U.S. ENVIRONMENTAL PROTECTION AGENCY

SUPERFUND PROPOSED PLAN FACT SHEET

SMOKEY MOUNTAIN SMELTERS SUPERFUND SITE

Knoxville, Knox County, Tennessee **July 2015**

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) invites comments on the proposed cleanup plan for the Smokey Mountain Smelters (SMS) Superfund Site (the Site) located in Knoxville, Knox County, Tennessee. This **Proposed Plan**[1] describes the remedial alternatives evaluated to address the Site contamination, and provides the rationale for EPA's preferred alternative. EPA, in consultation with the Tennessee Department of Environmental Protection (TDEC), will select a remedy to address the Site contamination after reviewing and considering the comments submitted during public comment period.

The SMS Site is the location of former fertilizer and aluminum smelting operations. EPA placed the Site on the **National Priorities List (NPL)** in 2010 because of contaminated soils, sediment and surface water resulting from past industrial operations. From 2011 through 2014, the **Remedial Investigation/ Feasibility Study (RI/FS)** was conducted. The conclusions drawn from the RI/FS form the basis of the proposed remedy presented herein.

This Proposed Plan was developed to comply with the requirements of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**, Section 300.430(f)(2) and the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**, Section 117(a). This Proposed Plan presents a summary of the RI/FS data and other documents included in the Site **Administrative Record**. These documents can be found at the **Information Repository** for the Site, which is at the Bearden Branch Library, 100 Golf Club Road, Knoxville, Tennessee.

[1] All terms in bold typeface are defined in the Glossary attached to this Proposed Plan.

Community Involvement Coordination

Public Comment Period

Dates: August 6, 2015 – September 5, 2015
Purpose: To solicit comments on the Proposed Cleanup Plan

Public Meeting

Date: Thursday, August 13, 2015
Time: 6:00 to 8:00 PM
Place: Montgomery Village Boys and Girls Club
4530 Joe Lewis Rd # 1
Knoxville, Tennessee 37920

Purpose: To discuss the Proposed Cleanup Plan for the Smokey Mountain Smelters Superfund Site.

EPA Contacts

Direct questions or written comments to:

Rusty Kestle, Remedial Project Manager
or
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61 Forsyth Street SW
Atlanta, Georgia 30303
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The Administrative Record and an Information Repository for the Smokey Mountain Smelters Site are located at:

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

SITE LOCATION AND DESCRIPTION

SMS is located at 1508 Maryville Pike in Knoxville, Knox County, Tennessee. A site location map is shown on **Figure 1.** The 13-acre property is bordered by mixed residential and commercial properties to the north; the Montgomery Village apartment complex approximately 200 feet 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 the Site are low density with large areas that are wooded and undeveloped. A site layout map is shown on **Figure 2**.

SITE HISTORY

From 1922 to 1979, various owners operated fertilizer and agricultural chemical companies on the property. SMS operated a secondary aluminum smelter at the Site from 1979 to 1994. The process involved the smelting of scrap aluminum and aluminum dross (a waste byproduct of primary and secondary aluminum smelting) and casting of molten aluminum ingots. Raw materials primarily consisted of scrap aluminum and aluminum dross. Waste material was primarily salt-cake, a residue from dross smelting with high salt and low metal content. Other waste materials included baghouse dust and discarded aluminum dross. In response to several site investigations, SMS was listed on the NPL on September 27, 2010.

SITE INVESTIGATIONS

Through multiple sampling events between 1997 and 2009, TDEC and EPA have characterized the composition and contaminant concentrations in the waste piles, the raw material piles, the on-site lagoon, leachate to the unnamed tributary, and downstream impacts to the unnamed tributary and Flenniken Branch. Dross and salt-cake are water-reactive materials that release heat and ammonia gas, and leach aluminum, ammonia, chlorides, and other contaminants.

In 1997, TDEC collected surface water and waste samples at SMS. Elevated levels of ammonia, arsenic, lead, and aluminum were found in surface waters at the Site. Elevated levels of aluminum, polycyclic aromatic hydrocarbons (PAHs), heptachlor, heptachlor epoxide and ammonia were found in the on-site waste pile. Air samples over the waste pile measured elevated concentrations of ammonia.

In 2002, TDEC collected waste, sediment, and surface water samples from the property. The waste samples contained elevated concentrations of beryllium, chromium, copper, lead, nickel, silver, and zinc. The sediment and surface water samples contained elevated concentrations of copper. Nickel and polychlorinated biphenyls (PCBs) were found in a sample collected from a leachate seep that flowed into the unnamed perennial tributary of the East Branch of Flenniken Branch.

In 2006, EPA collected soil, sediment, surface water, groundwater, spring, and waste samples. Soil and groundwater samples contained beryllium, cadmium, chromium, copper, lead, mercury, PAHs, and PCBs. The sample collected from the leachate emanating from the exterior waste pile contained antimony, arsenic, copper, lead, mercury, nickel, and methyl ethyl ketone (MEK). Surface water samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch contained antimony, arsenic, copper, cyanide, mercury, nickel, acetone, and MEK. Soil reactivity results indicated that ammonia could be generated under probable conditions within the waste pile.

In 2008, EPA observed that access controls were not adequate to keep trespassers off of the property. Holes had been cut in the Site fence, and a path led from the site to the nearby apartment complex. A time-critical removal action was initiated to provide stronger security measures in order to keep trespassers away from the water-reactive dross material and to collect additional data to determine if further waste removal or treatment action is necessary.

In 2009, EPA collected waste, surface and subsurface soil, surface water, and sediment samples. Samples collected from the interior and exterior waste piles contained copper, mercury, and nickel. The waste sample collected from 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. Co-located sediment samples contained elevated concentrations of chromium and copper. Waste samples contained high concentrations of aluminum.

