APPENDIX A

Record of Decision

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVES SELECTION

COPPER BASIN MINING DISTRICT SITE
OPERABLE UNIT 3
DAVIS MILL CREEK COLLECTION AND TREATMENT SYSTEM
POLK COUNTY, TENNESSEE

CERCLIS ID: TN0001890839

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA, GA

September 2012

10902952

Part 1:

Declaration for the Record of Decision

Declaration for the Record of Decision

Site Name and Location

Copper Basin Mining District Site, Operable Unit 3 (Davis Mill Creek Collection and Treatment System)
Polk County, Tennessee
EPA Site Identification Number: TN0001890839

Statement of Basis and Purpose

This decision document presents the Selected Remedy for the Copper Basin Mining District Site, (Site) Operable Unit 3 (OU3), the Davis Mill Creek Collection and Treatment System in Polk County, Tennessee. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 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). This decision is based on the Administrative Record file for the Site.

The State of Tennessee concurs with the Selected Remedy.

Assessment of the Site

The response actions selected in this Record of Decision (ROD) are necessary to protect public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

The selected remedy for OU3 is:

- Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls.

Davis Mill Creek, which is considered part of a collection and conveyance system and not a jurisdictional a jurisdictional Waters of the U.S., is a small tributary stream to the Ocoee River which is OU5 of the Site. The creek drains a small watershed of 5.2 square miles that hosted significant mining, mineral processing, and chemical production facilities and served as a disposal area for about 10 million cubic yards of mine waste and by-product materials. Historically, the watershed was a major source of contamination to the Ocoee River. The U.S. Environmental Protection Agency (EPA) issued a Record of Decision for the Ocoee River in September, 2011 that primarily selected Monitored Natural Recovery (MNR). This remedy was possible because of numerous removal actions that had been completed in the Davis Mill Creek watershed from 2001 to 2011. These actions contained and diverted clean water from the watershed directly to the Ocoee River to prevent its contamination and constructed a collection

and conveyance system capable of capturing contaminated water up to the 10-year, 24-hour storm for treatment in an existing upgraded water treatment plant.

The selected remedy for OU3 will complement existing and future remedies for other operable units at the Site; activities in other OUs are described in more detail in Part 2, Section 4 of this document. The overall cleanup strategy for the Davis Mill Creek Collection and Treatment System is collection and treatment of contaminated water to prevent its transport to the Ocoee River. Preventing this contaminant inflow to the river is critical to allow the MNR remedy for OU5 to continue to address identified chronic risks to aquatic organisms from metals and acid in sediment in portions of the river and deposited in Ocoee No. 3 Reservoir and Parksville Reservoir. Contaminant sources to OU3 have been identified as numerous piles of mine wastes and by-product materials in upland portions of the watershed and on the former Copperhill industrial plant area. This area, which is defined as OU4, is presently an area of active recycling of waste and by-product materials. EPA will select a remedy for this area at an appropriate time.

Collection and treatment of surface water are proven strategies that use engineered solutions to achieve the Remedial Action Objectives (RAOs) and reduce site contaminants to levels meeting site-specific goals. They employ routine actions to collect contaminated seepage and runoff, pump these contaminants to an existing water treatment plant, and remove these contaminants to acceptable levels using aeration and lime neutralization. These processes would be relatively permanent as long as the system is properly maintained. Proper function of the system will be ensured by monitoring and compliance with effluent limits set forth by the State of Tennessee.

The main components of the Selected Remedy include:

- Five previously constructed storm water retention dams.
- Existing diversion of the West Drainage Channel.
- Previously constructed Dam No. 5 and the Dam No. 5 pump station that conveys water from Davis Mill Creek to the Cantrell Flats water treatment plant.
- Previously constructed Belltown Creek and Gypsum Ponds clean water diversions.
- Existing Cantrell Flats water treatment plant, including necessary refurbishment.
- Encapsulation of discharge from the North Potato Creek diversion tunnel and French drain outlets in high density polyethylene piping from their source to Davis Mill Creek; covering contaminated sediment that would be exposed by the encapsulation of these surface waters with borrow soil.
- Installation of fencing, netting, or similar materials across the portal of the North Potato Creek diversion tunnel to eliminate direct contact with surface water.
- Construction of a fence along a portion of upper Davis Mill Creek to restrict access and reduce risk by direct contact.
- Implementation of institutional controls to restrict access and use of surface water in OU3.

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, is cost-effective, and uses permanent solutions and alternative treatment technologies to the maximum extent practicable.

To the greatest extent practicable, these components satisfy the statutory preference for reducing the toxicity, mobility, or volume of hazardous substances through treatment.

Because the Remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory Five-Year Reviews as required by CERCLA Section 121(c) will be used to ensure the Remedy for OU3 remains protective. A statutory Five-Year Review will be conducted for OU3 within five years after initiation of remedial actions to ensure that the Remedy is, or will be, protective of human health and the environment using criteria developed as part of the monitoring plan.

ROD Data Certification Checklist

The following information is included in the Decision Summary Section of this ROD. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern and their respective concentrations (Section 7).
- Baseline risk represented by the chemicals of concern (Section 7).
- Remediation Goals established for chemicals of concern and the basis for those levels (Section 8).
- How source materials constituting principal threats are addressed (Section 11).
- Current and reasonably anticipated future land use assumptions (Section 6).
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the cost estimates are projected (Section 10).
- Key factors that led to selecting the remedy (Section 12).

Authorizing Signature

Franklin E. Hill
Director, Superfund Division
U.S. Environmental Protection Agency, Region 4

Date 9/26/12

RECORD OF DECISION

TABLE OF CONTENTS

Acronyms vi
Decision Summary 1
1.0 Site Name, Location, and Description 2
2.0 Site History and Enforcement Activities 5
2.1 Site History 5
2.1.1 History and Designation of Davis Mill Creek 7
2.2 Regulatory and Enforcement History 8
2.2.1 1990 Agreement and Covenant Not to Sue 9
2.2.2 2001 Agreements 9
2.2.3 Administrative Orders on Consent 10
2.3 History of Removal Actions in the Davis Mill Creek Watershed 11
2.3.1 Actions under the Agreement and Covenant Not to Sue 11
2.3.2 Actions Pursuant to Administrative Orders on Consent 12
2.3.3 Other Actions 13
2.4 Investigation History 14
2.4.1 Investigations Prior to the 2001 Memorandum of Understanding 15
2.4.2 2002 Waste Inventory 15
2.4.3 2003 Remedial Investigation 15
2.4.4 2003 Focused Feasibility Study 16
2.4.5 Engineering Evaluation/Cost Analysis Reports 16
2.4.6 2012 Remedial Investigation 17
2.4.7 2012 Feasibility Study 17
3.0 Community Participation 19
4.0 Scope and Role of the Response Action 20
5.0 Site Characteristics 21
5.1 Conceptual Site Model 21
5.2 Overview of the Site 21
5.3 Features of OU3 22

5.3.1 Historical Changes to Davis Mill Creek 22
5.3.2 Davis Mill Creek Collection and Treatment System 23
5.3.3 Present Conditions in OU3 25
5.4 Sampling Strategy 26
5.5 Known or Suspected Sources of Contamination 27
5.6 Types of Contamination and Affected Media 28
5.6.1 Surface Water 28
5.6.2 Sediment 31
5.6.3 Interstitial Sediment Pore Water 33
5.7 Contaminant Location and Migration 34
5.7.1 Surface Water 34
5.7.2 Sediment 35
5.7.3 Interstitial Sediment Pore Water 35
5.8 Other Site-Specific Factors 36
6.0 Current and Potential Future Land Uses 37
6.1 Land Uses 37
6.2 Ground and Surface Water Uses 38
7.0 Summary of Site Risks 39
7.1 Summary of the Human Health Risk Assessment 39
7.1.1 Identification of Chemicals of Concern 39
7.1.2 Exposure Assessment 39
7.1.3 Toxicity Assessment 40
7.1.4 Risk Characterization 40
7.1.5 Media Concentrations Protective of Human Health 42
7.2 Summary of the Ecological Risk Assessment 42
7.2.1 Identification of Chemicals of Potential Concern 42
7.2.2 Risk Evaluations and Exposure Assessment 43
7.2.3 Ecological Effects Assessment 44
7.2.4 Risk Characterization 45
7.2.5 Media Concentrations Protective of Ecological Receptors 47
8.0 Remedial Action Objectives 48
8.1 Remedial Goals 48

9.0 Description of Alternatives 50
9.1 Alternative DMC-1 – No Action 51
9.2 Alternative DMC-2 – DMC Removal Actions 51
9.3 Alternative DMC-3 – DMC Removal Actions plus Institutional and Engineering Controls 52
9.4 Alternative DMC-4 – DMC Removal Actions plus Institutional and Enhanced Engineering Controls 53
10.0 Comparative Analysis of Alternatives 54
10.1 Overall Protection of Human Health and the Environment 54
10.2 Compliance with ARARs 55
10.3 Long-Term Effectiveness and Permanence 56
10.4 Reduction of Toxicity, Mobility, or Volume through Treatment 57
10.5 Short-Term Effectiveness 57
10.6 Implementability 58
10.7 Cost 58
11.0 Principal Threat Wastes 59
12.0 Selected Remedy 60
12.1 Summary and Rationale for Selected Remedy 60
12.2 Description of the Selected Remedy 61
13.0 Statutory Determinations 64
13.1 Protection of Human Health and the Environment 64
13.2 Compliance with ARARs 65
13.3 Cost Effectiveness 66
13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable 66
13.5 Preference for Treatment as a Principal Element 66
13.6 Five-Year Review Requirements 66
14.0 Documentation of Significant Changes 68
15.0 References 69

TABLES 74

Table 1-1 General Description and Status of Actions Required in the Davis Mill Creek Watershed Under the 1990 Agreement and Covenant Not to Sue 75

Table 1-2 Summary of Alternative Components Screened in 2003 Focused Feasibility Study 78

Table 5-1 Maximum Concentrations for Surface Water Samples in OU3 79

Table 5-2 Contaminant Mass Loads in Surface Water in OU3 80

Table 5-3 Maximum Concentrations and Average Constituent Loads for Surface Water Samples in Belltown Creek (diverted to Ocoee River) 82

Table 5-4 Maximum Concentrations for Sediment Samples in OU3 83

Table 5-5 Maximum Concentrations for Sediment Pore Water Samples in OU3 84

Table 5-6 ummary of Daily Mass Loads in Surface Water in OU3 85

Table 7-1 Chemicals of Potential Concern in Davis Mill Creek 85

Table 7-2 Summary of HHRA Exposure Scenarios to Sediment and Surface Water 86

(Ingestion and Dermal Contact) 86

Table 7-3 Summary of HHRA Risks from Exposure to Surface Water and Sediment 87

Table 7-4 Media Concentrations Protective of Human Health (Remedial Goal Options) 87

Table 7-5 Summary of Final Ecological Chemicals of Potential Concern 88

Table 7-6 Concentrations Protective of Ecological Receptors 89

Table 8-1 Remedial Goals for Surface Water and Sediment in OU3 90

Table 8-2 Remedial Goals for Surface Water and Sediment Discharging Directly into the Ocoee River 91

Table 12-1 Comparison of Capital and O&M Costs and Components Between Lowest Cost Alternative and the Selected Remedy 91

Table 12-2 Capital Cost Estimate Summary for the Selected Alternative 92

Table 12-3 O&M Cost Estimate and Present Worth Summary for the Selected Alternative DMC-4 93

Table 13-1 Chemical-Specific ARARs, Copper Basin Mining District Site - OU3 94

Table 13-2 Action-Specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3 98

Table 13-3 Location-Specific ARARs/TBCs, Copper Basin Mining District Site - OU3 108

Table 13-4 Matrix of Cost and Effectiveness Data 109

FIGURES 111

Figure 1 Site Location Map showing Copper Basin Operable Units F-1
Figure 2 Operable Unit 3, Davis Mill Creek Collection and Treatment System F-2
Figure 3 Features of the Davis Mill Creek Watershed F-3
Figure 4 Historic Positions of the Davis Mill Creek Channel F-4
Figure 5 Conceptual Site Model for OU3 ..... F-5
Figure 6 Photo of the North Potato Creek Diversion Tunnel Outlet F-6
Figure 7 Photo of Upper Davis Mill Creek at the Mudflat Slag Pile F-7
Figure 8 Components of Alternative DMC-1 ..... F-8
Figure 9 Components of Alternative DMC-2 ..... F-9
Figure 10 Components of Alternative DMC-3 ..... F-10
Figure 11 Components of Alternative DMC-4 ..... F-11

Responsiveness Summary 112

Appendices

Appendix A DMC Removed from Waters of the U.S. – EPA & State
Appendix B Proposed Plan Fact Sheet, OU3 Davis Mill Creek Collection and Treatment System
Appendix C Comments on the Proposed Plan
Appendix D Transcript of July 19, 2012 Public Meeting
Appendix E State of Tennessee Concurrence with Selected Remedy

Acronyms

ac-ft/yr	acre-foot per year
ALM	Adult Lead Methodology
AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
ave	average
BaP	Benzo(a)pyrene
BaP_{EQ}	Benzo(a)pyrene equivalents
BMP	Best management practice
BWSC	Barge Waggoner Sumner & Cannon
Ca	Calcium
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFWWTP	Cantrell Flats wastewater treatment plant
COC	Chemical of concern
COPC	Chemical of potential concern
CRA	Conestoga-Rovers & Associates
CRT	Current recreational trespasser
CSF	Cancer slope factor
CSM	Conceptual site model
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
diss	dissolved
DMA	N,N-dimethylaniline
DMC	Davis Mill Creek
DOT	Department of Transportation
Eco-SSL	Ecological soil screening levels
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
°F	degrees Fahrenheit
FFS	Focused feasibility study
FIW	Future industrial worker
FR	Federal Register
FRT	Future recreational trespasser
FS	Feasibility study
gpm	gallons per minute

GSH	Glenn Springs Holdings, Inc.
HDPE	High density polyethylene
HHRA	Human health risk assessment
HI	Hazard index
HMW-PAH	High molecular weight polycyclic aromatic hydrocarbon
HMR	Hazardous materials regulations
HMTA	Hazardous Materials Transportation Act
hp	horsepower
HQ	Hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
K	Potassium
lb/day	pounds per day
LOAEL	Lowest observed adverse effect level
µg/L	micrograms per liter
µm	micron
M	Million
max	maximum
Mg	Magnesium
mg/kg	milligram per kilogram
mg/L	milligrams per liter
Mgal	million gallons
MNR	Monitored natural recovery
MOU	Memorandum of Understanding
Na	Sodium
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	No observed adverse effect level
No.	number
NPC	North Potato Creek
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	parts per million
RAOs	Remedial action objectives
RCRA	Resource Conservation Recovery Act
RfD	Reference dose
RGs	Remediation goals
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
RM	River mile
ROD	Record of Decision
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act

SOW	Statement of work
s.u.	standard units
TAP	Technical Assistance Plan
TBC	To be considered
TCA	Tennessee Code Annotated
TCC	Tennessee Chemical Corporation
TDEC	Tennessee Department of Environment and Conservation
TMV	Toxicity, mobility, and volume
TRV	Toxicity reference value
TVA	Tennessee Valley Authority
UCL	Upper confidence limit
UCL95	95 Percent upper confidence limit
UIC	Underground injection control
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDW	Underground source of drinking water
UTS	Universal treatment system
WEFH	Wildlife Exposure Factors Handbook
WTP	Water treatment plant
WWTU	Wastewater treatment unit
yr	year

Part 2

Decision Summary

1.0 Site Name, Location, and Description

This Record of Decision is for OU3, the Davis Mill Creek Collection and Treatment System, which is part of the Copper Basin Mining District Site (Site), in southeastern Polk County, Tennessee (CERCLIS ID #TN0001890839). The Site is not listed on the National Priorities List, but is being addressed as a Superfund Alternative Site. EPA is the lead agency for the cleanup of OU3 and the State of Tennessee is the support agency.

The Copper Basin Mining District Site, located within the Blue Ridge physiographic province, encompasses an area of about 50 square miles adjacent to the towns of Copperhill and Ducktown, Tennessee. It comprises portions of the watersheds of North Potato Creek and Davis Mill Creek and a 26-mile-long reach of the Ocoee River (Figure 1). Mining, beneficiation, chemical manufacturing, and waste disposal occurred in the two creek watersheds and the Ocoee River was the receiving water for wastes and erosion from these watersheds. The Site is divided into five operable units (OU): OU1 – North Potato Creek Watershed; OU2 – North Potato Creek Removal Action; OU3 – Davis Mill Creek Collection and Treatment System; OU4 – Davis Mill Creek Watershed; OU5 – Ocoee River.

