another nuisance for the community. The community's voice would have to weigh in on whether they thought that jobs would outweigh the environmental risk long term. 18:45:30 18:45:35 18:45:39 18:45:39 18:45:44 18:45:46 18:45:50 18:45:53 18:45:56 18:46:00 18:46:04 18:46:07 18:46:12

It just depends on what you-all want. This is your community. The City will have a say. The community will definitely have a say. We just want to let everyone know that your voice, no matter how small, matters. Whatever the ultimate decision is, it is one that you-all will have to live with. 18:46:12 18:46:12 18:46:14 18:46:20 18:46:25 18:46:28

There are options out there, there are opportunities, and I can point you out all the federal grants that come in different cycles and how to apply for some of those and the best approach, not to go for a one-size-fits-all, but put a puzzle together. That could be meeting around a table with a map of this site saying, "What can we do?" and then eliminate those things as they come along of what people are just not going to go for and what things make sense. 18:46:30 18:46:32 18:46:34 18:46:38 18:46:39 18:46:44 18:46:44 18:46:49 18:46:52 18:46:55

Yes, sir. 18:46:57

MR. MASSEY: David Massey again from the City. 18:46:57 18:46:58

Can you-all provide funding to help the community do that kind of planning? 18:46:59 18:47:03

MR. BRYANT: We have grants for capacity building. We have environmental justice, small grants which are, like, 20, $25,000.00, which is an excellent grant to create a marketing strategy around a redevelopment concept. I mean, you can call it -- 18:47:07 18:47:10 18:47:12 18:47:15 18:47:19 18:47:23

MR. MASSEY: These are on brownfield sites or former brownfield sites? 18:47:26 18:47:28

MR. BRYANT: Or superfunds. 18:47:29

MR. MASSEY: Okay. What I'm thinking 18:47:30

of, for example, is that there's a nonprofit here called the East Tennessee Community Design Center, which helps communities work through a planning process for land development, but they can't do that for free. 18:47:36 18:47:38 18:47:41 18:47:44 18:47:52

Can you leave us, Ronnie and me, some information on where that kind of application would go or -- where are you based? 18:47:53 18:47:56 18:48:00

MR. BRYANT: We are in Atlanta, the Region 4 headquarters. 18:48:02 18:48:05

MR. MASSEY: Okay. 18:48:08

MR. BRYANT: Like I said, this is one of the sites that we are assigned; so I am your community involvement coordinator. I'm the person who would be your conduit to agency funding. I will make sure that you have my information, which is on the proposed plan. It's on the front page. You can reach out to me and ask me, like, "What grants do you have for redevelopment coming up?" or "What can you find out from other federal agencies?", and I can contact my colleagues at HUD or U.S. Department of Agriculture because this is still kind of rural. We're not in the downtown area. We could maybe make the case this is an agricultural area. 18:48:08 18:48:08 18:48:11 18:48:13 18:48:15 18:48:19 18:48:23 18:48:26 18:48:28 18:48:31 18:48:33 18:48:37 18:48:41

There are a lot of ways that you can go 18:48:44

after grants and then, like I said, build your puzzle based on what grants are in season, and there are many tricks to that, like knowing what the terms are that are popular now. For instance, there's a big issue in children's health about childhood obesity. What does that have to do with a superfund site? Well, if you create a green space and put up a couple of park stations and an exercise walking path, then that could be something that benefited that; so you can go to the National Institutes of Health and get $50,000.00 for that component of the grant, part of your $2,000,000.00 package of the redevelopment concept or are whatever it is. 18:48:46 18:48:51 18:48:53 18:48:57 18:49:02 18:49:04 18:49:07 18:49:09 18:49:13 18:49:15 18:49:18 18:49:20 18:49:25

Also, working with institutions, we have the University of Tennessee right here. We have had successful projects with major universities. I brought in Georgia Tech to a small town in the middle of Georgia to do the redevelopment plan for the city. When a private consulting firm wanted to charge almost $180,000.00 of the $200,000.00 grant for that, they did it for $50,000.00 and unleashed 11 graduate students onto the city and they came up with a whole redevelopment plan and came up with cutting-edge concepts that no one had ever thought of. 18:49:27 18:49:30 18:49:31 18:49:37 18:49:39 18:49:42 18:49:45 18:49:47 18:49:53 18:49:56 18:49:56 18:50:00

These are just sort of smart ways to use your -- to leverage your dollars with people who have talent and would love to work on a real world project. 18:50:01 18:50:03 18:50:08 18:50:09

Yes, ma'am. 18:50:10

MS. COFFEY: Janice Coffey. 18:50:09

I was also concerned as far as the health of the children and elderly because both are housed here. The A.D.H.D. factor, they have traced it back to the aluminum products. Also, the elderly have a problem with the aluminum as far as Alzheimer's. I was thinking maybe research as far as the Alcoa industry. Maybe they might be helping as far as that. 18:50:11 18:50:13 18:50:18 18:50:20 18:50:28 18:50:29 18:50:33 18:50:33

Maybe the buses with the access to roads and stuff like that would be more of a shuttle to have people -- to have a traffic area, a higher traffic area, just for kids, something they could -- I don't know if we can make money off the aluminum or not, if there is any money to be made off the stuff that's there. 18:50:39 18:50:44 18:50:47 18:50:52 18:50:55 18:50:59 18:51:05

MR. KESTLE: That is something we're going to be looking into in the future. When we did the cleanup, we recycled everything we could and we had some companies come out and take samples of some 18:51:08 18:51:08 18:51:09 18:51:13

of the material and they said it wouldn't be worth the while. It just wasn't recoverable. That's why we staged some of the higher aluminum content for perhaps some future -- 18:51:16 18:51:18 18:51:26 18:51:30