In June 2010, EPA initiated a removal action to reduce direct exposure pathways to nearby human populations, and to stop off-site migration of hazardous substances, pollutants, and contaminants. As part of the removal activities, EPA accomplished the following:

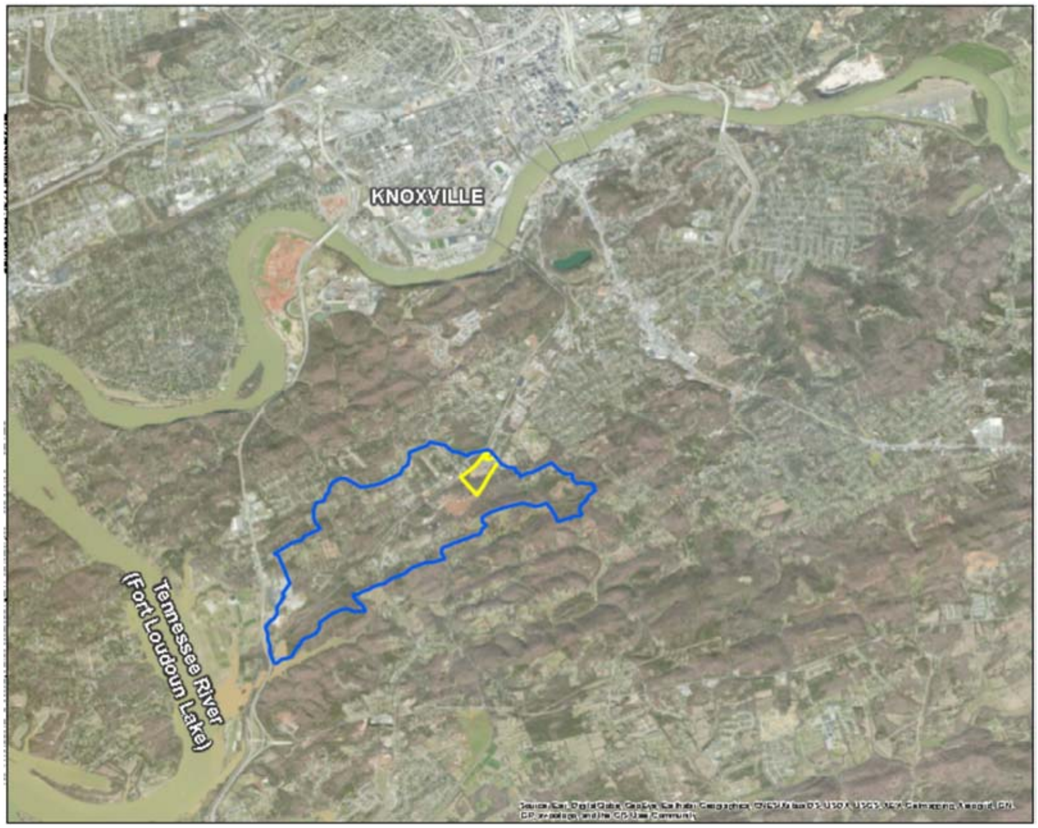

Figure 1 – Site Location

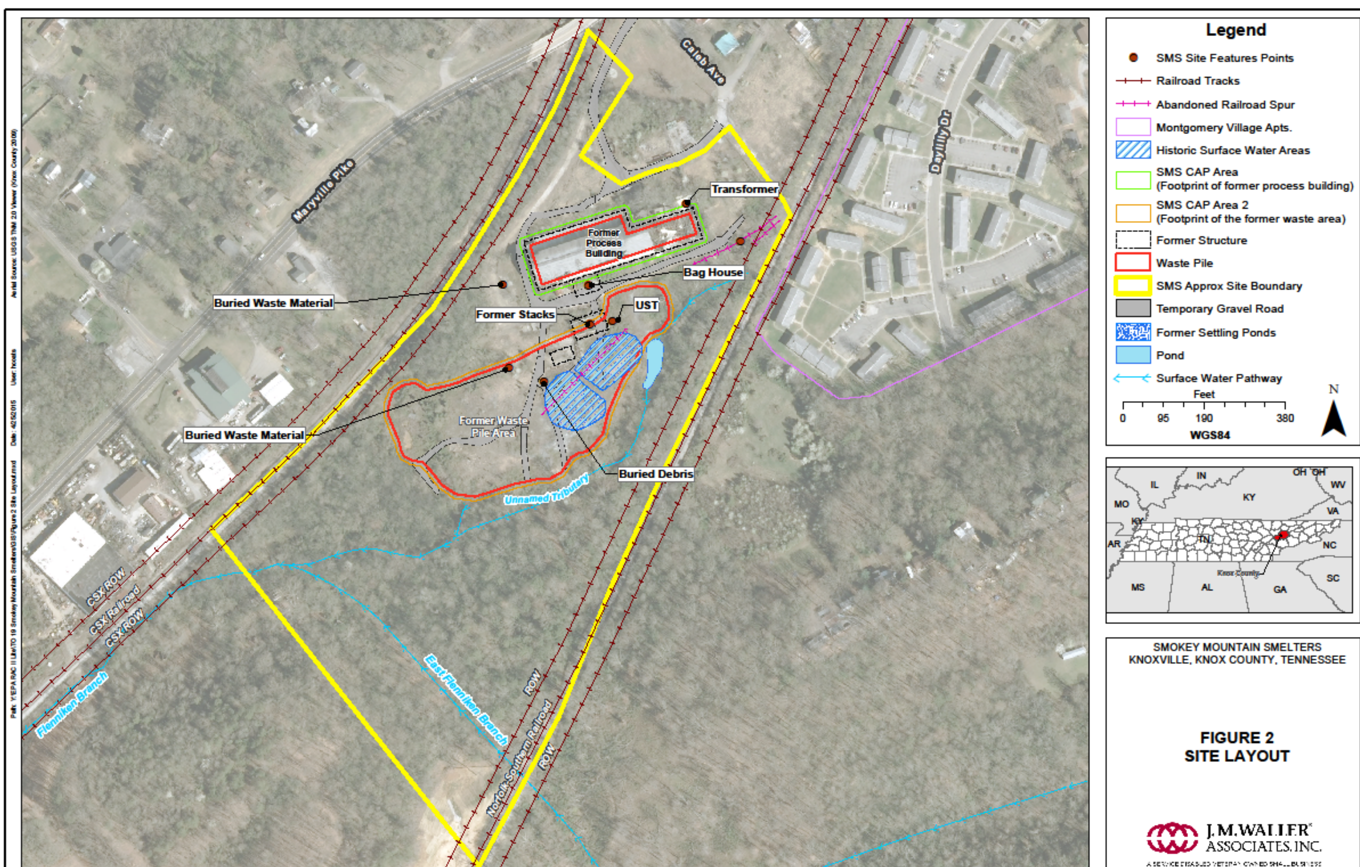

Figure 2 – Site Layout

1. Demolition of the remaining steel building (former process building).
2. Disposal and recycling of demolition debris offsite as appropriate.
3. Consolidation and capping of 2,700 cubic yards (yd^3) of aluminum dross and 75,000 yd^3 of salt-cake onsite.
4. Construction of a cap in order to prevent storm water from contacting the salt-cake and aluminum dross placed under the cap. The cap consists of 12 inches of clay overlain with 6 inches of topsoil and vegetation.
5. Storm water improvements with the construction of two channelized drainage channels along the east and west perimeters of the property.