EPA designated two OUs in the Davis Mill Creek watershed (Figure 1). Operable Unit 3, the Davis Mill Creek Collection and Treatment System, comprises surface water, sediment, and sediment pore water contained within the bed of Davis Mill Creek (DMC) from its origin at the Headwaters iron calcine pile downstream to and including Dam No. 5. It includes portions of the Gypsum Ponds tributary, West Drainage Channel, Belltown Creek channel, and other seepage and discharge areas, as well as the Cantrell Flats water treatment plant, five storm water retention dams along DMC, the Belltown Creek diversion dam, the Belltown and Gypsum Ponds diversion pipelines and their rights of way, and the Dam No. 5 pump station. Operable Unit 4, the Davis Mill Creek Watershed, comprises all upland areas of the watershed to the site boundary including waste and by-product piles and the Copperhill industrial site (the industrial site consists of the Copperhill plant site and the Cantrell Flats plant site, which are separated by Davis Mill Creek). Operable Unit 3 is completely enclosed within OU4 except for the point where the diversion pipeline discharges to the Ocoee River (OU5).

Most land in the Copper Basin Mining District Site is owned privately or held by a trustee; the portion of the Site within the DMC watershed is owned by Intertrade Holdings, Inc. Large portions of the DMC watershed are fenced, locked gates are present at road and rail access points, physical barriers and posted no trespassing signs are used to discourage trespassers along off-road trails in remote portions of the Site, and active security patrols are maintained during the week and weekends. Unstable mine workings associated with the historic Polk County and Mary mines have been fenced to prevent ingress to these areas.

Copper Basin OU3 is located on property owned by Intertrade Holdings, Inc., about 0.5 miles northwest of Copperhill, Tennessee. It consists of two main parts (Figure 2):

- The Davis Mill Creek collection and conveyance system, which includes clean water diversions; and
- The Cantrell Flats water treatment plant.

Davis Mill Creek Collection and Conveyance System. The DMC collection and conveyance system was constructed through interim removal actions conducted under the 1990 Agreement and Covenant Not to Sue and Administrative Orders on Consent (AOC) CERCLA Docket Nos. 01-12-C and CER-04-2003-3521 (Sections 2.2 and 2.3). The intent of these actions was to capture contaminated water and sediment in the DMC watershed and to treat these media in the existing upgraded Cantrell Flats treatment plant (treatment system) to prevent their continued migration to and degradation of Ocoee River resources.

The collection and conveyance system utilizes the existing stream channel to collect and convey contaminants downstream to a point where they can be diverted into the treatment system. Engineering solutions are used to maximize treatment capability by diverting clean water from the channel and retaining storm runoff up to the 10-year, 24-hour storm so that it can be sent through the treatment system.

The historic headwaters of DMC were impounded to form the Gypsum Ponds (OU4) in 1972. Consequently, present-day DMC originates as spring discharge of a few gallons per minute (gpm) from beneath the Headwaters iron calcine pile. The OU3 channel collects seepage and runoff from OU4 as it flows about 7,000 feet until it enters the first of four storm water retention structures which combined have the capacity to retain nearly 190 acre-feet of storm water. Additional runoff, seepage, and contaminated inflows are collected by the channel as it flows through and below these impoundments. A few hundred feet upstream of the Ocoee River, the channel is impounded by Dam No. 5. The entire flow of the channel at this point (typical base flow of 1,000 to 2,100 gpm) is routed to the Cantrell Flats water treatment plant by the Dam No. 5 pump station.

The Belltown Creek diversion pipeline contains and routes clean water through OU3 to prevent its contamination. In 2005, the flow of the Belltown Creek tributary, up to the 10-year, 24-hour storm, was captured at the upstream end of the Site and diverted to a point below Dam No. 3; the diversion was extended to the Ocoee River in 2009. Included in this diversion are flow from the Gypsum Ponds and storm water flow exceeding 500 gallons per minute from the West Drainage Channel. Water from the Gypsum Ponds (OU4) is gravity-fed through a pipeline to a point behind the Belltown Creek diversion dam. This dam diverts the base flow of Belltown Creek into a 20-inch-diameter high density polyethylene (HDPE) pipe and storm flow up to the 10-year, 24-hour storm into a 63-inch-diameter HDPE pipe that follows DMC. At Retention Dam No. 3, the pipes are joined into a single 72-inch-diameter acid-resistant concrete pipe which passes through Retention Dam No. 4 and continues along the creek until reaching the West Drainage Channel. At this point, the pipe increases to 84 inches in diameter. This pipe passes through Dam No. 5 and discharges to the Ocoee River at River Mile 36.9. The pipelines and their rights of way are included within OU3; the water encapsulated within the pipelines is not.

Cantrell Flats Water Treatment Plant. The Cantrell Flats water treatment plant was constructed in 1974 and was most recently refurbished in 2001-2002 under AOC Docket No. 01-12-C. Untreated water from various sources is held in a 2 million gallon, HDPE-lined surge pond and fed to the plant by gravity. Operating in batch mode, lime slurry is added to the water in a reaction tank to remove metals and neutralize acidity. Metal-rich sludge is separated from the treated water in clarifiers and pumped into underground stopes of the Calloway Mine for disposal in accordance with the provisions of Underground Injection Control (UIC) Permit 83-12 issued to Intertrade Holdings, Inc. by the State of Tennessee; overflow water from the mine is pumped back into the treatment system. Treated water is discharged to the Ocoee River through Outfall 009, immediately downstream of the DMC confluence in accordance with the provisions of National Pollutant Discharge Elimination System (NPDES) Permit No. TN0002411, issued to Intertrade Holdings, Inc. by the State of Tennessee in April, 2012. The permit imposes effluent limits for pH and several metals that are intended to be protective of aquatic life in the river downstream of a mixing zone.

The Cantrell Flats plant treats water from two main sources. Water from DMC and the West Drainage Channel (OU3) is treated by Glenn Springs Holdings, Inc. (GSH) in accordance with AOC Docket No. 01-12-C; treatment is conducted by Intertrade Holdings, Inc. via subcontract. Storm water from industrial portions of the Copperhill plant site (OU4) is treated by Intertrade Holdings, Inc. in accordance with the 1990 Agreement and Covenant Not to Sue.

2.0 Site History and Enforcement Activities

2.1 Site History

Mining and smelting began at the Site in the 1840s and 1850s. For many years, a variety of small operators simultaneously worked portions of the Site. From 1963 until 1982, Cities Service Company, its corporate predecessors and related entities operated at the Site (EPA, 2001a). Cities Service Company sold the mines, mills, smelting operations, and acid production plants to Tennessee Chemical Company in 1982. Mining ceased at the Site in 1987 and Tennessee Chemical Company declared bankruptcy in 1989. Chemical production continued under other corporate entities until ending in June 2008.

Three underground mines (Polk County, Mary, and Calloway) were intermittently active in the DMC watershed (OU4) from 1852 to 1983 (Figure 3). Ore processing occurred at several locations in the watershed including the Polk County Mine area, Cartertown roast yard, Copperhill industrial plant area, and Cantrell Flats industrial plant area. Open roasting of ore occurred near the Polk County Mine (1860 to 1871) and at the Cartertown roast yard (1891 to 1903). Ore smelting occurred at the Polk County Mine (1860 to 1871; 1896 to 1899), Copperhill industrial plant (1901 to 1972), and Cantrell Flats industrial plant (1972 to 1987). Copper was originally smelted from crushed ore; milled sulfide concentrates were smelted starting in 1922. Prior to 1919, all slag produced by smelting was disposed of by pouring molten slag onto the ground surface near the smelter buildings (pot slag), eventually filling in topographic depressions and creating cliffs of high relief. Beginning in 1919, slag was granulated by quenching with water; granulated slag was hauled by rail and disposed of in upland portions of the watershed. All slag was granulated after 1948.

Iron roasting of milled sulfide concentrate took place at the Copperhill (1925 to 1972) and Cantrell Flats (1972 to 1987) industrial plants in the lower part of the DMC watershed (OU4). Iron calcine produced by roasting iron concentrate was sintered or pelletized for sale, or stockpiled in the watershed for future sale. Iron calcine produced for sintering contained 7 to 10 percent residual sulfur and is referred to as high-sulfur iron calcine. Calcine produced for pelletizing contained less than 1 percent residual sulfur and is termed low-sulfur iron calcine. A high-sulfur iron calcine settling pond was located in OU4on the banks of DMC; historically, this pond was periodically cleaned by flushing the calcine into the DMC channel.

Sulfuric acid, created from sulfur dioxide exhaust gases from the copper smelters, iron roasters, and sulfur burners, was produced on the Copperhill plant site (OU4). Two technologies were employed: lead chamber acid plants (1907 to 1964) and contact acid plants (1942 to 2000). As many as two chamber acid plants and five contact acid plants plus two acid concentrator plants operated at the site. These plants produced varying grades of sulfuric acid and oleum. Wastewater from one or more of these plants was discharged to DMC; the amounts discharged are unknown.

Chemical manufacturing, which increased in diversity over time, took place on the Copperhill plant site. In addition to sulfuric acid, oleum, and iron oxide (as sinter or pellets), a variety of

other products were manufactured including shot copper, copper sulfate (1922 to 1993), ferric sulfate (1959 to 1996), copper fungicides (1937 to 1993), sulfonated organic compounds (1952 to 2008), liquid sulfur dioxide, sulfur trioxide (1963 to early 1990s), sodium hydrosulfite, and zinc oxide (1956 to 1971), among others. Wastewater from one or more of these plants is believed to have been discharged historically to DMC, although this has not been confirmed; the amounts discharged are unknown.

Rail lines connected the industrial plants to other parts of the Basin and to main transport lines out of the Basin. Rails extending the length of the DMC watershed (OU4) carried ore, sulfide mineral concentrate, slag, iron calcine, coal, coke, sulfuric acid, and various other products and materials. Waste materials, particularly granulated slag and fragmented pot slag, were used along the rail grades as ballast and structural fill material. Erosion and runoff from the rail grades flows to OU3.

Waste and by-product materials were placed above-ground throughout the DMC watershed (OU4). Mining, beneficiation, and processing wastes include pot slag, granulated slag, iron calcine, waste rock, acid tank sludge, water treatment sludge, and other materials that mostly were deposited directly atop the existing ground surface. Pot slag was poured near the Copperhill smelter and a small historic smelter near the Polk County Mine. Granulated slag, iron calcine, and sulfide concentrate were disposed of in dedicated piles primarily in the upper part of the watershed and on Carroll Hill in the lower watershed. Wastes such as granulated slag, waste rock, and crushed pot slag also were placed along rail lines throughout the drainage. Water treatment plant sludge was disposed of in a series of impoundments in the upper DMC watershed (Gypsum Ponds). Other wastes listed above are found locally throughout the area. By-products, primarily low-sulfur iron calcine and subordinate high-sulfur iron calcine and sulfide concentrate are found in dedicated stockpiles in the central and upper parts of the watershed; low-sulfur calcine presently is being excavated and recycled. Debris from the demolition of outdated facilities, such as lead chamber acid plants, also was dumped in the watershed, often mixed with other mining and processing wastes. Together, the volume of solid waste and by-product materials disposed of above ground in the watershed was estimated at 9.7 million cubic yards (SAIC, 2002a); subsequent work to define the volume of low-sulfur iron calcine indicates that more than 10 million cubic yards of wastes and by-products are present. In addition to these materials, an unknown volume of waste rock and mill tailings (from the London Mill in the North Potato Creek watershed) were backfilled into underground stopes of the Calloway Mine. Water treatment sludge from the Cantrell Flats plant has been disposed of in the Calloway Mine stopes since 2002.

Although waste and by-product materials were placed in OU4, in several locations, such as the Mudflats slag pile, Headwaters iron calcine pile, and Calloway B mine area, these piles form the banks of DMC. In these and other areas, wastes eroded into OU3 and can be found within the substrate sediment of the operable unit. In other cases, such as the iron calcine settling pond described above, waste materials were intentionally flushed into OU3 as part of maintenance operations. Migration of these materials to the Ocoee River is currently prevented by a series of five dams including Dam No. 5 at the downstream end of OU3.

Timbering and open roasting of ore in the late-1800s caused the Copper Basin area to become nearly devoid of vegetation. The ensuing soil erosion, which deposited large amounts of sediment in the creek channel, changed the character and position of DMC. The history of the creek is described in more detail in Section 2.1.1.

Revegetation of the denuded and impacted portions of the Copper Basin began in 1930 through the cooperative efforts of the mining companies, the U.S. Forest Service, Tennessee Valley Authority (TVA), and several other entities. The results of these attempts were largely ineffective in the first 40 years. However, efforts accelerated in the early 1970s, with greater success. TVA stepped up its tree planting program in 1984, motivated by concerns about continued sedimentation in their reservoirs on the Ocoee River. Revegetation of the Davis Mill Creek watershed was required by Task 2 of the Scope of Work attached to the 1990 Agreement and Covenant Not to Sue and for other portions of the Copper Basin by Task 5 of the 1990 Agreement. GSH has continued revegetating portions of the Site to the present day.

2.1.1 History and Designation of Davis Mill Creek

For over 150 years, wastes from the mining, processing, and chemical operations in the Copper Basin were placed in, on, and around DMC and its watershed. During that time, the original DMC channel locally was filled with wastes and the drainage altered and moved to various upland locations. As a result, DMC was transformed from a stream to an industrial disposal area and conveyance providing drainage for industrial wastes and wastewaters. The flow path of the former stream was subsequently modified by dams and impoundments constructed to reduce the amount of pollutants leaving the area and entering the Ocoee River.

Historic changes in the position of the DMC channel are shown in Figure 4. Modification of lower Davis Mill Creek began in the late 1800s as severe erosion from denuded upland areas deposited significant amounts of sediment in the lower reach. After smelting began at Copperhill in 1902, pot slag was poured along the eastern bank of the creek, eventually filling in a small tributary drainage beneath the present rail shops and forming a cliff of slag along the left bank which displaced the stream from its original location. As the Copperhill industrial plant grew in size and scope, it was common for discharges from facilities such as the lead chamber acid plants and iron roasters to be routed to the creek. In 1916, lawsuits were brought against the mining companies by the Tennessee Electric Power Company for acidic corrosion to Ocoee River hydro-electric plant turbines. An agreement was made to limit acidity in DMC to 1,000 parts per million (ppm) and the Tennessee Copper Company built the first neutralization plant at Copperhill to neutralize acidic wastewaters. In 1924, the Tennessee Copper Company agreed to further limit the acidity of DMC to 500 ppm. With time, mining and processing wastes, and by-products including granulated slag, iron calcine, sulfide mineral concentrate, demolition debris, and other materials, were disposed of or stockpiled on the banks of the creek throughout the upper portions of the drainage. These piles caused the position of the creek channel to shift as they encroached on or eroded into the stream bed. In addition, production shafts for the Calloway mine were constructed adjacent to the creek in the 1940s and 1950s. In the early 1970s, the original headwaters of DMC were impounded to form the Gypsum Ponds, where sludge from the Cantrell Flats water treatment plant and treated iron calcine and other wastes

from the Cantrell Flats industrial operations were disposed. After that time, the flow of DMC originated from one or two springs that discharged in the area of the Headwaters high-sulfur iron calcine pile, which was placed over a few years beginning in 1969. These springs, designated as "Copper Spring" on historic maps, became buried beneath the high-sulfur iron calcine material sometime in 1983 or 1984. Burial of the spring caused water quality in the creek to degrade significantly from increased concentrations of acidity, sulfate, and iron.

Anecdotal reports indicate that instream treatment by direct application of lime to the creek was used to control the amount of acidity released to the Ocoee River during plant operations. In 1974, the Tennessee Water Quality Control board classified DMC as a "wastewater stream," implying that the creek consisted primarily of industrial discharge. An NPDES permit issued in 1983 defined DMC where it meets the Ocoee River as an effluent outfall.

Despite the creek's historical use, sometime before 2000, the State of Tennessee promulgated designated beneficial uses for Davis Mill Creek and its tributaries under the Clean Water Act that included industrial water supply, fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. In addition, the State placed DMC on its list of impaired waters for not supporting these beneficial uses due to contamination by metals, siltation, and pH arising from waste storage, abandoned mining, and storage tank leaks (TDEC, 2004).

Recognizing the past history of DMC and its previous classification as a wastewater stream, EPA and the Tennessee Department of Environment and Conservation (TDEC) reviewed the status of the creek to determine whether it should be included as "Waters of the United States." On July 24, 2007, James Giattina, Director, Water Management Division, U.S. EPA Region 4 issued a letter to Paul Davis, Director, TDEC Division of Water Pollution, stating that, "In conclusion, based on the above history, EPA believes Davis Mill Creek is not a Waters of the United States for purposes of the Clean Water Act". The portion of Davis Mill Creek comprising OU3, therefore, is not considered jurisdictional Waters of the United States under the Clean Water Act (EPA, 2007; see Appendix A for a copy of the letter and the rationale behind this decision and a clarification by TDEC).

Pursuant to AOC Docket No. CER-04-2003-3521 as amended, the Belltown Creek and Gypsum Ponds tributaries of DMC were captured and routed via pipe to the Ocoee River so that these clean waters bypass the industrial waste disposal area (Section 2.2.3). TDEC has determined that Belltown Creek and the Gypsum Ponds tributaries remain jurisdictional waters in their respective reaches upstream of their capture and conveyance via pipe to the Ocoee River. The area defined as OU3 in Section 1.0 includes those portions of DMC and its tributaries that are removed from jurisdictional Waters of the United States. Portions of the stream that remain as jurisdictional waters are included in OU4.