MS. COFFEY: (Inaudible.) 18:51:31

MR. THOMPSON: Ronnie Thompson. 18:51:56

On that, there was contaminants on it. They got most of it, buried it, the waste they had contained? 18:51:56 18:52:04 18:52:11

MR. KESTLE: Contained. 18:52:12

MR. THOMPSON: Contained. 18:52:12

MR. KESTLE: There were some drums laying around we properly disposed of. Anything they left behind wouldn't have -- when the facility shut down, it just shut down. There wasn't any cleanup done and some people came and dumped -- 18:52:14 18:52:15 18:52:19 18:52:20 18:52:24

MR. THOMPSON: I seen photographs of 55-gallon drums -- 18:52:28 18:52:28

MR. KESTLE: Over the 15 years that it was done, it sat abandoned, and people helped themselves. 18:52:28 18:52:32 18:52:36

MR. THOMPSON: Are aluminums and metals on the property still? 18:52:38 18:52:39

MR. KESTLE: No, nothing right now that is of any value. 18:52:42 18:52:43

MR. THOMPSON: All right. 18:52:44

MR. KESTLE: I don't know if anybody is interested, it's still light out, I can show you the site and what it looks like now in the day. 18:52:45 18:52:47 18:52:50

You've already seen it? 18:52:53

MR. MASSEY: Yeah. I've seen it. 18:52:54

MR. KESTLE: Anybody else interested in seeing it? 18:52:54 18:52:55

No. Okay. 18:52:55

Any other questions? 18:52:58

No? 18:53:02

Thank you for coming. If anything comes up later on, like I said, give me a call. I'm always available, but you can also call Kyle. 18:53:01 18:53:05 18:53:10

MR. BRYANT: Some of you have left your contact information on the sign-in sheet; so if we have new information to share regarding grants or things that might be of interest to you, one of the first things I would suggest, since there are different ideas popping from this meeting is that you maybe look at a grant to bring people around the table just to get the ideas out in the open so you can really validate the interest from each specific area. Nothing can be worse than developing something over there that nobody wants. You know, 18:53:14 18:53:15 18:53:18 18:53:22 18:53:24 18:53:24 18:53:31 18:53:34 18:53:38 18:53:42 18:53:45

get somebody in from all of the stakeholders in the community, city, county, the local residents and all that, and even the private sector, and see where it goes. 18:53:50 18:53:55 18:53:57 18:54:03

I would touch my institutional assets, which I can assist you with that too, like the University of Tennessee, like the medical center, because you have concerns about health issues and things like that, the Department of Health. Get all of those different stakeholders around the table and say, "Have you considered this?" or "What about that?" and see what you come up with. 18:54:04 18:54:07 18:54:10 18:54:13 18:54:18 18:54:21 18:54:22 18:54:25

Yes, ma'am. 18:54:28

MS. COFFEY: Janice Coffey. 18:54:28

This is also on the Sevier County line. The reason I was bringing up the traffic was because Dollywood and Dolly Parton, she has resources available and she works with libraries. She might also be interested in developing this area, as well, because it's on the Sevier County line, which would help as far as costs. 18:54:28 18:54:33 18:54:36 18:54:37 18:54:48 18:54:51 18:54:56

MR. MASSEY: I have one last question, and that is: If and when this last phase is funded, can you let everybody on the mailing list know, I mean, you have this potential opportunity for 18:54:58 18:54:59 18:55:07 18:55:11

employment and so forth -- 18:55:13

MR. KESTLE: We'll give updates on what 18:55:16

is happening. We'll have mailers or we have 18:55:20

websites, too. 18:55:25

MR. MASSEY: Okay. 18:55:25

MR. BRYANT: Nothing prevents you from 18:55:25

going after grants and things now. Some people 18:55:29

think it's a curse to have a superfund site in their 18:55:30

backyard. It's kind of a mixed blessing because the 18:55:34

federal government, as it stands now, we're doing 18:55:37

the cleanup and have spent upwards of 18:55:41

three-and-a-half million dollars in this community; 18:55:41

so that looks good on a grant for application 18:55:45

because the application always is emphasized by 18:55:49

other funds, other federal dollars coming in. 18:55:54

It makes sense that USDA would say, 18:55:58

"Well, EPA is already spending three-and-a-half 18:55:58

million dollars here; so we can give them a 18:56:00

$25,000.00 visioning grant or we can give them a 18:56:02

rural development grant for $100,000.00 to look at 18:56:07

developing something on that site." 18:56:10

It's not a bad thing. It's serviceable 18:56:12

that it can be made into a good thing. 18:56:19

That is all I have. 18:56:21

MR. KESTLE: Thanks, again. 18:56:23

MR. BRYANT: Thank you, folks. 18:56:24

(WHEREUPON, the meeting was concluded.)

C E R T I F I C A T E

STATE OF TENNESSEE

COUNTY OF SEVIER

I, KRISTIN E. BURKE, Licensed Court Reporter, with offices in Knoxville, Tennessee, hereby certify that I reported the foregoing public meeting and questions and answers submitted during THE PUBLIC MEETING OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY SMOKEY MOUNTAIN SMELTERS SUPERFUND SITE by machine shorthand to the best of my skills and abilities, and thereafter the same was reduced to typewritten form by me.

I am not related to any of the parties named herein, nor their counsel, and have no interest, financial or otherwise, in the outcome of the proceedings.

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