EPA completed all removal activities in early May 2011.

SITE PHYSICAL CHARACTERISTICS

Topography

Existing SMS 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. The maximum topographic elevation present on Site is approximately 940 feet above mean sea level (amsl) northeast of the former industrial facility foundations, and the minimum elevation is approximately 884 feet 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.

Site Geology and Soils

The rocks underlying the area are Middle Ordovician Ottosee shale of the Chickamauga Group. In general, this formation is characterized by karst development including several dolines (depressions or sinkholes) on the west side of Maryville Pike, approximately 1,400-2,000 feet 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 thickness of the Ottosee shale is approximately 1,000 feet. The depth of the contact between the Ottosee Shale and the Holston Formation at SMS is unknown due to the lack of deep borings.

The original topography of SMS was altered during the Site's operating history and during an interim remedial action that added a clay cap over the former waste pile and contoured the surface to redirect storm water runoff. 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. The thickness of these unconsolidated deposits varies throughout the Site.

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 feet 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 feet of shale and associated native soil, waste, and landfill deposits at the center of the cap area.

Site Hydrogeology

Three distinct, but most likely interconnected hydro-geologic units exist. These units are as follows, in descending depth:

- Perched groundwater in the former on-site landfill
- Groundwater in the clayey surficial aquifer
- Groundwater in the upper portion of limestone, shale, and sandstone bedrock.

The uppermost groundwater is perched water observed in buried waste material in the on-site landfill. Most of the temporary wells constructed during the 2006 site investigation were screened in this perched water zone in saturated waste material.

Surficial aquifer groundwater occurs above competent bedrock in the clay and weathered shale over most of the Site. Depths to groundwater were observed during the RI to vary from approximately 4 to 40 feet.

Bedrock beneath the Site is a complex system of interlayered and interbedded limestone, shale, and sandstone. Groundwater 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 feet.

NATURE AND EXTENT OF CONTAMINATION

Suspected Source Areas

Sources of contamination at SMS are related to the former on-site operations, specifically the former fertilizer plant and secondary aluminum smelter operations. Specific on-site source areas, based on the historical data, 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. Currently, all suspected source areas which contain waste are covered under the clay caps as part of the time-critical removal action completed in 2011.

Soil

Surface soil sampling results were evaluated against the November 2011 EPA Region 9 Industrial/ Commercial and Residential Regional Screening Levels (RSLs) for human health. None of the surface soil samples analyzed exceeded the RSLs for PCBs, dioxins, or furans. The screening comparison found the following metals detected in surface soils as chemicals of potential concern (COPCs) exceeding one or more of the screening criteria: aluminum, arsenic, hexavalent chromium, cobalt, iron, and manganese.

Subsurface Soil and Sludge

Fifteen soil borings were advanced to collect subsurface soil, sludge, or groundwater samples for chemical analysis and to record the soil profile and identify potential waste content. Subsurface sludge samples were collected from 8-12 feet below ground surface (ft 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, residential, and groundwater protection RSLs.

Arsenic, cadmium, chromium, cobalt, copper, iron, lead, mercury, and nickel were detected in subsurface soil samples higher than the screening criteria in one or more samples. Cadmium, chromium, cobalt, copper, iron, lead, mercury, and nickel were detected in sludge samples at concentrations which exceed the groundwater protection RSLs. One sludge sample had PAHs in excess of the respective groundwater protection RSLs.

Sediment

Detected concentrations of inorganic and organic constituents were compared to available screening criteria. EPA considered a conservative scenario of recreational use of the surface water and exposure to sediment, and used the associated human health residential RSLs. 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.

Surface Water

EPA compared surface water sample results to relevant ecological screening criteria. Twenty-two surface water locations were sampled and analyzed for metals. Aluminum exceeded the chronic benchmark in eighteen surface water samples. Copper exceeded the chronic benchmark in two surface water samples. Cyanide, iron, nickel and zinc exceeded their respective chronic benchmarks in one seep sample. Lead exceeded the chronic benchmark in five surface water samples.

Groundwater

Groundwater sample results were compared to relevant **Maximum Contaminant Levels (MCLs)**. Fifteen monitor wells were sampled and analyzed for inorganics, PCBs, pesticides, VOCs, and SVOCs. No PCBs or pesticides exceeded the MCLs in any of the groundwater samples. The following inorganics exceeded MCLs: aluminum, ammonia, antimony, arsenic, beryllium, cadmium, chloride, chromium, cobalt, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate/nitrite, thallium, and zinc. The only organics that exceeded the MCL were bis(2-ethylhexyl)phthalate at four locations, tetrachloroethylene (PCE) at one location, methylene chloride at one location, and pentachlorophenol (PCP) at five locations. The extent of the impacts to the shallow and deep groundwater are shown on **Figures 3** and **4.**

SUMMARY OF SITE RISKS

EPA conducted a **Baseline Risk Assessment** to evaluate the potential human health and ecological risks from exposure to chemical constituents detected in the Site soil, sediments, groundwater, and soil gas. Each risk is discussed below.