2.2 Regulatory and Enforcement History

The complex regulatory history of the DMC watershed is described in some detail in the 2012 remedial investigation (RI) report (BWSC, 2012a). For the purposes of this Record of Decision,

the regulatory history of the watershed is reviewed beginning with the bankruptcy of Tennessee Chemical Corporation (TCC) in April 1989.

2.2.1 1990 Agreement and Covenant Not to Sue

In March 1990, Boliden Intertrade, A.G., TCC Holding S.A., and TCC Acquisition, Inc. (collectively referred to herein as "Boliden") entered into an Interim Agreement and Covenant Not to Sue with the United States and State of Tennessee. Thereafter, Boliden began operating the chemical manufacturing facility at Copperhill (U.S., Tennessee, and Boliden, 1990). Boliden collected and treated wastewater from inactive mining and ore processing operations pursuant to a NPDES permit; collected and treated water from a tailings pond in the North Potato Creek watershed; and funded a reforestation program in the Basin. Boliden subsequently petitioned to purchase the Copperhill industrial site and other TCC property in the DMC watershed from the bankruptcy trustee of the TCC estate. This transaction, which included the areas subsequently designated as Copper Basin OU3 and OU4, led to an Agreement and Covenant Not to Sue executed by the three parties on September 20, 1990 (U.S., Tennessee, and Boliden, 1990). In the Agreement and Covenant Not to Sue, Boliden agreed to undertake a series of response actions in the DMC watershed and other portions of the TCC property; actions pertaining to OU3 are described in detail in Section 2.3.1. The Agreement and Covenant Not to Sue remains in effect between EPA, the State of Tennessee and Intertrade Holdings, Inc., as a successor corporation of Boliden. The Agreement and Covenant Not to Sue remains the guiding legal authority for the ongoing recycling operations in OU4.

2.2.2 2001 Agreements

In early 2001, EPA, TDEC and OXY USA Inc. (through their affiliate GSH) reached agreements that collectively were intended to lead to the characterization and remediation of contaminated areas of the Copper Basin. A Memorandum of Understanding (MOU) between EPA, TDEC, and OXY USA Inc. was signed on January 11, 2001 (OXY USA, TDEC, and EPA, 2001). The MOU described the overall intent of the parties. As part of the MOU, EPA agreed to conduct remedial investigation/feasibility study (RI/FS) activities in the DMC watershed. Pursuant to the MOU, EPA and OXY USA Inc. and its affiliate GSH initially entered into three Administrative Orders on Consent (Settlement Agreement) (EPA, 2001a; 2001b; 2001c). Under the Settlement Agreement, GSH would conduct actions in the North Potato Creek and Davis Mill Creek watersheds that are described briefly below and in more detail in Section 2.3.2.

Under AOC Docket No. 01-11-C (EPA, 2001a), GSH constructed a water treatment plant in the lower North Potato Creek (NPC) watershed. In January 2005, this plant began treating the entire flow of NPC before it reached the Ocoee River. This plant also was configured to treat all contaminated waters collected in the NPC watershed. Pursuant to AOC Docket No. 01-12-C (EPA, 2001b), GSH refurbished the Cantrell Flats water treatment plant, located in the DMC watershed (see Section 2.3.2). In November 2002, the plant began treating the base flow of DMC prior to its discharge to the Ocoee River. Under AOC Docket No. 01-13-C (EPA, 2001c), OXY USA Inc. and GSH agreed to establish and fund a Special Account for partial repayment of costs incurred by EPA to conduct RI/FS actions in the DMC watershed.

In addition, to the EPA Orders, TDEC, OXY USA Inc. and GSH entered into a Commissioner's Order under which GSH would study and implement removal actions in other portions of the NPC watershed under TDEC's Voluntary Cleanup, Oversight, and Assistance Program (TDEC, 2001).

2.2.3 Administrative Orders on Consent

Five Administrative Orders on Consent have been issued by EPA for the Davis Mill Creek watershed. Actions taken under these Orders are described in Section 2.3.2. The Settlement Agreements are:

- Administrative Order on Consent for Removal Action at Davis Mill Creek, CERCLA Docket No. 01-12-C (EPA, 2001b; amended 2003a).
- Administrative Order on Consent for Partial Payment of Response Costs, CERCLA Docket No. 01-13-C (EPA, 2001c; amended 2003b).
- Administrative Order on Consent for Removal Action at the Davis Mill Creek Watershed, CERCLA Docket No. CER-04-2003-3521 (EPA, 2003c, amended 2008).
- Administrative Order on Consent for Removal Action in the Davis Mill Creek Watershed, CERCLA Docket No. CER-04-2005-3756 (EPA, 2004).
- Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study for Davis Mill Creek, CERCLA Docket No. 04-2005-3785 (EPA, 2005a).

AOC Docket No. 01-12-C. Under this Settlement Agreement, OXY USA Inc. and GSH agreed to, among other provisions, refurbish, operate, and maintain the Cantrell Flats water treatment plant up to its design capacity and to divert the Belltown Creek tributary of DMC and flow from the Gypsum Ponds up to the 10-year, 24-hour storm to the Ocoee River. The Settlement Agreement was amended in 2003 to change the discharge point for Belltown Creek/Gypsum Ponds diversion to a point below Dam No. 3 in Davis Mill Creek and to monitor water quality in the creek from the diversion discharge point to the Ocoee River for a period of one year. This Settlement Agreement applies to OU3.

AOC Docket No. 01-13-C. Under this Settlement Agreement, OXY USA Inc. and GSH agreed to, among other provisions, establish a special account to partially fund RI/FS investigations in the DMC watershed that would be conducted by EPA. The Settlement Agreement also provided for the review and comment by OXY USA Inc. on draft statements of work and major technical documents. It was amended in 2003 to allow EPA to use the full fund amount on the DMC watershed RI/FS activities. This Settlement Agreement applies to OU3 and OU4.

AOC Docket No. CER-04-2003-3521. This Settlement Agreement followed completion of EPA's 2003 RI and Focused FS for lower DMC (SAIC, 2003a; 2003b). Under this Settlement Agreement, OXY USA Inc. and GSH agreed to, among other provisions, implement a modified version of Alternative 5 of the 2003 Focused FS for lower DMC. After evaluating the results of

the water quality monitoring program required under amended AOC Docket No. 01-12-C, this Settlement Agreement was amended in 2008 to implement certain specific components of Alternative 4 of the Focused FS. This Settlement Agreement applies to OU3.

AOC Docket No. CER-04-2005-3756. This Settlement Agreement followed completion of the Engineering Evaluation/Cost Analysis (EE/CA) for remediation of the Apache Blast slag area of lower DMC (SAIC, 2004c). Under this Settlement Agreement, OXY USA Inc. and GSH agreed to, among other provisions, perform the removal action pursuant to the Action Memorandum dated September 27, 2004 (i.e., perform Alternative 3 of the EE/CA). This Settlement Agreement applies to OU4.

AOC Docket No. 04-2005-3785. Under this Settlement Agreement, OXY USA Inc. and GSH agreed to, among other provisions, conduct RI/FS and risk assessment investigations in the DMC watershed in accordance with an attached work plan. In addition, the parties agreed to a method for payment of any future response and oversight costs incurred by EPA with respect to the Settlement Agreement. Under the terms of this Settlement Agreement, GSH conducted sampling and analysis of various environmental media in the DMC watershed, assessed risk to human and ecological receptors, prepared RI and FS reports (BWSC, 2012a; 2012b). This Settlement Agreement applies to OU3 and OU4.

2.3 History of Removal Actions in the Davis Mill Creek Watershed

2.3.1 Actions under the Agreement and Covenant Not to Sue

A Statement of Work specifying a series of actions required of Boliden Intertrade and its successor firms was incorporated into the 1990 Agreement and Covenant Not to Sue (U.S., Tennessee, and Boliden, 1990). The Statement of Work was divided into seven tasks, each with one or more subtasks. The seven tasks are:

- Task 1. Davis Mill Creek Drainage Basin
- Task 2. Reforesting of the Davis Mill Creek Watershed
- Task 3. North Potato Creek Drainage Basin
- Task 4. Remediation of the Main TCC Manufacturing Area
- Task 5. Voluntary Reforestation
- Task 6. Other Operations
- Task 7. Gypsum Ponds

Table 1-1 shows each of the tasks and subtasks required of Boliden and its successor corporations in the DMC watershed and other portions of the former TCC property including the Copperhill industrial plant area; tasks not involving the DMC watershed are not shown. The table also shows the status of each task and subtask at the time this ROD was prepared.

In general, tasks identified in the Agreement and Covenant Not to Sue were aimed at reducing and controlling erosion from the DMC watershed, reducing contaminant transport to the Ocoee River, closing the Gypsum Ponds, and cleaning up local areas of hydrocarbon and N,N-dimethylaniline (DMA) contamination on the Copperhill industrial plant area.

Actions to reduce or control erosion included reforesting barren or sparsely vegetated upland areas; grading, covering, and vegetating barren waste piles in the watershed; employing best management practices to limit erosion from areas where waste and by-product materials are being reclaimed; and installing three sedimentation traps on Davis Mill Creek. Importantly, these requirements, including those to reforest the watershed (Task 2) and to grade, cover, and vegetate barren waste piles (Task 6), extend to the Copperhill industrial complex and the entirety of the upland area of the watershed that was previously owned by TCC. This includes all significant waste piles, disposal areas, and by-product stockpiles, including but not limited to Carroll Hill, the low-sulfur iron calcine stockpiles, the Mudflats and Cartertown granulated slag piles, the Headwaters high-sulfur iron calcine stockpile, the Calloway A and B mine area, the Calloway concentrate stockpile, and the Gypsum Ponds (Figure 3). These areas are within Copper Basin OU4 and have been identified as potential sources to OU3. Between 1994 and 1999, vegetated soil covers were placed over portions of Carroll Hill, the low-sulfur iron calcine stockpiles, the Cartertown slag pile, the Headwaters high-sulfur iron calcine stockpile, the Calloway concentrate pile, and portions of the Gypsum Ponds. These covers successfully halted erosion and transport of sediment and wastes from these piles by wind and water.

Actions to reduce contaminant transport to the Ocoee River included capture and treatment of all storm runoff from the Copperhill industrial area, capture and treatment of the East Acid Branch (a small stream discharging directly to the Ocoee River), separation and diversion of the base flow and storm flows of upper DMC and Belltown Creek to the Ocoee River, and treatment of the base flow of Davis Mill Creek in the Cantrell Flats water treatment plant at a point above sediment Dam No. 3. Water treated by the Cantrell Flats plant (which included creek water, storm runoff, and industrial process wastewater) was discharged to the Ocoee River in accordance with effluent limits established by an NPDES permit. These requirements led to the construction of five lined storm water collection ponds in lower DMC (completed in 1993 with a total capacity of 11.1 million gallons, these ponds are located in and capture runoff from OU4) and three sediment retention ponds on Davis Mill Creek (Dam No. 1, 2, and 3 completed in 1995). In addition, the Cantrell Flats water treatment plant was configured to treat water from DMC, the storm water runoff collection system, and wastewater from industrial operations.

2.3.2 Actions Pursuant to Administrative Orders on Consent

AOC Docket No. 01-12-C. Under this Settlement Agreement (as amended), OXY USA Inc. and GSH refurbished the Cantrell Flats water treatment plant and began treating the base flow of Davis Mill Creek in November 2002. As part of the refurbishment, underflow from the treatment system was piped to the Calloway Mine for disposal, and a recycle system was constructed to permit water to be decanted from the mine and recirculated to the treatment system. In addition, GSH constructed a new diversion dam on Belltown Creek at a point above its confluence with the main stem of DMC, diverted flow from the Gypsum Ponds to behind the

Belltown Creek dam, and routed storm flow from Belltown Creek and flow from the Gypsum Ponds into a new 63-inch-diameter pipeline that discharged below sediment Dam No. 3. This work was completed in 2003.

AOC Docket No. CER-03-2004-3521. Under this Settlement Agreement (as amended), OXY USA Inc. and GSH reconfigured sediment Dam Nos. 1, 2, and 3 to serve as storm water retention structures. As part of this construction, Dam Nos. 1 and 2 were raised 5 feet in height and sediment behind the dams was excavated and removed to Carroll Hill. This work was completed in 2004. Two new dams were constructed: Dam No. 4 was built as a storm water retention structure downstream from Dam No. 3 and Dam No. 5 was constructed at the lower end of the watershed, upstream from the Ocoee River. A pump station was installed at Dam No. 5 to transport DMC water to the Cantrell Flats water treatment plant. The Dam No. 5 pump station became fully operational in July 2010; Dam No. 4 received a Safe Dams operating permit from the State of Tennessee in November 2011 and detains up to 130 acre-feet of storm water. The Belltown Creek diversion pipe was extended to below Dam No. 5 in 2009. While the base flow of the West Drainage Channel was routed into DMC to permit treatment, storm flows exceeding 500 gpm in the West Drainage Channel were routed to the Belltown Creek diversion pipeline.

AOC Docket No. CER-04-2005-3785. Under this Settlement Agreement, OXY USA Inc. and GSH excavated and removed 47,000 cubic yards of granulated slag and other wastes from the Apache Blast area of lower DMC (OU4) and disposed of this material atop the Mary Mine tailings pile in the North Potato Creek watershed where it was covered and vegetated. The excavated area was graded and seeded. In addition, GSH scarified, limed, and seeded a sediment delta on the north bank of the Ocoee River at the confluence of Davis Mill Creek.

2.3.3 Other Actions

To facilitate recycling of iron calcine and other materials in the watershed, Intertrade Holdings, Inc. reconfigured the Cantrell Flats area in 2005 to serve as a loading area for rail cars. This involved removing concrete foundations from previous industrial facilities, installing rail sidings, and creating a truck dump and rail loading area. In addition, Intertrade Holdings, Inc. constructed a haulage road across Carroll Hill as the main access to the iron calcine stockpiles.

Intertrade Holdings, Inc. installed new fencing around unstable and potentially unstable mine shafts, stopes, and openings associated with the Polk County and Mary Mines to restrict access to these areas in 2006. Intertrade Holdings, Inc. also demolished unused industrial facilities and buildings on site and recycled salvaged materials; demolition and recovery actions are ongoing.

At the time of this ROD, recycling of waste and by-product materials by Intertrade Holdings, Inc. was active or planned for several areas of the DMC watershed in OU4. These include the low-sulfur iron calcine stockpiles, the Headwaters high-sulfur iron calcine stockpile, the Gypsum Ponds, the Mudflats granulated slag area, the sulfide concentrate pile, and pot slag on the Copperhill industrial plant area. Recycling is being done under the authority of and in accordance with the Statement of Work, Task 6 and Additional Requirements of the Agreement and Covenant Not to Sue. Intertrade Holdings, Inc. is required to submit work plans for EPA and TDEC approval for all areas being recycled. Work plans approved by EPA and TDEC

require grading, covering, and vegetating (capping) these areas after recycling operations are completed. All capping activities will be conducted and completed in a manner that protects human health and the environment.

2.4 Investigation History

Investigations have been conducted in the Davis Mill Creek watershed since 1989. These studies, which are part of the Administrative Record file for the Site, describe the types and volumes of wastes and by-product materials within the watershed and provide analytical results for samples of surface and subsurface soil, waste and by-product materials, surface water, sediment, and shallow ground water. The reader is referred to the 2012 Remedial Investigation Report (BWSC, 2012a) for a complete listing of past studies. Studies and reports that form the basis for selecting the remedial action for OU3 include:

- Draft, Installation and Initial Sampling of Surface Water Monitoring Stations on Davis Mill Creek, Copper Basin, Tennessee (SAIC, 2000a)
- Draft, Summary of Results for November 2000 Sampling of Waste, Soil, and Sediment in the Davis Mill Creek Watershed, Copper Basin, Tennessee (SAIC, 2000b)
- Project Management Plan for the Davis Mill Creek Watershed, Copper Basin, Tennessee (SAIC, 2001a)
- Final Hydrologic and Water Quality Analysis in Davis Mill Creek, Evaluation of Stream Flow and Water Quality Data, Copper Basin, Tennessee, January – May 2001 (SAIC, 2001b)
- Revised Draft, Inventory of Solid Mine Wastes, By-product Materials, and Contaminated Areas in the Davis Mill Creek Watershed, Copper Basin, Tennessee (SAIC, 2002a)
- Draft, Design and Implementation of Davis Mill Creek Watershed Source Load Analysis, Copper Basin, Tennessee (SAIC, 2002b)
- Final Phase 1 Remedial Investigation Report for Davis Mill Creek Operable Unit 3-D, Copper Basin, Tennessee (SAIC, 2003a)
- Final Focused Feasibility Study of Potential Interim Actions in Davis Mill Creek Operable Unit 3-D, Copper Basin, Tennessee (SAIC, 2003b)
- Results from Davis Mill Creek Continuous Stream Monitoring Program, August 2002 through July 2003, Copper Basin, Tennessee (SAIC, 2003c)
- Draft, Headwaters Iron Calcine Pile Engineering Evaluation/Cost Analysis, Davis Mill Creek, Copper Basin, Tennessee (SAIC, 2004a)
- Results of Surface Water Sampling in Davis Mill Creek OU 3-D, Summer 2003 (SAIC, 2004b)
- Draft, Diversion Tunnel/French Drain Engineering Evaluation/Cost Analysis, Davis Mill Creek, Copper Basin, Tennessee (SAIC, 2004d)

- Work Plan for Remedial Investigation/Feasibility Study, Davis Mill Creek Surface Water, Copperhill, Tennessee, Revision 2 (BWSC, 2005)
- Report of Water Quality and Substrate Monitoring, Davis Mill Creek Watershed, Copperhill, Tennessee (BWSC, 2006a)
- Report of Supplemental Monitoring in the Headwaters Calcine Pile, Davis Mill Creek Watershed, Copperhill, Tennessee (BWSC, 2006b)
- Report for Remedial Investigation, Davis Mill Creek, Copperhill, Tennessee, Revision 2 (BWSC, 2012a)
- Feasibility Study, Copper Basin OU3, Copperhill, Tennessee (BWSC, 2012b)

2.4.1 Investigations Prior to the 2001 Memorandum of Understanding

Numerous investigations, most of a reconnaissance nature, were completed in the Copper Basin prior to the 2001 Agreements. These studies provided a general understanding of the extent of impacts and the media affected by contamination. Initial reports were prepared prior to the 1990 Agreement and Covenant Not to Sue (NUS, 1989; CRA, 1990). Follow-up studies were conducted by EPA in 1997 (PRC, 1997) and 2000 (EPA, 2000). The first sampling efforts dedicated solely to the DMC watershed were completed on behalf of EPA in late 2000 (SAIC, 2000a; 2000b; 2001b).