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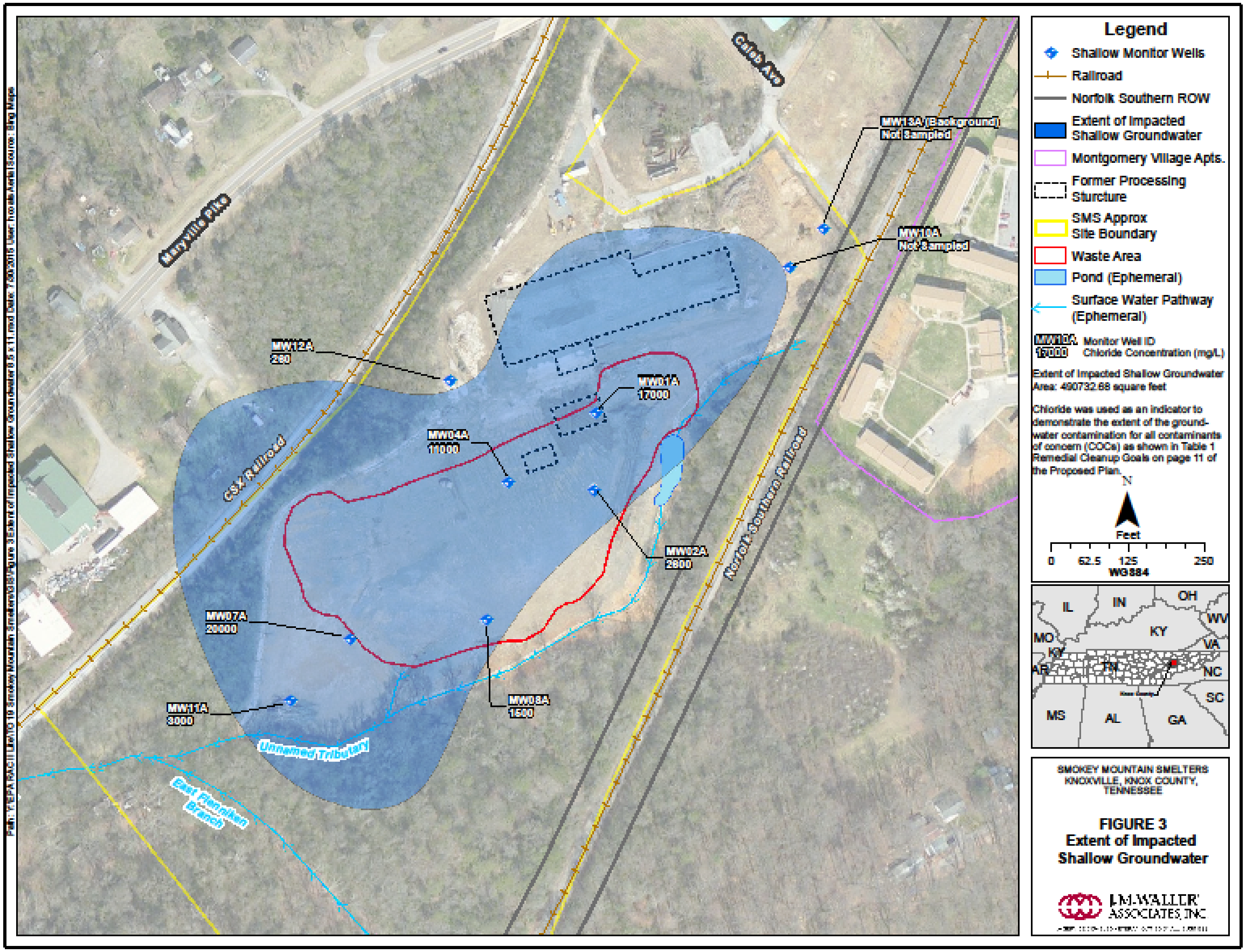

Figure 3 – Extent of Impacted Shallow Groundwater

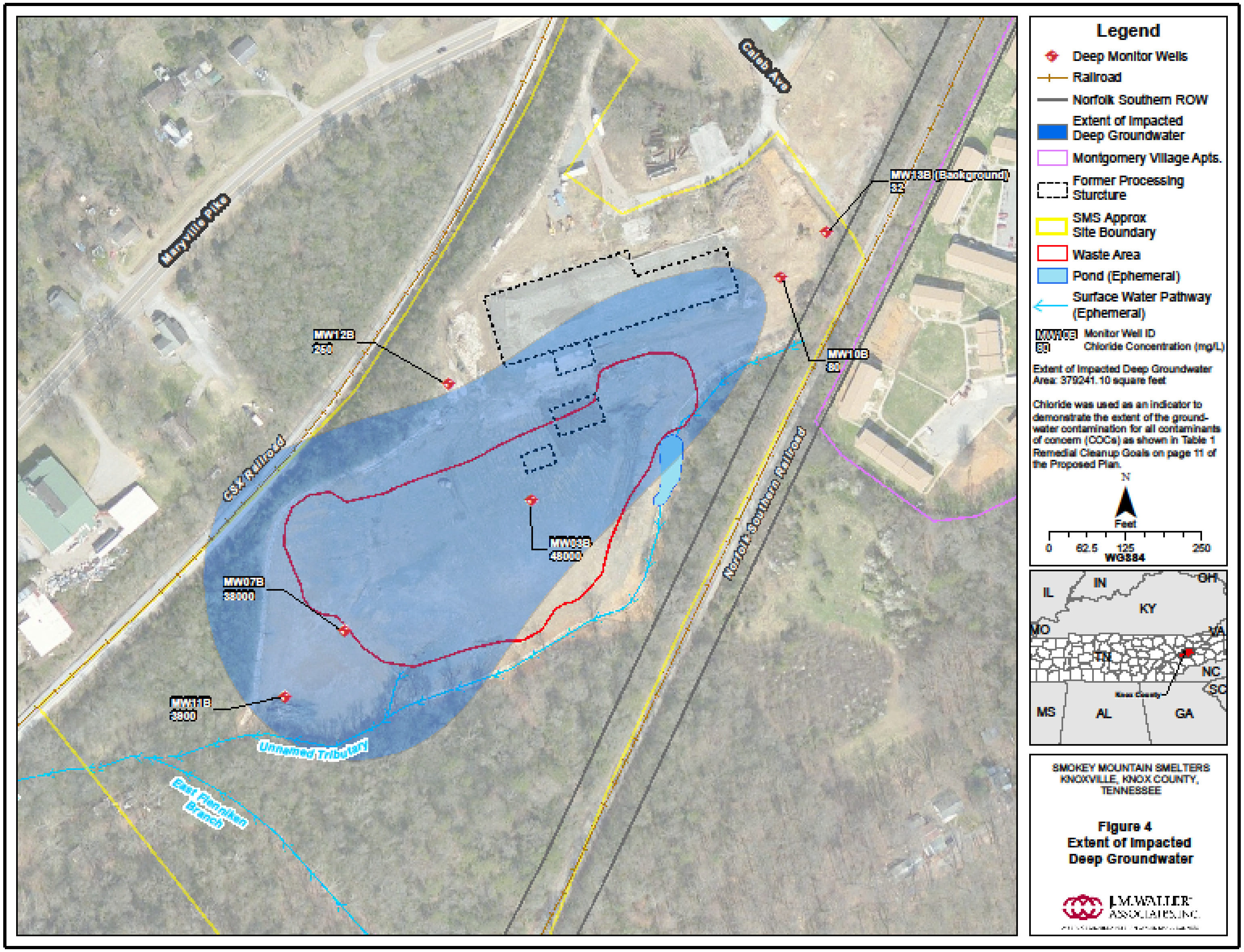

Figure 4 – Extent of Impacted Deep Groundwater

Human Health Risks

In accordance with EPA and EPA Region 4 guidance, EPA conducted the Human Health Risk Assessment (HHRA) to evaluate risks based on the current and reasonably anticipated future land and water uses. Potential receptors included on-site workers, trespassers, recreational users, construction/utility workers and hypothetical future residents. Because of the various land and water uses throughout the Site, the HHRA was based on three separate exposure areas (EAs), which included the on-site EA, Flenniken Branch, and Knob Creek Embayment. The primary exposure media of concern were soil (on-site), sediment (on-site, Flenniken Branch, and Knob Creek Embayment), groundwater (on-site), fish (Knob Creek Embayment), soil gas (on-site), and surface water (on-site, Flenniken Branch, and Knob Creek Embayment).

The majority of soil cancer risks and non-cancer hazard indices (HIs) were below the EPA acceptable levels. Although there were a few exceedances, given that the overall approach to the HHRA tends to overestimate actual risks to a fairly significant degree, it is unlikely that soil exposure at the Site would result in any unacceptable health impacts for the evaluated soil receptors. Several shallow and deep groundwater COPCs had total cancer risks or total HIs in exceedance of EPA's acceptable levels. Although site groundwater risks are likely overestimated, there is still the potential that groundwater exposure at the Site would result in unacceptable health impacts to the evaluated receptors. Risks and hazards associated with exposure to shallow and deep groundwater are summarized below.

Scenario	Shallow or Deep Groundwater	Cancer Risk	HI
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

The HHRA concluded the following:

- The excess cancer risks for future on-site workers and lifetime residents exceed EPA's generally accepted risk range. Potential ingestion exposure to arsenic and chromium in both shallow and deep groundwater accounts for the majority of the excess cancer risk.
- Potential non-cancer hazards are possible for future on-site workers, future adult residents, and future child residents based on HIs greater than 1. Potential ingestion exposure to cobalt, manganese, and thallium in shallow groundwater, and exposure to manganese and thallium in deep groundwater, account for the majority of the potential non-cancer hazard.

Ecological Risks

The Baseline Ecological Risk Assessment (BERA) documented the potential exposure and consequential risk to ecological receptors exposed primarily to contamination down gradient of the Site. Areas and media evaluated in the BERA include: off-site surface soils, surface water and sediments in Flenniken Branch, and surface water, sediment, and fish tissue collected from the Knob Creek Embayment. In addition, the BERA included sediment toxicity testing and benthic community analysis for Flenniken Branch.

Based on the findings presented in the BERA, it was concluded that sufficient information was collected to assess ecological risk associated with site-related contamination. Those results failed to show the presence or likelihood of substantial future ecological impairment associated with site-related contamination.

REMEDIAL ACTION OBJECTIVES AND CLEANUP LEVELS

Remedial Action Objectives (RAOs) provide the overall goals of the Proposed Plan and are used to guide the development of the remedial alternatives. EPA identified the following RAOs:

- Implement the final capping of the waste material in a manner to minimize direct contact to human and ecological receptors.
- Reduce or eliminate the migration of contaminants from the capped waste areas that could cause adverse impacts to the groundwater and Flenniken Branch.
- Prevent human exposure (direct contact or ingestion) to groundwater contaminated with COCs above levels that are protective of

WHAT IS RISK AND HOW IS IT CALCULATED?

Human Health Risk

A Superfund human health risk assessment estimated the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help EPA to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of the exposure. Using the information, EPA calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. EPA considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound of probability; for example a "1 in 10,000" chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. EPA's target range for acceptable cancer risk is "1 in 1,000,000" to "1 in 10,000." These probabilities are often expressed in scientific notation (i.e., 1×10^{-6} or 1E -6 to 1×10^{-4} or 1E -4). An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated, and summarized.

Ecological Risk

Current EPA guidance recommends an eight-step process for designing and conducting ecological risk assessments (ERAs) for the Superfund Program. Steps 1 and 2 constitute a screening level ecological risk assessment (SLERA), which compares existing site data to conservative screening level values to identify those chemicals which can confidently be eliminated from further evaluation, and those for which additional evaluation is warranted. At the end of Step 2, all involved parties meet and discuss whether: there is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk; if the information is not adequate to make a decision at this point, the ERA process will continue to Step 3; or the information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

If further evaluation is warranted, Step 3 of the eight-step process is initiated as the planning and scoping phase for implementing a baseline ecological risk assessment (BERA). Step 3 includes several activities, including refinement of the list of contaminants of potential concern (COPCs), further characterization of ecological effects, refinement of information regarding contaminant fate and transport, complete exposure pathways, ecosystems potentially at risk, selecting assessment endpoints, and developing a conceptual model with working hypotheses or questions that the site investigation will address. In Step 4, a sampling and analysis plan (SAP) is developed and used to gather further data to support the BERA. Step 5 is a site visit to verify the Step 4 sampling design. Step 6 of the process is the actual data collection for the BERA. Step 7 is the summary and analysis of the data, and prediction of the likelihood of adverse effects based on the data analysis, which is presented as the risk characterization. It also includes consideration of uncertainties and ecological significance of risks in view of the types and magnitude of effects, spatial and temporal patterns, and likelihood of recovery. Step 8, the final step, results in a discussion of significant risks, recommended cleanup (if any), and future efforts.

drinking water use.

- Restore Site groundwater contaminated with COCs to levels that are protective of its beneficial use as a potential drinking water source.

The Site-specific groundwater cleanup levels are presented in **Table 1**.

Table 1 – Remedial Cleanup Levels

Contaminant of Concern	Cleanup Level (µg/L)	Basis of Cleanup Level
Groundwater – Shallow		
Aluminum	1,997	HQ=1
Ammonia	30,000	EPA Health Advisory
Arsenic	10	MCL
Chromium	100	MCL
Cobalt	0.6	HQ=1
Fluoride	4,000	MCL
Manganese	43	HQ=1
Mercury	2	MCL
Nickel	39	HQ=1
Nitrate/Nitrite	10,000	MCL
Pentachlorophenol	1	MCL
Thallium	2	MCL
Zinc	600	HQ=1
Groundwater – Deep		
Arsenic	10	MCL
Chromium	100	MCL
Cobalt	0.6	HQ=1
Manganese	43	HQ=1
Pentachlorophenol	1	MCL
Thallium	2	MCL

DESCRIPTION OF ALTERNATIVES

When developing the **Feasibility Study** (FS), medium-specific remedial alternatives were evaluated. After an initial screening process, some of the evaluated alternatives were retained for further examination to develop comprehensive remedies capable of addressing the impacted media (soil and groundwater). The alternatives were developed using various combinations of general response actions and evaluated with respect to their effectiveness in protecting human health and the environment, compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)**, implementability, cost, and the time required to achieve the RAOs and cleanup levels. For additional details regarding the remedial alternatives, refer to the final FS report.