2.4.2 2002 Waste Inventory

EPA inventoried solid mine wastes, by-product materials, and contaminated areas throughout the DMC watershed including upland areas and the Copperhill industrial site that are included in OU4 (SAIC, 2002a). The report divided wastes and by-product materials into thirteen general categories, mapped the distribution of these materials, and estimated their volumes. Inventories of areas where granulated slag was being excavated (Carroll Hill) and reprocessed (Mudflats slag pile) in 2002 were updated in technical memoranda prepared in 2004 after slag recycling ceased (SAIC, 2004g; 2004h). The inventory found that four wastes and/or by-products comprised about 90 percent of the estimated 9.7 million cubic yards of material in the watershed: iron calcine, pot slag, granulated slag, and water treatment sludge. These waste and by-product materials, which are contaminant sources to water collected in OU3, are ubiquitous in the upper watershed, occurring on upland areas and stream banks alike.

2.4.3 2003 Remedial Investigation

EPA completed a Remedial Investigation report for lower Davis Mill Creek (Dam No. 3 downstream to the Ocoee River) in 2003 (SAIC, 2003a). The report characterized the area downstream of the intake pumps for the Cantrell Flats water treatment plant (at the time located on the upstream side of Dam No. 3) including surface water and sediment quality in the creek, soil and waste materials adjacent to the creek, seeps and other inflows to the creek, and pore water on the creek banks and contained in stream sediment. Data collected during field sampling were used to determine the nature and extent of contamination in each environmental medium,

evaluate the fate and transport of contaminants through the environment, and assess risks to human and ecological receptors from exposure to contaminants.

2.4.4 2003 Focused Feasibility Study

A Focused Feasibility Study (FFS) of lower DMC was completed by EPA in 2003 (SAIC, 2003b). The FFS addressed contaminant loadings to the Ocoee River from DMC that were identified by the 2003 RI. The Interim Actions envisioned by the FFS would operate in conjunction with treatment of DMC required under AOC Docket No. 01-12-C (Section 2.3.2). The FFS developed and evaluated seven alternatives, including two No Action alternatives. These alternatives were developed by screening a variety of technologies and components that could be used to reduce the flow of contaminants from the watershed to the Ocoee River. The evaluated components are shown in Table 1-2; the reader is referred to SAIC (2003b) for additional information. To support the alternatives analysis, EPA developed and calibrated rainfall-runoff and water surface profile models of the watershed to estimate stream discharge and stage at selected locations for precipitation events of different frequencies and magnitudes. These models are described in detail in Appendix B of SAIC (2003b). The alternatives evaluated mechanisms to capture and treat water flowing in Davis Mill Creek below the Cantrell Flats treatment intakes, increase the capture and treatment of creek water up to the 10-year, 24-hour storm event, and to capture and treat the base flow of the West Drainage Channel, which joins Davis Mill Creek upstream of the Ocoee River. GSH agreed to implement components of these alternatives under AOC Docket No. CER-04-2003-3521 (Section 2.3.2).

2.4.5 Engineering Evaluation/Cost Analysis Reports

EPA completed three EE/CA reports for portions of the DMC watershed (SAIC, 2004a; 2004c; 2004e). Each of these reports presented analytical results for samples from the areas of interest, characterizations of the nature and extent of contamination in the environmental media of interest, assessments of human health and ecological risks, screening of technologies that could be used to address contamination, and evaluations of technical alternatives to reduce risk. These reports were prepared for two discrete by-product piles (Headwaters high-sulfur iron calcine and Calloway sulfide mineral concentrate) and one waste disposal and waste processing area (Apache Blast slag). In addition to the completed reports, data were collected to support two additional EE/CA reports that were not finalized. These partial reports targeted a waste disposal area (Calloway Mine waste rock) and an area of ground water discharge (North Potato Creek diversion tunnel outlet and French drain outlet) (SAIC, 2004d and 2004f). Of the partial and complete EE/CA reports, two provide significant data utilized in this Record of Decision for OU3 and are summarized below.

An EE/CA was completed for the Headwaters high-sulfur iron calcine pile which is located atop "Copper Spring" in the headwaters of DMC (SAIC, 2004a). Although the pile itself is considered part of OU4, seeps emanating from the pile, which has a vegetated soil cap, form the headwaters of DMC. Seepage water entering OU3 has high concentrations of acidity and metals created by the interaction of ground water with the high-sulfur iron calcine material. The EE/CA evaluated five alternatives to address this contaminant source, including No Action, but did not select a preferred alternative for implementation. A work plan to excavate and recycle the high-

sulfur iron calcine was submitted by Intertrade Holdings, Inc. and approved by EPA and the State of Tennessee in 2012.

Data were collected to support an EE/CA for the NPC diversion tunnel outlet and French drain outlet (SAIC, 2004d). These sources, which have high concentrations of metals and acidity, are included within OU3. The NPC diversion tunnel was driven in 1976 to create flood protection for mines in lower North Potato Creek. The tunnel crosses the strike of the mineralized trend that connects the Calloway and Mary/Polk County Mines. The French drain was installed in 1988 and collects water from beneath a stockpile of low-sulfur iron calcine that covers historic waste rock dumps in the area of the drain. Data in SAIC (2004d) provide information on contaminant concentrations and seepage discharge from both sources.

2.4.6 2012 Remedial Investigation

Pursuant to AOC Docket No. 04-2005-3785, GSH agreed to conduct RI/FS activities in the Davis Mill Creek watershed. The Remedial Investigation report, which was finalized in April 2012 (BWSC, 2012a), evaluated conditions in OU3 and certain upland portions of the watershed included in OU4. The purpose of the RI was to characterize sources of contamination, determine the nature and extent of contamination, evaluate contaminant transport mechanisms, and evaluate risks to human health and the environment. The RI included data for surface water, sediment, and interstitial sediment pore water in OU3. Most data were collected while interim actions to construct the collection and conveyance system were ongoing.

Based on results of the remedial investigation, EPA determined that remedial actions likely would be required in specific areas of OU3 and that the existing collection and treatment system would be required to remain in place to protect the Ocoee River.

2.4.7 2012 Feasibility Study

In June 2012, GSH completed a Feasibility Study for OU3 (BWSC, 2012b). The FS developed four alternatives to address residual risk to human and terrestrial wildlife receptors in OU3 including the upper and middle reaches of DMC and the NPC diversion tunnel and French drain outlets. The alternatives were:

- DMC-1 – No Action.
- DMC-2 – Davis Mill Creek Removal Actions.
- DMC-3 – Davis Mill Creek Removal Actions plus Institutional and Engineering Controls.
- DMC-4 – Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls.

The FS evaluated these alternatives against the two threshold and five primary balancing criteria specified by the NCP at 40 CFR §300.430(e)(9)[1]. A comparative analysis of the alternatives was included in Section 6 of the FS.

[1] The two threshold criteria are Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements (ARARs); the five primary balancing criteria are Long-Term Effectiveness and Permanence, Reduction in Toxicity Mobility and Volume through Treatment, Short-term Risk, Implementability, and Cost.

3.0 Community Participation

Under the 2001 Settlement Agreements, as referenced in the MOU, and other agreements thereafter, OXY USA Inc. was required to comply with EPA's community relations plan, provide information to support the plan, and be an active participant in preparing information to disseminate to the public. For the Site, EPA, the State of Tennessee, and GSH formed a partnership and developed a site-specific community relations plan. In accordance with this plan, numerous open houses and public meetings have been held where information has been presented collectively regarding planned and on-going studies and projects. In addition, the partnership publishes a newsletter for the local community describing on-going projects and activities in the Basin. One day each year, GSH provides bus tours for the public of completed and on-going activities at the Site. Pursuant to requirements in the MOU, GSH prepared a Technical Assistance Plan (TAP) and provided $500,000 as a TAP grant for community involvement.

Project documents have been made available to the public in both the administrative record and in the information repositories maintained at the EPA Superfund Record Center in Region 4 offices and at the Ducktown City Hall. The Proposed Plan for the OU3, which is presented as Appendix B, was released to the public for comment on July 9, 2012 (EPA, 2012). Over 500 copies of the Proposed Plan were mailed to officials, citizens, and other interested parties on the project mailing list and a Notice of Availability was published in the *Polk County News* on July 11, 2012 and in the Blue Ridge *News Observer* on July 13, 2012. A public comment period on the Proposed Plan was held from July 13 through August 13, 2012. EPA held a public meeting on July 19, 2012 at the office of GSH in Ducktown to allow nearby residents and interested parties to comment on the documents and the Proposed Plan, and to ask questions of EPA officials. Approximately 28 people attended the meeting; a transcript of the meeting is included as Appendix D.

There were a number of comments and questions during the open house that representatives of EPA responded to during the meeting. EPA received three written comments on the Proposed Plan from members of the public; these comments supported the preferred alternative. A Responsiveness Summary is included as Part 3 of this ROD; comments received are provided in Appendix C.

4.0 Scope and Role of the Response Action

This Record of Decision is for CERCLA Operable Unit 3 (Davis Mill Creek Collection and Treatment System) of the Copper Basin Mining District Site. The OU3 response action will be consistent with the final action selected for the site and with planned actions and remedies in four other OUs. Continuity across the Site is facilitated by regular (bimonthly) meetings between EPA, TDEC, and GSH which have allowed project goals and actions to be coordinated. In addition, all work is conducted in accordance with the governing principles and commitments set forth in the 2001 MOU. The intent of actions in the remaining four OUs is to achieve an overall Site goal of protecting the Ocoee River and remediating the entire Copper Basin Mining District Site.

- OU1 (North Potato Creek Watershed) – This OU is being addressed through the Tennessee Voluntary Oversight and Assistance Program as specified in the 2001 TDEC Commissioner's Order. The goal of actions taken in this OU is to restore North Potato Creek in a manner that will achieve and maintain a performance goal of biological integrity. TDEC will issue a decision document for this OU.
- OU2 (North Potato Creek Non-Time Critical Removal Action) – This OU was the subject of a removal action specified in a 2001 Settlement Agreement (EPA, 2001a). The treatment plant that was constructed and brought on-line in 2005 will be required to meet the substantive requirements of an NPDES permit.
- OU4 (Davis Mill Creek Watershed) – This OU is being addressed under the authority of the 1990 Agreement and Covenant Not to Sue. Under this authority, Intertrade Holdings, Inc. is presently recycling waste and by-product stockpiles that are contaminant sources to OU3. This work is being conducted under work plans approved by EPA and TDEC. EPA will assess residual risk in OU4 at an appropriate time after recycling activities have been completed and determine if further action under CERCLA is needed.
- OU5 (Ocoee River) – This OU was addressed by a Record of Decision issued by EPA in September 2011 (EPA, 2001). The Selected Remedy consists of three separate response actions to address chronic risk from contaminated sediment and surface water in each of three river reaches. The overall approach consists of monitored natural recovery in each river reach. Hydraulic controls will additionally be employed in the Ocoee No. 3 Reservoir, while consistent inundation of a sediment delta additionally will be required in Parksville Reservoir.

The Response Action for OU3 will address risks associated with the chemicals of concern (COCs) in contaminated sediment and contaminated surface water identified in the OU. The Selected Remedy for OU3 is compatible with the planned future use of the Ocoee River and with the anticipated or realized effects of actions taken in other Site OUs. As such, the ROD addresses all impacts to all media and represents the final remedy for OU3.

5.0 Site Characteristics

5.1 Conceptual Site Model

Figure 5 presents a generalized Conceptual Site Model (CSM) for OU3 in its present condition. This model was developed by refining preliminary CSMs using the data and results obtained during the RI. The CSM illustrates how the primary inputs and contaminant sources to OU3, many of which are located in OU4, can potentially affect human, terrestrial wildlife, and semi-aquatic wildlife receptors through their exposure to the primary affected media of surface water and sediment. Although benthic macroinvertebrates and fish receptors are shown on Figure 5, these receptors are not present in OU3 due to decades of acid drainage and metals release. Consequently, there are no complete pathways for aquatic receptors. Importantly, the affected media in OU3 (surface water, sediment, and sediment pore water) are contained and do not flow from the OU to the Ocoee River except under conditions that exceed the 10-year, 24-hour storm. All affected media are stopped at Dam No. 5, where the entire flow of DMC is routed to the Cantrell Flats water treatment plant.

Inputs to OU3 include seepage and runoff from OU4, seepage and ground water flow from the NPC diversion tunnel and French drain outlets, and base flow in the West Drainage Channel (storm flow is routed to the Belltown Creek diversion). Although process waste water is known to have been discharged to OU3 during industrial operations, this input no longer applies and is not shown. Significant contaminant release mechanisms include the oxidation and chemical weathering of mine wastes, by-product materials, and contaminated soil in OU4 and the leaching and dissolution of contaminants from solids by water infiltration. Oxidation of sulfide ore minerals, which are present in varying amounts in a variety of solid wastes and by-products, releases metals, sulfate, and acidity to the environment in aqueous form. These contaminants are transported primarily by surface and ground water flow where they may cycle through secondary geochemical reservoirs such as chemical precipitates (not shown). Contaminants mobilized from source areas in solid form are carried though OU3 as suspended load or bed load in DMC.

5.2 Overview of the Site

The Copperhill area, which has a mean annual temperature of approximately 57°F, receives average annual precipitation of about 60 inches, most of which falls as rain. Mean annual lake evaporation is about 36 inches. Although rainfall is distributed fairly evenly throughout the year, intense rainfall events associated with convective or cyclonic storms are common. Rainfall constituting the 10-year, 24-hour storm event is 5.7 inches.

The watershed lies within the Blue Ridge physiographic province, an area underlain by Precambrian-aged schists and gneisses. Surface exposures, which are rare, are saprolite which forms a thick weathering zone atop competent bedrock. The bedrock is folded along northeast to southwest structural trends. Faulting is common, with most faults trending perpendicular to the fold system. Ore bodies occur within the metamorphosed rock as massive lodes and veins of sulfide minerals along three major trends which parallel the bedrock fold system. Primary ore

minerals include iron sulfides (pyrrhotite and pyrite), copper-iron sulfide (chalcopyrite), and zinc sulfide (sphalerite). Ore mineralization in the DMC watershed occurs near the former Calloway mine and the former Mary-Polk County mine.

Most of the watershed was denuded by timbering and ore processing practices in the early 1900s. The ensuing erosion largely stripped top soil from the watershed; eroded material was deposited in DMC and the Ocoee River. Upland areas of OU4 are now mostly vegetated with pines while several waste disposal areas along the creek and portions of the Copperhill industrial site remain barren to sparsely vegetated.

Unimpacted surface water flowing through this portion of the Blue Ridge province is poorly buffered and has low hardness. These chemical characteristics cause it to be especially susceptible to the effects of acid rock drainage.

5.3 Features of OU3

The Davis Mill Creek watershed drains an area of about 5.2 square miles. From its headwater seeps to its former discharge point at the Ocoee River, DMC flows southward 2.4 miles at an average gradient of 1.2 percent (Figure 3). It is a small stream that varies in width from less than five feet adjacent to the Headwaters iron calcine pile to 20 to 50 feet in its downstream reaches. Base flow discharge of DMC is about 15 cubic feet per second (cfs; equivalent to about 6,750 gpm), of which about 60 percent is diverted directly to the Ocoee River through the Belltown Creek diversion. Typical of many small streams, storm response is swift, with abrupt increases in discharge and velocity common during and shortly after significant rain events.

5.3.1 Historical Changes to Davis Mill Creek

Prior to construction of the collection and treatment system (see Section 5.3.2), DMC was composed of two tributaries. The former main stem of the creek was impounded by the Gypsum Ponds in the early 1970s, while the second tributary originated as seeps that now emanate from beneath the Headwaters iron calcine pile. These branches combined upstream of the Calloway B mine shaft (Figure 3). Belltown Creek, which is a significant tributary, joined DMC from the east downstream of the Calloway B mine (Figure 3), while the West Drainage Channel provided additional perennial flow to lower DMC from the west. Although DMC gains flow from ground water discharge along much of its length, there are no other natural tributaries presently contributing flow to the creek. Springs and seeps enter DMC from beneath the Headwaters iron calcine pile, on the west bank at the Mudflats slag pile, on the east bank across from the Calloway concentrate pile, on the west bank above Dam No. 2, and on the east bank at the pot slag cliff beneath the rail shop (this was a tributary stream now filled with slag) (Figure 3). In 1976, a tunnel was driven from Davis Mill Creek to North Potato Creek as part of a flood protection plan for mines in lower North Potato Creek. Although the upstream end of the 2,350-foot-long tunnel was plugged with concrete in 1992, a small amount of poor quality seepage, typically less than 10 gallons per minute, continues to discharge to DMC from the downstream tunnel portal, which remains open (Figure 6).

The banks and bed of DMC have been significantly altered by historic and recent actions to the point that the present stream likely bears little resemblance to its pre-mining predecessor. As shown in Figure 4, the position of the stream channel has shifted over time in response to sediment aggradation, channelization, and waste disposal. Sediment aggradation caused by upland erosion and dam construction flattened and widened the channel, smothered pre-mining channel morphology, and constructed a large sediment delta at the Ocoee River confluence. In some locations, such as the Mudflat slag pile, the disposal of waste materials along one stream bank forced the channel to migrate upslope on the opposite bank as the original channel filled with material eroded from the piles (Figure 7). In some locations, waste disposal completely filled in tributary branches, such as the pot-slag-filled stream valley that lies beneath the rail shop on the Copperhill plant site. Construction of rail corridors locally impacted wetlands and channelized portions of the stream. Actions taken as part of "Project Copperhill" in the early 1970s channelized the lower stream along Cantrell Flats, increased storm flow from the interbasin transfer of storm water through the North Potato Creek diversion tunnel, and impounded the main stem headwaters by construction of the Gypsum Ponds. Further actions beginning in the 1980s routed a significant proportion of stream flow directly to the Ocoee River through clean water diversion pipelines, while most of the remainder of the creek is captured and treated.

The reach of DMC adjacent to the industrial complex historically received wastewater discharges from the lead chamber acid plants and other chemical manufacturing facilities. Prior to 1970, a secondary settling pond for iron calcine was situated on the banks of DMC upstream of Highway 68. The contents of this pond were periodically flushed to the creek as part of routine maintenance.

5.3.2 Davis Mill Creek Collection and Treatment System

The DMC collection system was constructed through actions taken under the 1990 Agreement and Covenant Not to Sue and EPA Settlement Agreements 01-12-C and CER-04-2003-3521. Since the historic headwaters of Davis Mill Creek were impounded to form the Gypsum Ponds (OU4) in 1972, DMC has originated as spring discharge from beneath the Headwaters iron calcine pile. The OU3 channel collects seepage from OU4 as it flows about 7,000 feet until it enters the first of four storm water retention structures which combined have the capacity to retain nearly 190 acre-feet of DMC water (Figure 2). Additional seepage and contaminated inflows are collected by the channel as it flows through and below these impoundments. A few hundred feet upstream of the Ocoee River, the channel is impounded by Dam No. 5. The entire flow in the channel at this point (typical base flow of 1,000 to 2,100 gpm) is routed to the Cantrell Flats water treatment plant by the Dam No. 5 pump station.

Dam Nos. 1 and 2 were originally constructed of compacted local clay keyed three feet into original ground or bedrock with a layer of concrete poured over the dam surface; downstream faces were covered with grouted granite riprap. These dams were each raised 5 feet in height in 2005 by the addition of a reinforced concrete wall keyed into the concrete crest of the initial dam. The upstream and downstream slopes of the new dams were covered with grouted granite riprap tied into the existing upstream and downstream slopes. Fourteen–inch-diameter HDPE

pipes on the upstream side of each dam feed to 18-inch-diameter HDPE pipes that carry base flow through the dams. Both dams are designed to be overtopped during very large rain events.

Dam No. 3 is a low-head concrete structure penetrated with several pipes to permit passage of base flow. The dam was designed to be overtopped and to permit vehicular traffic across its crest.

Dam No. 4 is a clay-cored earthen dam keyed into bedrock. Two 14-inch-diameter HDPE pipes pass through the dam. Each pipe is capable of passing approximately 4,000 gpm, but the actual rate is controlled by pinch valves. An emergency bedrock spillway is designed to release water exceeding the holding capacity of the dam to prevent overflow of the crest. Dam No. 4 is regulated under Tennessee Safe Dams Certificate No. 7953-0.

Dam No. 5 is a concrete wall keyed into bedrock at the base and to railroad bridge abutments on each side. The 84-inch diameter concrete Belltown diversion pipe penetrates the dam and discharges to the Ocoee River approximately 100 feet downstream of the dam. Dam No. 5 is designed to be overtopped during storm events in excess of the 10-year, 24-hour storm. The Dam No. 5 pump station consists of two 150 hp pumps plus a third backup pump, designed to convey up to 5,200 gpm of creek water to the surge pond at the Cantrell Flats water treatment plant.

The Belltown Creek diversion was originally constructed in 1987 to 1988 when a low head dam was constructed on Belltown Creek near the site boundary. The dam diverted the base flow of the unimpacted creek into a 20-inch-diameter HDPE pipe that discharged to the DMC channel at a point below the Cantrell Flats treatment plant intakes (below Dam No. 3).

The Belltown Creek diversion was expanded in 2005 under AOC Docket No. CER-04-2003-3521 to convey Belltown Creek storm water and overflow from the Gypsum Ponds to prevent their contamination. Gypsum Ponds water was routed into an 18-inch-diameter HDPE pipe that discharges behind the Belltown Creek dam. To capture storm water up to the 10-year, 24-hour storm[2], the Belltown Creek dam was reconstructed to hold 28 acre-feet of water. The Belltown Creek dam is a compacted earthen structure with concrete-filled uniform section matting overlaying the crest and spillway. The upstream face of the dam is penetrated by the 63-inch-diameter HDPE pipe that carries water to a point below Dam No. 3. The two HDPE pipes (63-inch and 20-inch) were joined into a single 72-inch-diameter concrete pipe in 2009 that follows Davis Mill Creek downstream. The Belltown Creek diversion also accepts storm flows from the West Drainage Channel greater than 500 gpm (Figure 2) and the concrete diversion pipe increases to 84 inches in diameter at this point. The 84-inch pipe passes through Dam No. 5 and discharges to the Ocoee River.

The Cantrell Flats water treatment plant was constructed in 1974 and was most recently refurbished in 2001 to 2002 by GSH under AOC Docket No. 01-12-C. Untreated water is pumped to a 2 million gallon surge pond and fed to the plant by gravity. Lime slurry is added to

[2] The 10-year, 24-hour storm is the amount of runoff generated by a rainfall event with an amount of precipitation over 24 hours that is statistically expected to occur once every 10 years. For the Copper Basin, this is equivalent to 5.7 inches of rain.

the water in a reaction tank to remove metals and neutralize acidity. Metal-rich sludge is separated from the treated water in clarifiers and pumped underground into the Calloway Mine for disposal under Tennessee Underground Injection Control permit No. 83-12; overflow water from the mine is routed back into the treatment system. Treated water is discharged to the Ocoee River through Outfall 009, immediately downstream of the Davis Mill Creek confluence in accordance with the provisions of NPDES permit No. TN0002411, issued by the State of Tennessee in April, 2012. Effluent limits for pH and several metals imposed by the permit are protective of aquatic life in the river. Treatment of Davis Mill Creek water is conducted by GSH under EPA Settlement Agreement 01-12-C and implemented by Intertrade Holdings, Inc. via subcontract.

5.3.3 Present Conditions in OU3

Presently, perennial surface water flow in the OU3 channel begins in the area of the Headwaters iron calcine pile. From this point, the portion of Davis Mill Creek that lies within OU3 flows approximately 2.4 miles at an average grade of 1.2 percent downstream to Dam No. 5. Water gains to the channel through the discharge of seeps, springs, and shallow ground water, some of which have been impacted by soil and wastes in OU4. In addition, the channel receives inflow from the Gypsum Ponds tributary, North Potato Creek diversion tunnel, French drain outlet, and West Drainage Channel. Storm runoff from the tributary drainages and OU4 enters the channel during precipitation-runoff events. Storm events also may cause an ephemeral increase in the amount of shallow ground water discharging to the stream.

Water conveyed by the Belltown Creek diversion, which includes overflow water from the Gypsum Ponds and storm water exceeding 500 gpm from the West Drainage Channel, is discharged directly to the Ocoee River below Dam No. 5. Operation of the Belltown Creek diversion has significantly reduced the volume of base and storm flow conveyed by the OU3 channel; Belltown Creek historically comprised about 60 percent of the flow of lower Davis Mill Creek. Since the OU3 Removal Actions were completed, base flow in OU3at Dam No. 5 has ranged from about 1,000 to 2,100 gpm.

Currently, the base flow of OU3 flows through Dam Nos. 1, 2, 3, and 4 without being retained until it is detained by Dam No. 5 and pumped to the Cantrell Flats water treatment by the Dam No. 5 pump station. During storm events, water flow that exceeds the capacity of the retention dam pipe outlets is temporarily impounded behind each of the dams. This water is released downstream over time as dictated by hydrologic conditions and pipe capacities; all retained storm water is collected and pumped to treatment. Storm runoff exceeding the 10-year, 24-hour design storm is expected to overtop the retention dams and be released to the Ocoee River.

Sediment within OU3 is a mix of natural soil and wastes eroded from OU4; in some locations, the substrate is composed entirely of waste materials. Waste materials visually identified as components of OU3 sediment include granulated slag, fragmented pot slag, iron calcine, and demolition debris. Throughout its length, the substrate of OU3 is coated with a several-inch-thick layer of yellowish-orange iron oxyhydroxide and hydroxysulfate minerals precipitated from the water column. These minerals, which locally form hardened terraces, are present on the

streambed adjacent to the Headwaters iron calcine pile where perennial flow in OU3 is initiated and continue downstream to Dam No. 5.

Successful revegetation of large portions of the upland Davis Mill Creek watershed has significantly reduced erosive transport of soil and waste materials to OU3. Nevertheless, sediment input from OU4 continues and a significant amount of sediment is present in the OU3 channel. This sediment will continue to migrate downstream during storm events but its passage to the Ocoee River is slowed by Dam Nos. 1 through 4 and blocked by Dam No. 5.

Interstitial pore water is present within sediment in the OU3 channel. This water represents shallow ground water that wells up into the channel and surface water that percolates downward. Pore water is expected to migrate downstream by porous media flow and to interact intimately with sediment particles.

As a result of the OU3 Removal Actions, surface water, sediment, and interstitial sediment pore water in OU3 no longer discharge to the Ocoee River except during large runoff events (those exceeding the 10-year, 24-hour design storm event). An event large enough to exceed the containment capacity of the system has not yet occurred.

5.4 Sampling Strategy

The nature and extent of contamination in OU3 was determined through a phased, multi-media investigation that included sampling and analysis of surface water, sediment, and sediment pore water samples. This work was conducted as part of a Remedial Investigation of the Davis Mill Creek watershed which included significant portions of OU4 (BWSC, 2012a). Sampling in OU3 built on the results of an RI and Focused FS completed for the lower portion of the OU in 2003 (SAIC 2003a; 2003b). The intent of the sampling program was to gather snapshots of Davis Mill Creek prior to and during construction of the Removal Actions to provide an understanding of the factors affecting contaminant release and transport and potential effects to receptors within the OU.

Sampling strategy and design was guided by a preliminary conceptual site model of the Davis Mill Creek watershed. The 2012 RI divided the watershed into the upper, middle, and lower sections within which samples of surface water, sediment, and interstitial pore water were collected. Additional sampling of soil and waste materials in OU4 provided information on potential source areas to OU3.

Surface water samples were collected from OU3 prior to and during construction of the Belltown Creek storm water diversion, storm water retention dams, and Dam No. 5 and its associated pump station. Samples were collected from numerous points along the main stem of the OU3 channel, as well as from the Gypsum Ponds and West Drainage Channel tributaries, Belltown Creek, various seeps and springs, and the North Potato Creek diversion tunnel and French drain outlets. On some occasions, stream discharge was measured concurrently with sample collection to provide information on mass loading through OU3. In general, sampling focused on characterizing contaminant concentrations and mass loads during base flow and storm runoff

conditions and determining whether certain source control measures would significantly reduce the amount of contaminants collected by OU3. These data were used to evaluate risks to human and ecological receptors.

Surface and subsurface sediment samples were collected from various locations in OU3 to characterize contaminant concentrations and distribution. Samples represent materials found at depth within the channel and surface material that could be mobilized during high flow events, including iron precipitates. Sample results were used to determine the nature and extent of sediment contamination and risks to human and ecological receptors that may be exposed to the sediment.

Interstitial sediment pore water samples were collected from transects across OU3 at different points along the channel. Pore water samples, many of which were co-located with sediment samples, were collected using temporary well points installed manually or using an auger rig. Sample results were used to determine the nature and extent of contamination.

5.5 Known or Suspected Sources of Contamination

Large piles of granulated slag, pot slag, high-sulfur and low-sulfur iron calcine, sulfide mineral concentrate, demolition debris, and other mining and processing wastes and by-products are present in OU4. In many locations, these piles form the banks of OU3. Previous work in the watershed identified nearly 10 million cubic yards of wastes and by-products within OU4. Many of these materials currently are being or are planned to be recycled by Intertrade Holdings, Inc. under work plans approved by EPA Region 4 and the State of Tennessee.

Sampling of the OU4 piles and the ground water contained within them indicates they are a major source of contaminants to OU3. Contaminants are conveyed to OU3 through erosion by wind and water and the flow of shallow ground water. Prior to revegetation actions taken under the 1990 Agreement and Covenant Not to Sue, many of these piles were barren and actively eroding to OU3. Since these actions were completed, erosion from the reclaimed piles has been significantly curtailed, but shallow ground water flow continues to OU3.

In addition to the waste piles, discharges of variably contaminated surface water flow into OU3. These sources include the Gypsum Ponds tributary, the North Potato Creek diversion tunnel outlet, the French drain outlet, and the West Drainage Channel tributary. Contamination in these streams is thought to derive from mine wastes and by-product materials and/or natural mineralization.

Contaminants were also discharged directly into OU3 during active mineral processing and chemical production operations. These occurred primarily adjacent to the Copperhill and Cantrell Flats industrial plants in the lower part of the watershed. Discharges included wastewater from various chemical production facilities, storm water runoff from the industrial areas, and discharges of wastes such as high-sulfur iron calcine from settling ponds.

5.6 Types of Contamination and Affected Media

Sections 5 and 6 of the 2012 RI report (BWSC, 2012a) discuss the nature and extent of contamination and the fate and transport of hazardous materials and residual mining wastes in the Davis Mill Creek watershed (both OU3 and OU4). Affected media in OU3 include surface water, subaqueous sediment, and interstitial pore water contained in sediment.

5.6.1 Surface Water

To facilitate analysis, the RI divided Davis Mill Creek into three sections informally designated as the upper, middle, and lower sections.

5.6.1.1 Main Stem of Davis Mill Creek

Upper Section. The upper section, which extends from the origin downstream to Dam No. 1, collects seepage and runoff from piles of high-sulfur iron calcine, granulated copper slag, demolition debris, waste rock, and sulfide mineral concentrate as well as a small amount of flow from the Gypsum Pond tributary (Section 5.6.1.2) (Figures 2 and 3). As measured in November 2005, base flow discharge in the upper reach increased downstream from less than 20 gpm at its source to about 420 gpm at Dam No. 1.

Analytical results for surface water samples in the upper reach (BWSC, 2012a) show that surface water contains high concentrations of numerous dissolved metals, total sulfate, and total acidity and low pH. In most cases, the highest concentrations were measured adjacent to or immediately downstream of the Headwaters iron calcine pile. Table 5-1 shows the maximum constituent concentrations measured in samples collected in 2005.

Although constituent concentrations decrease with distance downstream through the upper section, the mass load of constituents carried by the creek increases downstream due to increasing discharge. Table 5-2 shows that the upper section collected 1,724 pounds per day of dissolved metals, 1,146 pounds per day of acidity, and 4,622 pounds per day of sulfate. Iron accounted for 44 percent of the metal load while aluminum, manganese, and zinc combined accounted for 8 percent of the metals.