CRITERIA FOR EVALUATING REMEDIAL ALTERNATIVES

In selecting a preferred cleanup alternative, EPA uses the following criteria to evaluate those screened in the **Feasibility Study (FS)**. The first two criteria are threshold criteria and must be met for an option to be considered further. The next five are balancing criteria for weighing the merits of those that meet the threshold criteria. The final two criteria are used to modify EPA's proposed plan based on state and community input. All nine criteria are explained in more detail here.

1. **Overall Protection of Human Health and the Environment** – Eliminates, reduces, or controls health and environmental threats through institutional or engineering controls or treatment.
2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** – Compliance with Federal/State standards and requirements that pertain to the site or whether a waiver is justified.
3. **Implementability** – Technical feasibility and administrative ease of conducting a remedy, including factors such as availability of services.
4. **Short-Term Effectiveness** – Length of time to achieve protection and potential impact of implementation.
5. **Long-Term Effectiveness and Permanence** – Protection of people and environment after cleanup is complete.
6. **Reduce Toxicity, Mobility, or Volume by Treatment** – Evaluates the alternative's use of treatment to reduce the harmful effects of principal contaminants and their ability to move in the environment.
7. **Cost** – Benefits weighed against cost.
8. **State Acceptance** – Consideration of state's opinion of the preferred alternative(s).

The following sections present a summary of the remedial alternatives evaluated to address the impacted soil and groundwater. All costs for alternatives are presented in millions of dollars.

ALTERNATIVE I
No Action

Estimated Project Cost: $0
Estimated Operation & Maintenance (O&M) Cost: $0
Estimated Present Worth Cost: $0

As required by the NCP, this alternative was evaluated to provide a comparative basis for the other alternatives. Under this alternative, no action would be taken and the Site would remain in its present conditions. As there is no evidence of passive reduction of COCs, the timeframe to achieve cleanup levels would be excessively long.

ALTERNATIVE II
Capping, *In situ* Groundwater Treatment, Monitored Remediation (MR), and Institutional Controls (ICs)

Alternative II includes soil capping, *in situ* groundwater treatment using an **injection barrier**, and **Institutional Controls** (ICs). Under this alternative, a cap compliant with RCRA Subtitle C hazardous waste landfill cover design and construction requirements would be installed over waste areas previously covered by 12 inches of clay and 6 inches of soil. Injection wells would be installed in a line down to the shallow groundwater in order to inject a reagent or combination of reagents to remove COCs from the groundwater. The injections would comply with TDEC underground injection control requirements for experimental treatments of groundwater, and the injection wells would comply with underground injection well construction and abandonment standards, as appropriate. Reagents(s) would be added as needed until such time as groundwater cleanup standards are achieved. ICs such as restrictive covenants and land and groundwater use restrictions would be required to ensure protectiveness of the remedy and the integrity of capped areas.

Estimated Project Cost: $3.4M
Estimated O&M Cost: $1M
Estimated Present Worth Cost: $3.7M

ALTERNATIVE III
Capping, MR, and ICs

Alternative III is the same as Alternative II except that no *in situ* groundwater treatment would be performed, and the groundwater remedy would be monitored remediation (MR).

Estimated Project Cost: $2.7M
Estimated O&M Cost: $1M
Estimated Present Worth Cost: $3.4M

ALTERNATIVE IV
Excavation, Containment Cell, MR, and ICs

Alternative IV includes removal of wastes under the current caps, construction of a containment cell onsite, MR, and ICs. Under this alternative, all wastes currently onsite within the current capped areas would be removed temporarily. Following the removal of the waste, a containment cell would be created for the removed waste. The containment cell would consist of a liner under the contaminated soil/waste and a RCRA Subtitle C compliant cap system as described in Alternative II. MR and ICs as described in Alternative II would be implemented.

Estimated Project Cost: $31.3M
Estimated O&M Cost: $1M
Estimated Present Worth Cost: $32M

ALTERNATIVE V
Excavation, Solidification/Stabilization, Onsite Disposal, Cap, MR, and ICs

Alternative V includes removal of wastes under the current caps, solidification/stabilization of the removed waste, onsite disposal, capping, MR, and ICs. 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. Stabilization refers to techniques that chemically reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms.

Under this alternative, all wastes currently on Site within the current capped areas would be removed temporarily. Following the removal of the waste, the waste would undergo solidification/stabilization and then would be placed back into the excavation for onsite disposal. A RCRA Subtitle C compliant cap system as described in Alternative II would then be installed over the onsite disposal area. MR and ICs would be implemented.

Estimated Project Cost: $22.7M
Estimated O&M Cost: $1M
Estimated Present Worth Cost: $23.4M

EVALUATION OF ALTERNATIVES

A summary of the evaluation of the potential alternatives to address the Site contamination is presented below. Detailed evaluation of the alternatives is included in the Final FS Report, which can be found in the Information Repository. The objective of this evaluation is to compare and contrast the alternatives, and to ultimately select and present a preferred alternative.

Common Elements

Implementation of a groundwater sampling and monitoring program, ICs, and engineering controls are common to all remedial alternatives.

Since all remedial alternatives anticipate COC-impacted soil and/or groundwater 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.

The remedial alternatives presented in this Proposed Plan were evaluated using the nine criteria specified the NCP. A summary of the evaluation is presented below.

Overall Protection of Human Health and the Environment

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 will not be carried through the remaining evaluation criteria. Alternatives II through V would address the wastes under the current caps and the groundwater by eliminating, reducing, or controlling risks through treatment, engineering controls, and/or institutional controls. 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 groundwater, would also achieve overall protection of human health and the environment but over a longer timeframe.

Compliance with ARARs

Alternatives III through V rely solely on natural degradation processes to remediate the impacted groundwater, and for this reason, RAOs would not be achieved within a reasonable timeframe. This is inconsistent with the expectation of treatment for principal threat materials. By contrast, Alternative II includes active treatment to address the groundwater contamination, thereby meeting the expectation for treatment and significantly reducing the overall cleanup timeframe. Implementation of any of these alternatives would comply with all chemical-, location- and action-specific ARARs.