Middle Section. The middle section extends from Dam No. 1 downstream to Dam No. 3. This reach collects seepage and runoff from large stockpiles of low-sulfur iron calcine, copper slag and other materials along former rail grades, and waste rock and other wastes that are buried beneath the calcine stockpiles (Figures 2 and 3). Shortly downstream of Dam No. 1, the creek accepts discharge from the North Potato Creek diversion tunnel and a French drain (Section 5.6.1.3). Base flow discharge in the middle reach measured in November 2005 was similar to that at the lower end of the upper section (within measurement error).

Analytical results for surface water samples in the middle section (BWSC, 2012a) indicate that the concentrations of most dissolved metals, total sulfate, and total acidity increase downstream through the middle reach, with the highest concentrations measured at Dam No. 3. Table 5-1 shows the maximum constituent concentrations measured in samples collected in 2005.

The mass load of constituents conveyed by OU3 increases significantly through the middle section. As shown in Table 5-2, the load of dissolved metals increased in this reach by 2,498 pounds per day and the loads of total sulfate and acidity increased by 5,304 and 5,084 pounds per day, respectively. Iron accounted for 54 percent of the metal load; aluminum, manganese, and zinc combined to account for 18 percent.

Lower Section. The lower section comprises the reach from Dam No. 3 downstream to Dam No. 5, which is situated just upstream of the Ocoee River. This section receives seepage and runoff from the Carroll Hill slag disposal area, a pot slag disposal area, and the former Cantrell Flats and Copperhill industrial plants (Figures 2 and 3). Near the downstream end of the lower section, base flow and limited storm runoff from the West Drainage Channel discharge to OU3 (Section 5.6.1.4). In past years, when minerals and chemicals were actively processed and manufactured on the industrial sites, this reach also received direct discharges of process water. Pursuant to the 1990 Agreement and Covenant Not to Sue, Intertrade Holdings collects storm runoff from the Copperhill plant site and treats this water in the Cantrell Flats treatment plant and thus, this water no longer enters OU3. Base flow discharge measured in November 2005 increased by 560 gpm in the lower section.

At the time of the RI sampling, surface water in the middle section of the creek was pumped to the Cantrell Flats plant for treatment. Consequently, surface water entering the lower section originated from the Belltown diversion pipeline (BWSC, 2012a). The Belltown diversion has since been extended to the Ocoee River and the capture point for treatment of Davis Mill Creek has been moved to the downstream end of OU3 at Dam No. 5. Consequently, analytical results for surface water presented in the RI tables (and shown in Table 5-1) are no longer representative of water quality in this section of Davis Mill Creek.

The mass load of constituents conveyed by OU3 was noted to increase through the lower section of Davis Mill Creek; this increase is expected to be applicable to the present setting. As shown in Table 5-2, the load of dissolved metals increased in this reach by 1,211 pounds per day and the loads of total sulfate and acidity increased by 2,833 and 537 pounds per day, respectively. Iron accounted for 18 percent of the metal load; aluminum, manganese, and zinc combined to account for 11 percent.

5.6.1.2 Gypsum Pond Tributary

The Gypsum Pond Tributary originates from seeps along the toe of the Gypsum Pond dam and flows approximately 1,200 feet through a series of shallow pools until its confluence with the upper section of Davis Mill Creek (Figure 2). Flow of the tributary above the confluence was measured at 100 gpm. Flow from the Gypsum Ponds, which historically entered this reach, is captured and routed to the Belltown diversion pipeline.

Analytical results for surface water samples from the Gypsum Pond tributary (BWSC, 2012a) indicate that the concentrations of most dissolved metals, total sulfate, and total acidity decrease downstream through the tributary, with the highest concentrations measured near the base of the

Gypsum Pond dam. Table 5-1 shows the maximum constituent concentrations measured in samples collected in 2005.

The mass load of constituents conveyed from the Gypsum Pond tributary to Davis Mill Creek is shown in Table 5-2. This tributary carries about 171 pounds per day of dissolved metals (63 percent is calcium) and 375 pounds per day of sulfate. These constituents are consistent with the wastewater treatment sludge that was disposed of in the Gypsum Ponds during plant operations.

5.6.1.3 North Potato Creek Diversion Tunnel and French Drain

The North Potato Creek diversion tunnel outlet and French drain outlet are located adjacent to one another in the middle section of Davis Mill Creek (Figure 2). The diversion tunnel was formerly used to transfer flood water from the North Potato Creek watershed in order to protect surface mining operations; the upstream end of the tunnel is now sealed. Acid rock drainage discharges from the tunnel and flows overland 350 feet until joining Davis Mill Creek. The French drain originates beneath low sulfur iron calcine stockpiles and conveys captured drainage through a pipe to a point south of the diversion tunnel. The French drain outlet discharges surface water that flows 140 feet to a point where it meets the diversion tunnel surface water discharge on its path to Davis Mill Creek. Flow in the diversion tunnel outlet is perennial and typically 10 to 20 gpm. Flow of the French drain varies, but is typically less than 10 gpm and it may cease during prolonged dry spells.

Table 5-1 shows the maximum constituent concentrations measured in samples from the diversion tunnel and French drain outlets collected in 2005 (BWSC, 2012a). Analytical results for samples from the diversion tunnel outlet show high concentrations of numerous dissolved metals, total sulfate, and total acidity and low pH. Results for samples from the French drain have extremely high concentrations of numerous dissolved metals, total sulfate, and total acidity and low pH.

The estimated mass loads of constituents conveyed from these two sources are shown in Table 5-3. The diversion tunnel conveys about 131 pounds per day of dissolved metals, 432 pounds per day of sulfate, and 252 pounds per day of acidity to Davis Mill Creek. Iron accounts for 37 percent of the metal load; aluminum, manganese, and zinc combine to account for 23 percent. The French drain discharges about 343 pounds per day of dissolved metals, 777 pounds per day of sulfate, and 452 pounds per day of acidity. Iron accounts for 49 percent of the metal load; aluminum, manganese, and zinc combine to account for 22 percent.

5.6.1.4 West Drainage Channel

The West Drainage Channel is an engineered ditch approximately one-half mile in length located along Highway 68 south (Figure 2). The ditch discharges to Davis Mill Creek approximately 3,000 feet downstream of Dam 3. Up to 500 gpm of flow from the West Drainage Channel discharges into the lower section of Davis Mill Creek upstream of Dam No. 5 where it is captured for treatment. Flows exceeding 500 gpm, which occur during storm events, are conveyed by gravity to the Belltown Creek diversion pipeline for discharge into the Ocoee River.

Analytical results for surface water samples from the West Drainage Channel (BWSC, 2012a) show elevated concentrations of numerous dissolved metals and total sulfate and low pH. Table 5-1 shows the maximum constituent concentrations measured in samples collected in 2005.

The mass load of constituents conveyed by the West Drainage Channel is shown in Table 5-2. This channel carries about 61 pounds per day of dissolved metals, 169 pounds per day of sulfate, and 47 pounds per day of acidity. Iron accounts for less than 1 percent of the metal load; aluminum, manganese, and zinc combine to account for 23 percent.

5.6.1.5 Belltown Creek and Gypsum Pond Overflow

Belltown Creek has not been impacted by acid mine drainage. Prior to its diversion around OU3, it accounted for about 60 percent of the discharge in lower Davis Mill Creek. Calculated Belltown Creek flow ranges from 82 cfs for the 1-year, 24-hour storm event to 600 cfs for the 10-year, 24-hour storm event (SAIC, 2003b).

Analytical results for surface water samples from Belltown Creek at the diversion pipe outlet show that this water contains low concentrations of dissolved metals, total sulfate, and total acidity and has moderate pH (BWSC, 2012a). Table 5-3 shows the maximum constituent concentrations measured in samples collected in 2007.

The typical daily mass load of constituents conveyed by Belltown Creek is shown in Table 5-3. This tributary carries about 160 pounds per day of dissolved metals, 199 pounds per day of sulfate, and less than 58 pounds per day of acidity. Iron accounts for less than 2 percent of the metal load; aluminum, manganese, and zinc combine to account for less than 1 percent.

5.6.2 Sediment

Samples of sediment were collected from OU3 using a combination of grab samples and split spoon samples.

5.6.2.1 Main Stem of Davis Mill Creek

The bed of Davis Mill Creek was repeatedly moved during mining and mineral processing operations to control the flow of the creek through the industrial areas and to accommodate waste and by-product disposal. Consequently, in most areas, the stream no longer flows across the natural alluvium that was present prior to mining.

Sediment within Davis Mill Creek contains a large proportion of mine waste and by-product materials including granulated slag, pot slag, iron calcine, and other materials eroded from disposal areas within OU4 (Figure 3). Throughout the main stem, this clastic sediment is overlain by a several-inch-thick layer of iron oxyhydroxide and hydroxysulfate minerals precipitated from the water column. A significant amount of sediment that had accumulated behind sediment Dams No. 1 and 2 was excavated and removed to Carroll Hill in 2004 to 2005 when the dams were reconfigured into storm water retention structures.

Analytical results for sediment samples in Davis Mill Creek are presented in BWSC (2012a). These tables show that sediment within the stream has elevated concentrations of numerous metals that are consistent with a significant component of mine waste and by-product materials. Table 5-4 presents the maximum concentrations in sediment samples from each section of Davis Mill Creek and shows that the maximum concentrations for most metals are similar in each section. Exceptions include copper, which is significantly higher in the lower section of the creek adjacent to the former copper smelters and lead, which is significantly higher adjacent to the Mudflats slag pile where acid tank sludges were wasted.

5.6.2.2 Gypsum Pond Tributary

The Gypsum Pond tributary flows through a heavily vegetated area downstream of the Gypsum Pond dam. Insofar as the tributary originates as seepage from the dam, the stream has a poorly defined bank through most of this reach. Consequently, it is unclear whether the historic alluvial channel is present at depth beneath the present stream. Mine wastes are not known to have been deposited in the area of the tributary, but rock excavated from the mines is thought to have been used in the construction of the dam. Unlike Davis Mill Creek, the substrate of the Gypsum Pond tributary contains little to no iron precipitates.

Analytical results for samples of sediment from the Gypsum Pond tributary are presented in BWSC (2012a). Most samples have metal concentrations that are lower than samples collected from Davis Mill Creek. An exception is one sample collected from the tributary below the Gypsum Pond spillway that contained an unusually high concentration of lead (9,110 mg/kg vs. 11.4 to 144 mg/kg in seven other samples). The maximum sediment concentrations measured during the remedial investigation are shown in Table 5-4.

5.6.2.3 North Potato Creek Diversion Tunnel and French Drain

The North Potato Creek diversion tunnel discharges through a broad, shallow channel that was excavated through native saprolite. The channel is heavily armored with terraces of rusty orange iron precipitates. Stream alluvium is not present beneath the precipitate layer. The French drain discharges from a pipe and flows downslope to Davis Mill Creek. Prior to 2005, the discharge flowed southeast to the creek; since that time it was routed to flow north where it joins the North Potato Creek diversion tunnel stream slightly upstream of Davis Mill Creek. The French drain pipe and substrate are coated with a thick layer of light yellow iron precipitates (jarosite) that overlies soil and saprolite.

Analytical results for samples of sediment from the diversion tunnel and French drain discharges are provided in BWSC (2012a). Maximum values, which are generally lower than those in Davis Mill Creek, are shown in Table 5-4.

5.6.2.4 West Drainage Channel

The West Drainage Channel is a concrete-lined ditch that lacks natural sediment. One sample of solid material that represents material eroded into the drainage channel was collected from above the Davis Mill Creek channel in 2001 (SAIC, 2003a).

Table 5-4 presents concentrations for metals in sediment from the West Drainage Channel. These concentrations are generally lower than those in Davis Mill Creek. An exception is copper, which is elevated in West Drainage Channel sediment, likely reflecting proximity to the Cantrell Flats ore processing area.

5.6.3 Interstitial Sediment Pore Water

5.6.3.1 Main Stem of Davis Mill Creek

Interstitial pore water was extracted from sediment at numerous locations and depths beneath the bed and banks of Davis Mill Creek. This water represents either surface water that interacts with and flows through the sediment (hyporheic zone) or ground water or seepage that gains to the streambed in OU3.

Analytical results for samples of interstitial pore water (BWSC, 2012a) show that the concentrations of metals, sulfate, and acidity are elevated and pH is low in sediment pore water in all sections of the creek. Maximum values for these constituents are shown for each section of Davis Mill Creek in Table 5-5. The highest constituent values typically occur in the middle section of the creek and most of these are found in the area of Pond 2 downstream from the confluence of the NPC diversion tunnel discharge; these are the highest contaminant values measured in water in OU3. Maximum metal concentrations in sediment pore water are typically higher than the maximum values in surface water from the corresponding creek reach, consistent with the effects of interaction with waste materials in the sediment column.

5.6.3.2 Gypsum Pond Tributary

Interstitial pore water was sampled from sediment at three locations in the Gypsum Pond tributary. Analytical results for these samples indicate low to moderate concentrations of most metals, reflecting the absence of significant mine wastes in this area. Maximum values for these samples, which are shown in Table 5-5, are mostly lower than the maximum values in surface water for most constituents.

5.6.3.3 North Potato Creek Diversion Tunnel and French Drain

Samples of interstitial pore water were collected from sediment in the North Potato Creek diversion tunnel outlet upstream of Davis Mill Creek and from the outflow channel of the French drain prior to its rerouting in 2005.

Analytical results for pore water samples from these areas are presented in BWSC (2012a); maximum constituent values are shown in Table 5-5. Pore water has high concentrations of metals, sulfate, and acidity, and low pH in both areas. Values for many constituents are higher than the maximum values measured in surface water in the middle section of Davis Mill Creek. Pore water concentrations in sediment from the diversion tunnel outlet and French drain are mostly lower than the surface waters that discharge from these sources.

5.6.3.4 West Drainage Channel

Sediment pore water was not sampled in the West Drainage Channel because the channel is a concrete-lined ditch that lacks natural sediment.

5.7 Contaminant Location and Migration

5.7.1 Surface Water

Surface water samples have been collected from OU3 since 2001. These samples have consistently contained high concentrations of metals, sulfate, and acidity, and low pH. Prior to 2005, when the Belltown Creek diversion was modified to divert additional unimpacted water directly to the Ocoee River, surface water in the middle and lower sections of the OU was diluted by clean water input. However, since construction of the collection and treatment system, which diverted clean water from OU3, surface water concentrations in the middle and lower sections of the OU increased to values similar to or greater than those in the upper section of the OU. The RI noted minor spatial and temporal variations in surface water concentrations within OU3 (BWSC, 2012a). These were ascribed to inputs of shallow ground water with variable compositions and to physical-chemical effects such as iron precipitation and sorption.

Analyses of total and filtered (0.45 μm) samples suggest that metals in surface water occur mostly in dissolved form. These migrate downstream with the water column. For many constituents, OU3 behaves as an open chemical system, with metals such as iron, aluminum, and manganese precipitating (or dissolving) as oxide or hydroxide minerals depending on the prevailing pH and oxidation conditions. Other metals, such as copper, lead, and zinc likely co-precipitate (or co-dissolve) with these phases or may be sorbed to these minerals, clay particles, or organic detritus.

Substrate sediment is subject to mobilization and downstream transport in the surface water column during increases in channel velocity that occur during high flow events. Prior to the continuous treatment of the base flow of Davis Mill Creek in 2002, all contaminants migrated downstream to the Ocoee River. Treatment of base flow significantly decreased the amount of contamination discharged from OU3 and completion of Dam No. 5 in 2009 halted the downstream release of all contaminants except during storm events exceeding the 10-year, 24-hour storm.

Table 5-2 shows that under base flow conditions in November 2005, OU3 collected 5,433 pounds per day of dissolved metals, 12,759 pounds per day of sulfate, and 6,767 pounds per day of acidity (sum of the loads for the upper, middle, and lower sections). Calcium, magnesium, potassium, and sodium combined to account for 43.7 percent of the metals. However, the largest single contributor to the metals total was iron, which accounted for 42.6 percent (2,313 pounds per day). Other significant contributors were zinc (7.1 percent; 387 pounds per day), manganese (5 percent; 272 pounds per day), aluminum (1.2 percent; 65.7 pounds per day), cobalt (0.2 percent; 9.8 pounds per day), and copper (0.2 percent; 8.3 pounds per day).

Table 5-6 shows that the largest load increases in OU3 occur within the relatively short (2,000 feet) reach of the middle section of Davis Mill Creek. This section collects 75 percent of the total acidity, 42 percent of the sulfate, and 46 percent of the total metals conveyed by OU3. Although more than half of the cobalt, iron, and zinc loads enter in the middle reach, metals are collected along the entire length of OU3, with 32 percent of the total metals entering in the 4,000-foot-long upper section, and 75 percent of the copper load entering in the 4,000-foot-long lower section.

The RI showed that contamination collected and conveyed by OU3 originates from mine waste and by-product piles and other industrial waste materials present throughout OU4 (BWSC, 2012a). As discussed in the RI, these contaminants enter OU3 along its entire 2.4 mile length. Importantly, discrete point source inflows to OU3 are few and most contamination is collected by diffuse ground water gain along the entirety of OU3.

5.7.2 Sediment

The largest volume of contaminated sediment in OU3 occurs within the channel of Davis Mill Creek and in the French drain and North Potato Creek diversion tunnel outlet channels. This material is a mix of natural soil and a variety of mining and processing wastes and by-products that were eroded from OU4 which is overlain by a several-inch-thick layer of iron minerals precipitated from surface water. Sediment sampling during the RI indicated that contaminated sediment extends to depths of up to several feet beneath the OU3 channel (BWSC, 2012a). As shown in Table 5-4, poor quality sediment is widely distributed within OU3 and "hotspots" of contaminated sediment do not appear to be significant.

Contaminated sediment moves downstream by suspension and bed load transport during high flows. Prior to the revegetation of the upland areas of OU4 and construction of sediment Dam Nos. 1 through 3 in 1988, the transport of contaminated sediment from OU3 to the Ocoee River was uncontrolled. Some of this sediment was deposited as a large delta along the right bank of the river at the mouth of Davis Mill Creek. Completion of the sediment retention dams and successful revegetation significantly reduced, but did not completely halt, the amount of sediment migrating from OU3. However, since 2009 when Dam No. 5 was completed, sediment transport to the river has been halted. Sediment migration downstream within OU3 is expected to continue, with sediment being deposited behind Dam No. 5.

5.7.3 Interstitial Sediment Pore Water

Interstitial sediment pore water quality is poor in all sections of Davis Mill Creek and in the French drain and North Potato Creek diversion tunnel outlets. The highest concentrations occur in the middle section of OU3 between Dam No. 1 and Dam No. 3. Comparison of the maximum interstitial pore water concentrations in OU3 (Table 5-5) with the maximum concentrations in surface water (Table 5-1) shows that pore water typically has higher contaminant concentrations.

Interstitial pore water is expected to migrate downstream via intergranular flow during which it interacts with sediment particles and shallow ground water that gains to the channel from upland areas. In addition, exchanges and interactions between surface water and interstitial pore water

(primarily mixing and diffusion) are expected to occur in the hyporheic zone of the OU3 channel. Consequently, poor quality interstitial water can negatively affect less contaminated surface water flowing in the channel. Prior to the construction of Dam No. 5 in 2009, sediment pore water in OU3 migrated to the Ocoee River. This process has been halted by construction of the dam which is keyed into bedrock.

5.8 Other Site-Specific Factors

Over the past two years, Intertrade Holdings, Inc. has developed a series of work plans to recycle mine waste and by-product materials in OU4. These plans have been approved by EPA and the State of Tennessee. Excavation and removal of the large low-sulfur iron calcine stockpile is ongoing as of the date of this Record of Decision. Recycling actions are expected to remove a significant portion of the materials that have been identified as contaminant sources to OU3. While these efforts, which will take many years to complete, are expected to reduce contaminant loads to OU3, recycling will not remove contamination in shallow ground water beneath OU4 that gains to the OU3 channel. Consequently, restoration of Davis Mill Creek to improve water and sediment quality to acceptable levels is unlikely to succeed given continued ground water inflow.

Pursuant to requirements of the 1990 Agreement and Covenant Not to Sue, Intertrade Holdings, Inc. collects and treats storm water runoff from industrial portions of the Copperhill plant site in the lower section of OU3. This continuing action prevents contaminated runoff from the industrial site reaching OU3.

6.0 Current and Potential Future Land Uses

6.1 Land Uses

The Copper Basin hosted mining-related activities for the 150 years. Historic land use within the DMC watershed (OU3 and OU4) was primarily industrial, but included commercial use adjacent to Highway 68, transportation corridors, and some residential use. The watershed hosted underground mining operations that were active through 1983. Industrial features included rail yards, landfills, equipment storage areas, salvage yards, lagoons, processing and maintenance facilities, and support structures. Historically, land use in the industrial portion of the site included manufacturing facilities for iron roasting, copper smelting, sulfuric acid production, chemical manufacturing, acid production, and organic chemical production. None of these plants remain active and many of the historic facilities have been demolished; however, large volumes of mining waste and by-product materials remain on Site.

Current land use in OU3 is an industrial water collection and treatment system; current land use in OU4 (Davis Mill Creek Watershed) is industrial. OU3 is entirely surrounded by and contained within OU4. As a result, access to OU3 is through OU4 which is owned by Intertrade Holdings, Inc. Access to OU4 is restricted by fencing, locked gates at road and rail access points, physical barriers, and no trespassing signs posted to discourage trespassers along off-road trails in remote portions of the Site. Active security patrols are maintained during the week and on weekends. Due to continuing recycling operations under the oversight of EPA and TDEC and provisions of the 1990 Agreement and Covenant Not to Sue, access to OU4 is expected to remain restricted indefinitely. It is anticipated that the selected remedy for OU4 will include land use restrictions to prevent residential development in the watershed.

Historically, Davis Mill Creek transported surface water and eroded mining wastes from the watershed to the Ocoee River (OU5) resulting in significant degradation of aquatic life and habitat in the river. Since capture and treatment of Davis Mill Creek began in 2002, the volume of mine-impacted water discharged from Davis Mill Creek to the Ocoee River has decreased over time and it ceased in 2010, resulting in measureable improvements in water and sediment quality in the river. The river continues to receive treated effluent from Davis Mill Creek under an NPDES permit and flow from clean water diversions that are not impacted by mining wastes. Although the Ocoee River is used extensively for recreational purposes, public access to the Ocoee River is limited between the Site and the Whitewater Center approximately 7 miles downstream.

Currently, land use within a one mile radius of the DMC watershed is primarily industrial, with some residential and commercial use. Residential areas consist mostly of single-family dwellings located primarily along Belltown Creek upstream of the site and east of the Copperhill plant. The Cherokee National Forest and Cherokee National Forest Wildlife Management Area are located within a mile west of the site. Upstream of the National Forest, near the towns of Copperhill and McCaysville, a few thousand residents live or work on privately owned lands within a corridor along the Toccoa River (the Ocoee River is referred to as the Toccoa River

upstream of the Georgia state line). The populations of Copperhill, McCaysville, and Ducktown are approximately 510, 1070, and 440, respectively.

6.2 Ground and Surface Water Uses

There is no potential beneficial ground water use (e.g., irrigation or drinking water) associated with the Site.

Due to the past history of Davis Mill Creek and its previous classification as a wastewater stream, Davis Mill Creek, is not considered jurisdictional Waters of the United States under the Clean Water Act (EPA, 2007; see Appendix A). Consequently, there are no designated beneficial uses that apply to surface water in OU3.

If capture and treatment of Davis Mill Creek surface water were to cease, mine-impacted surface water and sediment would discharge to the Ocoee River. The river is a jurisdictional Waters of the U.S. for which the Tennessee Water Quality Control Board has promulgated designated beneficial uses of:

- Fish and aquatic life
- Recreation
- Irrigation
- Livestock watering and wildlife
- Industrial water supply.

7.0 Summary of Site Risks

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

7.1 Summary of the Human Health Risk Assessment

The baseline risk assessment estimates the risk a site poses if no action is 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 HHRA that was completed in 2012 for Davis Mill Creek with respect to OU3 (BWSC, 2012a). The purpose of the HHRA was to assess the potential current and future human health effects associated with past releases of hazardous materials to the watershed. The HHRA assessed exposure to impacted soil and waste, exposed sediment, subaqueous sediment, and surface water throughout the DMC watershed. Because the scope of this ROD is limited to OU3 (defined as the present stream bed of Davis Mill Creek including surface water, sediment, and pore water), only exposures to sediment and surface water are applicable. Additional detail regarding exposure assumptions and characterization of human health risks is provided in Appendix E of the RI (BWSC, 2012a).

7.1.1 Identification of Chemicals of Concern

Chemicals of concern (COCs) were identified in surface water and sediment of Davis Mill Creek using a conservative, site-specific screening process and screening values based on EPA's Regional Screening Levels. Table 7-1 lists the COCs that were evaluated in the HHRA.

7.1.2 Exposure Assessment

Table 7-2 provides a summary of the general exposure scenarios for ingestion and dermal contact to surface water and sediment of Davis Mill Creek.

Exposure point concentrations for the reasonable maximum exposure scenarios were based either on the maximum concentrations in each medium or the 95 percent upper confidence limit (UCL95) of the arithmetic mean (EPA, 2002a). Other conservative exposure parameters such as body weights, exposed skin surface, dermal absorption factors, averaging time, and incidental ingestion rates of water and sediment were obtained as default parameters from EPA guidance documents (EPA, 1989a).

An assessment of lead-related risks was conducted separately. For children under seven years of age, EPA's Integrated Exposure Uptake Biokinetic Model for Lead (IEUBK) was used to predict blood lead levels (EPA, 2002b). For adults, EPA's Adult Lead Methodology (ALM) model was used to predict receptor and fetal blood levels (EPA, 2003d). A modified ALM was used to predict blood levels for adolescents.

7.1.3 Toxicity Assessment

Toxicity profiles for each COC were described in the HHRA toxicity assessment section. Non-cancer toxicity values (e.g., oral and dermal reference doses, oral absorption efficiencies, primary target organ, and uncertainty factors) were listed for cobalt, copper, iron, manganese, and mercury. Cancer toxicity values (e.g., oral and dermal slope factors, cancer type, and weight of evidence) were summarized for arsenic and benzo(a)pyrene equivalents (BaP_{EQ}). The IEUBK and ALM models were used to evaluate risks to children and adults from lead in sediments of Davis Mill Creek.

7.1.4 Risk Characterization

Approach

Non-Cancer Hazards. The potential for non-cancer health effects was evaluated by comparing the intake of a chemical with the reference dose. The resulting ratio or hazard quotient (HQ) is calculated using the following equation:

$$HQ = CDI / RfD$$

Where:

CDI	=	Chronic Daily Intake of a chemical (mg/kg-day)
RfD	=	Reference dose (mg/kg-day)

When the CDI of a chemical exceeds the reference dose (i.e., HQ greater than 1) there is a potential for non-cancer health effects. Non-cancer hazards resulting from exposure to multiple chemicals are estimated through the calculation of a hazard index (HI). The HI is a summation of relevant HQ values and is used to determine if an exposed individual is at risk of developing adverse health effects resulting from simultaneous exposure to all selected chemicals by all complete exposure pathways. Potential hazards from exposure to multiple chemicals were assumed to be additive.

Cancer Risks. Potential cancer risks associated with carcinogens (polychlorinated biphenyl [PCB] compounds and arsenic) were calculated according to the following equation:

$$\text{Cancer Risks} = CDI * CSF$$

Where:

CDI	=	Chronic daily intake (mg/kg-day)
CSF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$

The total lifetime cancer risk was calculated by summing the cancer risks across both carcinogenic chemicals and for all complete exposure pathways. Resulting cancer risks represent the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. EPA has established a target cancer risk range of 1E-6 (1 x

10^{-6} or one in 1,000,000) to 1E-4 (1 x 10^{-4} or one in 10,000). Increased cancer risks less than 1E-6 indicate no action is required. Cancer risks between 1E-6 and 1E-4 will probably not warrant cleanup unless dictated by site-specific circumstances or other considerations. Increased cancer risks greater than 1E-4 indicate some type of action needs to be considered.

Risk Results

Risks from Sediment and Surface Water. Table 7-3 summarizes the risks identified in the HHRA from exposure to surface water and sediment in Davis Mill Creek. For the surface water pathway, the HHRA determined that unacceptable hazards would occur to current and future recreational trespassers, with hazard indices (HI) of 3 and 5, respectively. For the current and future industrial workers, no single chemical of concern was identified (i.e., individual chemicals of potential concern [COPC] had HQs <1). Exposures to cobalt concentrations in the French drain and manganese concentrations in the French drain, NPC diversion tunnel (in the middle section of Davis Mill Creek), and waters adjacent to the Headwaters iron calcine pile (the pile is located in OU4 adjacent to the upper section of the creek) were the primary contributors to risk estimates. Specifically, manganese accounted for the majority of the estimated risk under each scenario with over 95 percent of its hazard quotient attributable to the dermal exposure route. No unacceptable human health risk via the surface water pathway was identified for the lower section of the creek; however, conditions in this section changed following collection of the RI surface water samples.

The HHRA concluded that exposure to DMC sediment (also called subaqueous sediment) was not complete under current conditions per EPA Region 4 guidance (i.e., the sediment is not accessible for contact due to inundation). Potential exposures to other solids, such as exposed sediment, soil, and waste materials, were evaluated in the HHRA. Regardless of whether sediment is currently exposed or subaqueous, completion of the exposure pathway could result in potential risk. Evaluation of the future industrial worker where subaqueous sediment may be dewatered and exposed resulted in a potential cancer risk of 2 x 10^{-5} primarily due to arsenic and BaP_{EQ} and an excess cancer risk of 4 x 10^{-6} entirely due to arsenic. Trespassers would be at risk from arsenic and BaP_{EQ} in exposed sediment (1 x 10^{-4}). Cobalt, copper, iron, manganese, and mercury also contribute to hazards from exposed sediment (HI=11). Based on the blood lead exposure models, lead was also identified as contributing to adverse health effects to future workers and trespassers exposed to sediment.

Uncertainties

Numerous uncertainties were discussed in the HHRA including uncertainty in the completeness of historical data sets and the lack of background samples for surface water and sediment. Perhaps the largest source of uncertainty in risk in OU3 was the relevance of historical samples to the altered conditions within the OU. Other related uncertainties included water and sediment ingestion rates, oral and dermal absorption factors, exposure duration, and assumed additivity of toxic effects from mixtures of the chemicals of potential concern (COPC). In general, the assumptions presented in the risk assessment were considered very conservative and that risks were somewhat overestimated.

7.1.5 Media Concentrations Protective of Human Health

The HHRA calculated remedial goal options (RGOs) defined as the concentrations of chemicals of concern considered to be protective of human health. The RGO media concentrations were "back-calculated" from the exposure scenarios based on a HI of 1 or a target risk of 1×10^{-6}.

Table 7-4 summarizes the surface water and sediment concentrations that would be protective of human health for the chemicals of concern in Davis Mill Creek.

7.2 Summary of the Ecological Risk Assessment

An Ecological Risk Assessment (ERA) was completed as part of the watershed-wide RI for Davis Mill Creek (BWSC, 2012a) to assess the potential risk to ecological organisms due to exposures to chemicals at the Site. The results of the ERA with respect to OU3 are summarized below.

7.2.1 Identification of Chemicals of Potential Concern

Maximum detected concentrations in exposure media were compared to conservative risk-based screening concentrations to determine the list of COPCs. All screening levels were based on no observed adverse effects levels (NOAELs). Separate screenings were performed for chemicals in solid media (i.e., soil, sediment, and waste) and surface water.

Additional analyses were performed to further reduce the COPCs to include only those likely to be primary contributors to risk in soil, waste, and sediment. The COPCs that were eliminated from further assessment by comparison to site-specific or regional background levels, or based on their frequency of detection, magnitude of risk-based exceedance, lack of evidence of association with site activities, or lack of reported analytical detection included aluminum, barium, silver, thallium, tin, vanadium, di-n-butylphthalate, 4,4'-DDT and PCB compounds. Benzo(a)pyrene and chrysene were excluded as COCs because they were both addressed under high molecular weight polycyclic aromatic hydrocarbon compounds (HMW-PAH).

Chemicals identified as COPCs in soil, waste, and sediment were also selected for surface water to support terrestrial receptor analysis. Due to markedly elevated concentrations, aluminum was added to the COPC list for surface water.

Table 7-5 summarizes the COPCs that were quantitatively evaluated in the ERA. Other chemicals of potential concern were assessed qualitatively.

7.2.2 Risk Evaluations and Exposure Assessment

Assessment and Measurement Endpoints
Assessment endpoints are the ecological resources or receptors whose protection from adverse effects is the goal of risk management actions. The following assessment endpoints were evaluated for the OU3:

- Protection of aquatic and semi-aquatic receptors from hazardous substances that would result in adverse survival, reproduction, or growth effects.
- Protection of terrestrial receptors from hazardous substances that would result in adverse reproduction or growth effects.

Risk to aquatic receptors in OU3 was not quantitatively addressed because the portion of Davis Mill Creek comprising OU3 is a conveyance and treatment system and is no longer considered as Waters of the U.S. Although surface water and sediment in OU3 would be expected to pose significant risk to aquatic receptors, appreciable aquatic or semi-aquatic habitat does not exist.

The exposure pathway for terrestrial wildlife to permanently inundated sediment was considered incomplete and was not evaluated. However, the ecological risk assessment showed unacceptable risk to terrestrial fauna due to contact with exposed sediment, soil, and waste in OU4 and throughout the site. Over the years, much of this material has eroded into Davis Mill Creek where it comprises a significant portion of the sediment within the creek. Therefore, the potential risks associated with these materials are included in the discussions below and the remedial goals developed for solid media throughout the watershed would be protective of terrestrial organisms if sediment in OU3 was to become exposed under future conditions.

Decades of erosion of mining-related waste and soil from the Site altered the substrate and habitat within OU3 through siltation and chemical input. Numerous measurement endpoints and metrics were used to evaluate chemical and physical stressors on the ecosystem for each of the assessment endpoints. These included:

- Concentrations in soil and exposed waste materials (also considered as exposed sediment concentrations) for wildlife exposure.
- Food chain models documented in U.S. EPA guidance.
- Sediment and surface water concentrations and field parameters.