The preferred alternative, Alternative II, is expected to attain cleanup levels based on MCLs promulgated pursuant to the Safe Drinking Water Act for underground sources of drinking water, which includes groundwater that is a potential drinking water source. Alternative II will also comply with RCRA waste characterization, storage and disposal requirements (40 CFR Parts 262, 264, 265, 268), TDEC requirements for monitoring well construction and abandonment (TDEC 0400-12-01-.06; 0400-45-09-.16), TDEC requirements for underground injections of experimental treatments for groundwater (TDEC 0400-45-06-.09), and underground injection well construction and abandonment standards (TDEC 0400-45-06-.14).

All land disturbing activities during remedy construction will comply with TDEC requirements for controlling fugitive dust emissions (TDEC 1200-3-8-.01), storm water management and runoff controls (TDEC 0400-40-10-.03(2), and Tennessee General Storm Water Permit No. TNR100000. The final cover system will comply with RCRA Subtitle C hazardous waste landfill cover design and construction requirements in 40 CFR §264.310(a) (TDEC 1200-1-11-.06(14)(k))) which provide for a performance-based final cover system designed and constructed to function with minimum maintenance, promote drainage and minimize erosion of the cover, provide long-term minimization of migration of liquids through the closed landfill, accommodate settling and subsidence so that the cover’s integrity is maintained, and have a permeability of less than or equal to the permeability of any bottom liner systems or natural subsurface soils present. The capped area will also comply with the general post-closure care and notices requirements found in 40 CFR 264.310(b) (TDC 1200-1-11-.06(14)(k)) and 40 CFR 264.116 (TDEC 1200-1-11-.06(7)).

Long-Term Effectiveness and Permanence

Alternatives II, IV, and V, which include active treatment for soil and groundwater, would achieve the RAOs, comply with ARARs within a reasonable timeframe, and provide effectiveness and permanence over the long-term. In contrast, Alternative III, which relies solely on natural processes to remediate the contaminated groundwater, would provide limited protectiveness, and attainment of RAOs and cleanup goals would not be achieve with a reasonable timeframe.

Reducing Toxicity, Mobility or Volume through Treatment

Alternatives III through V primarily rely on natural degradation processes to remediate contaminated groundwater. For Alternative II, active treatment would be utilized to treat the groundwater, therefore reducing the toxicity and volume of the contamination. All alternatives reduce the mobility of contaminants in the wastes/soils under the current capped areas.

Short-Term Effectiveness

The remedy will require specific additional institutional and administrative controls over the short term to remain effective, but these controls can be removed when cleanup levels are attained. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated soil 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.

Implementability

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

Cost

Cost estimates for all remedial alternatives were developed during the FS and are summarized below. It should be noted that present worth costs are based on an effective discount rate of 7 percent (%).

Remedial Alternative	Estimated Project Costs	Estimated O&M Costs	Estimated Present Worth
I	$0	$0	$0
II	$3.4M	$1M	$3.7M
III	$2.7M	$1M	$3.4M
IV	$31.3M	$1M	$32M
V	$22.7M	$1M	$23.4M

State Acceptance

TDEC has been actively involved in the development and review of the RI, FS, and the cleanup plan for the Site. State support for the preferred alternative plan is contingent upon the further study of the buffering capacity of the carbonate aquifer during remedial design. State acceptance of this alternative is anticipated if the results indicate that the existing aquifer conditions do not provide adequate pH adjustment of the groundwater.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated subsequent to the Proposed Plan comment period. Comments received during this period will be addressed and responses will be presented in the **Responsiveness Summary**, which will be included in the **Record of Decision (ROD)**.

PREFERRED REMEDIAL ALTERNATIVE

Alternative II is EPA's preferred remedial alternative and consists of the following components:

- Capping
- *In situ* groundwater treatment
- Monitored remediation
- Implementation of ICs
- Five-Year Reviews

Alternative II consists of constructing a RCRA cover system over Source No. 1 and Source No. 2. The contaminated soils within both source areas would be overlain with a cover system consisting of a gas collection layer (geonet), a geosynthetic clay liner, a high density polyethylene liner drainage layer, 18 inches of protective soil layer, 6 inches of topsoil, and vegetative cover.

In addition, groundwater treatment will be accomplished by injecting a reagent or combination of reagents along a line perpendicular to groundwater flow direction to form an injection barrier. The injection barrier would be located between the former processing structure (Source No. 2) and the Waste Area (Source No. 1) so that groundwater would be treated as it flows through the area towards to the Waste Area (Source No. 1). Based on the results of groundwater monitoring, additional rounds of injection may be necessary. **Figure 5** shows the Preferred Remedial Alternative.

CONCLUSIONS

EPA believes the preferred alternative meets the threshold criteria and provides the best balance of cost and benefits among the other alternatives with respect to the balancing and modifying criteria. 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 soil and groundwater contamination, the remedy also meets

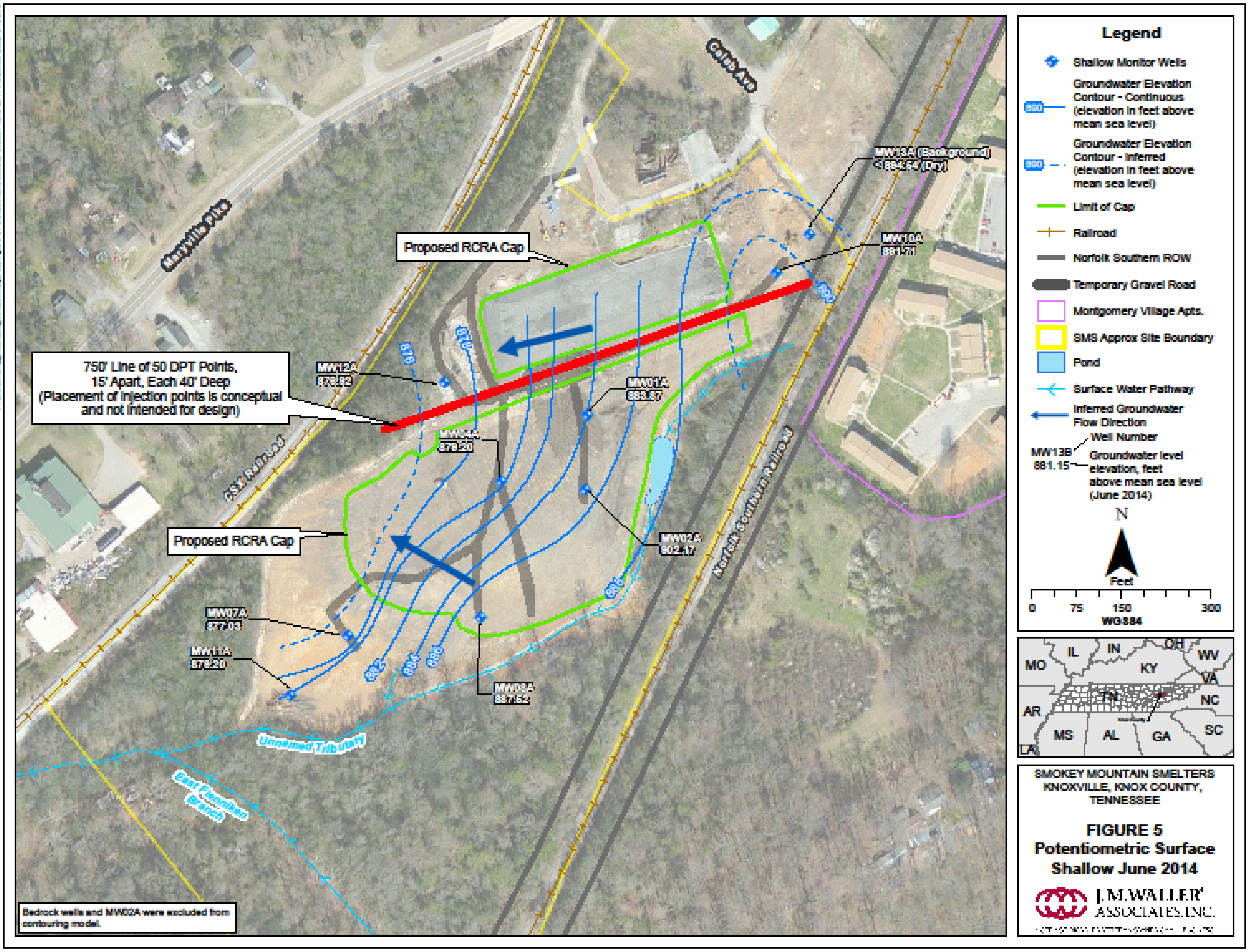

Figure 5 – Preferred Remedial Alternative

the statutory preference for the selection of a remedy that involves treatment as a principal element. Since COC-impacted soil and groundwater is anticipated to 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.

GLOSSARY

Administrative Record: Material documenting EPA's selection of cleanup remedies at Superfund Sites, a copy of which is placed in the **information repository** near the Site.

Applicable or Relevant and Appropriate Requirements (ARARs): Refers to Federal and State requirements a selected remedy must attain, which vary from site to site.

Baseline Risk Assessment: A qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and the environment by the presence or potential presence of specific contaminants.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): Also known as **Superfund**, is a federal law passed in 1980 and modified in 1986 by the Superfund Amendment and Reauthorization Act (SARA); the act created a trust fund, to investigate and cleanup abandoned or uncontrolled hazardous waste sites. The law authorizes the federal government to respond directly to releases of hazardous substances that may endanger public health or the environment. EPA is responsible for managing the Superfund.

Contaminants of Concern (COCs): Chemical constituents associated with a Superfund Site that have been released into the environment and pose a risk to human health.

Feasibility Study (FS): Study conducted after the Remedial Investigation to determine what alternatives or technologies could be applicable to clean up the site-specific COCs.

Five-Year Review: A statutory requirement to evaluate the implementation and performance of a remedy in order to determine whether the remedy is or will be protective of human health and the environment.

Groundwater: The supply of fresh water found beneath the Earth's surface (usually in aquifers) which is often used for drinking water.

Information Repository: A library or other location where documents and data related to a Superfund project are placed to allow public access to the material.

Injection barrier: A subsurface treatment zone created by injecting chemicals into an aquifer. Passive treatment is accomplished as groundwater flows through the barrier.

Institutional Controls (ICs): Restriction that prevents an owner from inappropriately developing a property. The restriction is designed to prevent harm to workers or the general public and maintain the integrity of the remedy.

Maximum Contaminant Levels (MCLs): Standards that are set by the United States Environmental Protection Agency (EPA) for drinking water quality in Title 40 of the Code of Federal Regulations. A Maximum Contaminant Level (MCL) is the legal threshold limit on the amount of a hazardous substance that is allowed in drinking water under the Safe Drinking Water Act.

Monitored Remediation (MR): This term refers to the reliance on natural attenuation processes to achieve site-specific remediation objectives. The natural attenuation processes that are at work in such remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater.

National Contingency Plan (NCP): The Federal Regulation that guides the Superfund program. The NCP was revised in February 1990.

Operation and Maintenance (O&M): Activities conducted at sites after cleanup remedies have been constructed to ensure that they continue functioning properly.

Proposed Plan: A Superfund public participation fact sheet which summarizes the preferred cleanup strategy for a Superfund Site.

Record of Decision (ROD): A public document describing EPA's rationale for selection of a Superfund remedy.

Remedial Design (RD): The technical analysis procedures which follow the selection of remedy for a site and result in a detailed set of plans and technical specifications for implementing the remedial action.

Remedial Investigation / Feasibility Study (RI/FS): A two part investigation conducted to fully assess the nature and extent of a release, or threat of release, of hazardous substances, pollutants, or contaminants, and to identify alternatives for cleanup. The Remedial Investigation gathers the necessary data to support the corresponding Feasibility Study.

Responsiveness Summary: A summary of oral and written comments received by EPA during a comment period on key EPA documents, and EPA's responses to those comments. The responsiveness summary is a key part of the ROD, highlighting community concerns for EPA decision-makers.

Source areas: Subsurface areas of the Site where a high concentration of contamination has been found.

Superfund: The common name used for the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the federal law that mandates cleanup of abandoned hazardous waste sites

USE THIS SPACE TO WRITE YOUR COMMENTS
Your input on the Proposed Plan for the Smokey Mountain Smelters Superfund Site is important in helping EPA to select a remedy for the Site. Use the space below to write your comments, then fold and mail. A response to your comment will be included in the Responsiveness Summary.

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Place
Stamp
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Name_________________________
Address____
City_____________State_______Zip_________

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