The conceptual site model presented in Section 5-1 was used to evaluate contaminant pathways and potential exposure pathways.

Exposure Analysis

Ecosystem Characterization. In-stream conditions and habitat are poor throughout the watershed and sediment and surface water within OU3 are highly contaminated. Moreover,

stream flow across the iron-armored substrate is shallow, leading to significant temperature and habitat effects. These chemical and physical impairments make OU3inhospitable to aquatic and semi-aquatic organisms.

Most riparian areas are sparsely vegetated and at least partially covered by waste materials. As such, the riparian zone seldom provides any appreciable wildlife habitat for terrestrial or semi-aquatic organisms.

Aquatic and Semi-Aquatic Receptors. Quantitative exposure estimates were not made for aquatic or semi-aquatic receptors. However, chemical concentrations in relevant media were compared to regulatory criteria or risk-based levels in order to gauge potential effects on aquatic organisms that may be in direct contact.

Semi-aquatic organisms would be expected to contact surface water, inundated sediment, and exposed sediment/waste. Under current conditions, the lack of riparian and in-stream habitat severely limits the potential for development of a typical semi-aquatic community.

Terrestrial Receptors. For mammals and birds, COPC doses were calculated for direct ingestion (soil/waste and surface water), and indirect (food chain) exposure pathways. Basic equations from EPA guidance (EPA, 1997) were used to estimate exposure for a suite of wildlife species. Exposure was estimated for each of three pathways: soil/waste incidental ingestion, food ingestion, and surface water ingestion using sensitive life stages, where supported. Food and water ingestion rates were estimated based on allometric models provided in the Wildlife Exposure Factors Handbook (WEFH) (EPA, 1993a). Tissue concentrations were estimated using simplified bioaccumulation models from ecological soil screening level (Eco-SSL) guidance documents and other sources based on soil, forage or prey concentrations. All water and food was assumed to have been obtained onsite and all food items could potentially accumulate site-related chemicals.

For this assessment, use of model-estimated food and water ingestion rates provided conservative approximations of reasonable maximum exposure. Chronic daily intakes for soil/sediment, food and water-related routes were computed separately for each species and age group to allow assessment of relative contribution to total exposure. Analyses were performed using the upper bound concentration estimates. Point-specific concentrations for each COC were also used to quantify combined direct and indirect (food chain) soil and waste-related exposures at each sampling location.

7.2.3 Ecological Effects Assessment

Surface Water and Permanently Inundated Sediment
As discussed above, formal effects characterization was not performed relative to aquatic (or semi-aquatic) organism exposure to surface water due to the existing adverse chemical and physical effects to aquatic organisms. Only a screening-level analysis was performed using risk-based screening values that indicated adverse effects to aquatic species.

Exposed Sediment, Soil, and Waste
For mammals and birds, effects associated with soil/sediment and waste and food-related exposures were characterized using toxicity reference values (TRVs). These values express potential toxicity as a function of chronic daily intake or dose (mg/kg-day). The TRVs were based upon NOAEL (TRV-Low) and lowest observed adverse effects level (LOAEL; TRV-High) values obtained largely from the Eco-SSL documents. Alternate sources were referenced to provide TRVs for aluminum and mercury. TRVs based on growth, reproduction or survival, were preferentially selected.

7.2.4 Risk Characterization

Risk characterization integrates the exposure information with the effects data to evaluate each assessment endpoint.

Protection of Aquatic and Semi-Aquatic Receptors from Hazardous Substances that would Result in Adverse Survival, Reproduction, or Growth Effects
Surface water and sediment screening results were used to characterize risks to aquatic receptors. In surface water, aluminum, beryllium, cadmium, cobalt, copper, iron, lead, manganese, nickel, selenium, zinc, and sulfate were found to exceed their respective screening values in 85 percent or more of samples. Average concentrations of aluminum, cadmium, copper, iron, and zinc were over 100 times water quality criteria. In-stream pH was consistently below 4.5 s.u. and dissolved oxygen concentrations were below 2 mg/L in the upper reaches of DMC near the Headwaters iron calcine pile.

In sediment, aluminum, antimony, arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, nickel, zinc, 4'4'-DDT, and PCBs were found to exceed their respective screening values. Average concentrations of copper, iron and zinc were over 10 times the risk-based values, and each (along with lead) exceeded screening values in at least 85 percent of samples.

Semi-aquatic organisms would be expected to contact surface water and sediment in OU3. The potential exists for significant chemical exposure from each medium through both direct and indirect (food chain) routes. Both riparian and in-stream habitats were identified as severely degraded throughout much of the DMC watershed providing few areas where semi-aquatic organisms would be expected to reside. In addition, physical and chemical stressors present in both the terrestrial and aquatic environments would be expected to limit the availability of prey or forage. As a result, it is unlikely that amphibians or other semi-aquatic fauna would colonize the DMC corridor under current conditions. With natural recovery or augmentation during remedial actions, it is possible the riparian zone could provide some habitat for amphibians and other semi-aquatic organisms in the future. However, poor surface water and sediment quality would probably limit the utilization of riparian habitat by these organisms.

Protection of Terrestrial Receptors from Hazardous Substances that would Result in Adverse Reproduction, or Growth Effects
For mammals and birds, HQs were calculated by dividing the estimated chronic daily intakes of each COC by the TRVs. Additivity of toxic effects was conservatively assumed for all COCs

regardless of the toxic endpoint. Risk estimates were made based upon both NOAEL and LOAEL values. Overall risk (as total HI) was calculated by summing all applicable exposure routes. An HI (or HQ) less than 1 using the NOAEL value was interpreted to indicate that toxic effects were not likely; HI (or HQ) greater than 1 using the NOAEL value was interpreted to indicate that toxic effects were possible, while the same result using LOAEL value was assumed to suggest that effects were probable.

Surface water in Davis Mill Creek adjacent to and downstream of the Headwaters calcine pile (in OU4) and surface water discharges from the French drain and North Potato Creek diversion tunnel were found to pose unacceptable risk to ecological terrestrial wildlife using NOAEL values. Surface water-related risk for mammalian species (HIs averaging 1.6 and ranged from less than 1 to 5) was attributable principally to aluminum. Hazard indices for surface water based on LOAEL values were below 1 for each location indicating that effects were not probable.

For avians, surface water HIs averaged 0.3 and ranged from less than 0.1 to 2.4 (using NOAEL values) with the highest risks predicted at the French drain where zinc was the primary contributor. Apart from this location, surface water HIs were less than or equal to 1. Hazard indices for surface water based on LOAEL values were 0.9 or less for each location indicating that effects were not probable.

Although risk to avians and mammals exposed to sediment was not quantified in the ERA, COPCs in soils and wastes along Davis Mill Creek were used to back-calculate protective solid media concentrations for wildlife should the creek sediments become exposed in the future.

Uncertainties

Conclusions regarding risks to terrestrial organisms reflect considerable uncertainty for a number of reasons. Firstly, the screening benchmarks, exposure models, and TRVs used in these assessments are highly conservative. Secondly, the sampling program conducted to support the remedial investigation was biased toward locations with known or suspected contamination (e.g., exposed waste deposits). Thirdly, and perhaps most importantly, food source concentrations were not directly measured but instead predicted based on conservative food chain models. Since associated risks were commonly the most significant among the routes, overall risk estimates are highly sensitive to changes in estimated food source contaminant levels.

Contributions to estimates of wildlife risk from surface water also reflect conservative assumptions. In addition to the conservative TRV values used to assess potential effects, the surface water risk estimates assume that an organism obtains all of its drinking water from a single location represented by the upper confidence limit mean for each COPC. In reality, it is unlikely that any animal would obtain all of its drinking water from a single location, or only from DMC and its tributaries. It was also noted that the French drain discharge was identified as a problem location although it has not produced flow in over three years.

7.2.5 Media Concentrations Protective of Ecological Receptors

DMC surface water and sediment would be expected to pose a significant risk to aquatic and semi-aquatic receptors based on the chemical stressors present as well as on the severely degraded in-stream and riparian habitat and the lack of forage/prey. However, an appreciable aquatic or semi-aquatic community does not currently exist.

Significant risks are posed to terrestrial receptors by soil and waste, predicted food sources in OU4, and, to a lesser extent, surface water contamination throughout the DMC watershed. On a location-specific basis, surface waters from the French drain and North Potato Creek diversion tunnel discharges and water adjacent to the Headwaters iron calcine pile could pose a wildlife risk.

Table 7-6 summarizes the range of concentrations for each chemical of concern that are expected to provide protection to ecological receptors. These values were back-calculated using both the NOAEL and LOAEL values set to an HI of 1.

8.0 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for OU3 were revised following completion of the 2012 RI. The revised RAOs, which were presented in the 2012 Proposed Plan, are consistent with the findings of the RI with respect to OU3, including the human health and ecological risk assessments presented therein and summarized in Section 7 of this ROD. They are intended to prevent or control releases of hazardous substances from OU3 to the Ocoee River and to prevent human and terrestrial wildlife exposure to unacceptable contaminant levels. The RAOs are:

- Prevent or control the transport of metals-contaminated sediment from OU3 to the Ocoee River.
- Prevent discharges of contaminated surface water from OU3 at levels that may cause exceedances of ambient water quality criteria in the Ocoee River or at levels that will adversely affect the quality of the river for its designated uses and classifications.
- Limit human exposure to the surface water and sediment within OU3 that would result in a Hazard Index (HI) greater than or equal to one; an excess cancer risk greater than 1 in 100,000; or unacceptable fetal blood lead levels.
- Limit exposure of terrestrial wildlife receptors to surface water and sediment within OU3 that would result in a HI greater than or equal to one.

8.1 Remedial Goals

Remedial Goals (RGs) are numerical values that the remedy will ultimately achieve and provide the basis for evaluating the achievement of RAOs. They may be expressed in contaminant-specific terms such as a cleanup concentration for a certain chemical in surface water. Acceptable contaminant concentrations are calculated based on risk/hazard targets for specific receptors and exposure scenarios and from consideration of ARARs.

Remedial goals for OU3 were calculated from risk-based concentrations to prevent exposure of human and terrestrial wildlife receptors to surface water and sediment within Davis Mill Creek. Although the human health risk assessment concluded that current scenarios for exposure to DMC sediment, also called sub-aqueous sediment, were not complete (i.e., permanent inundation by surface water eliminates the exposure pathway), hazards and risks from exposure to solids were calculated in the HHRA in the event the subaqueous sediments become exposed. Table 8-1 shows remedial goals for surface water and sediment within Davis Mill Creek; these remedial goals will serve as clean-up levels for these environmental media within OU3. Surface water and sediment RGs for protection of human receptors were based on an excess cancer risk of 1E-5 and a noncancer HQ of 1. Surface water and sediment RGs for protection ecological organisms have been set to achieve levels of contaminants that are less than the LOAEL (TRV-high). Where multiple RGs were calculated for contaminant within a given media (i.e., arsenic in sediment), the more conservative RG was used as the final cleanup number.

If treatment of Davis Mill Creek surface water and operation of the existing dams were to cease, water and sediment quality within the Ocoee River would be expected to degrade significantly. Consistent with the Record of Decision for OU5 (Ocoee River), Tennessee Water Quality Criteria for protection of human recreation, aquatic life, and biological integrity would apply to untreated surface water from Davis Mill Creek (EPA, 2011). Thus, the sediment remedial goals selected in the ROD for OU5 (Ocoee River) also would be applicable to Davis Mill Creek sediment if it discharges into the Ocoee River. Because Davis Mill Creek is a designated collection and treatment system and not considered as "Waters of the United States" these remedial goals are applicable only to discharges into the Ocoee River and not along the length of OU3. Table 8-2 shows remedial goals for surface water and sediment discharging from OU3 to the Ocoee River; these remedial goals will serve as clean-up levels to protect the Ocoee River.

9.0 Description of Alternatives

The NCP at 40 CFR §300.430(e)(7) describes methods for screening cleanup technologies in order to develop applicable remedial alternatives. These procedures were used to ensure that the best or most promising alternatives were retained for detailed analysis and comparison. As a part of the FS, a variety of cleanup technologies were first screened for their implementability and effectiveness in abating the identified residual risks in OU3. Technologies that passed screening were then combined to develop a final set of remedial alternatives to be further evaluated.

Two broad categories of potential cleanup strategies were identified for OU3 that would achieve the RAOs presented in Section 8: those aimed at contaminant source control and cleanup of OU3 and those aimed at containment and treatment of contaminants collected in OU3. The former would require restoration of the Davis Mill Creek watershed (OU3 and OU4) to near pristine conditions so that water and sediment flowing from the creek would not degrade the aquatic resources of the Ocoee River. The RI showed that contamination collected and conveyed by OU3 originates from mine waste and by-product piles and other industrial waste materials that are present throughout OU4. Contaminants enter OU3 along its entire 2.4 mile length. Discrete "point source" inflows to OU3 are few and most contamination is collected by diffuse ground water gain along the entirety of OU3. The volume of potential source materials in OU4 was estimated at 9.7 million cubic yards. A significant amount of this material is expected to be excavated and recycled by Intertrade Holdings, Inc. under work plans approved by EPA and the State of Tennessee[3]. While these efforts, which will take many years to complete, are expected to reduce contaminant loads to OU3, recycling will not remove contamination in shallow ground water beneath OU4 that gains to OU3. Consequently, attempts to restore the creek to improve water and sediment quality to acceptable levels are unlikely to succeed given continued ground water inflow. For this reason, the FS focused on strategies to contain and treat water in OU3.

Four remedial alternatives were developed for OU3:

- Alternative DMC-1 – No Action
- Alternative DMC-2 – DMC Removal Actions
- Alternative DMC-3 – DMC Removal Actions plus Institutional and Engineering Controls
- Alternative DMC-4 – DMC Removal Actions plus Institutional and Enhanced Engineering Controls

[3] Some of the potentially recyclable waste materials in OU4, particularly those in the Polk County Mine area, cannot be excavated and recycled because they overlie unstable underground mine workings that could potentially collapse.

9.1 Alternative DMC-1 – No Action

Alternative DMC-1 is the No Action alternative required under CERCLA. It provides a base from which to compare the risk reduction achieved by other alternatives. Components of Alternative DMC-1 are depicted in Figure 8.

The No Action alternative would involve cessation of all operations and maintenance (O&M) actions currently taken with respect to the Removal Actions completed in OU3. This means that the pumps at Dam No. 5 would not operate and water would not be sent to the Cantrell Flats plant for treatment. Although the Cantrell Flats plant would continue to treat storm water flow from the Intertrade Holdings industrial site as required under the 1990 Agreement and Covenant Not to Sue, it would no longer treat water from OU3. Because the pumps at Dam No. 5 would not operate, Davis Mill Creek water would eventually overtop the dam and flow directly into the Ocoee River without treatment. Initially, the Belltown Creek diversion and Gypsum Ponds diversion would operate. Without maintenance, however, the intakes to these diversions would eventually clog with debris and water from these sources would flow into Davis Mill Creek rather than through the pipelines. Discharges from the French drain and North Potato Creek diversion tunnel outlets would continue to flow into OU3 as they presently do. Base flow from the West Drainage Channel would discharge to Davis Mill Creek. Storm flow (i.e., flow in excess of 500 gpm) from the West Drainage Channel initially would continue to flow into the Belltown Creek diversion pipeline. Similar to other diversions, this intake will eventually clog with debris after which storm water from the West Drainage Channel would flow into OU3. Retention Dam Nos. 1, 2, 3, 4, and 5 and the Belltown diversion dam would not be maintained. Without maintenance, the pipes that convey base flow through the dams will eventually clog and water will pond behind the dams until overflowing across the dam crests. Absent functioning surface water diversions, the total volume of untreated water predicted to reach the Ocoee River under Alternative DMC-1 would be 1,106 acre-feet during a 10-year, 24-hour storm event (figure includes Belltown Creek; SAIC, 2003b).

9.2 Alternative DMC-2 – DMC Removal Actions

Under Alternative DMC-2, the Davis Mill Creek collection, conveyance, and treatment system as constructed pursuant to AOC Docket No. 01-12-C and AOC Docket No. CER-04-2003-3521 will be operated and maintained. This will permit treatment of OU3 water up to the 10-year, 24-hour storm event at the Cantrell Flats plant. Components of Alternative DMC-2 are depicted in Figure 9. As part of this alternative, uncontaminated surface discharge from Belltown Creek and the Gypsum Ponds up to the 10-year, 24-hour storm and storm flow in the West Drainage Channel exceeding 500 gpm, will be diverted to the Ocoee River. Treated water from the Cantrell Flats plant will be discharged to the Ocoee River through Outfall 009 in accordance with NPDES permit No. TN0002411 issued to Intertrade Holdings, Inc. Sludge generated during waste water treatment at Cantrell Flats will be piped and disposed in the Calloway mine as a slurry under UIC permit No. 83-12. Maintenance and inspection of Dam No. 4 will be consistent with the requirements of Tennessee Safe Dams Certificate No. 7953-0.

This alternative diverts 668 acre-feet of clean water out of the Davis Mill Creek watershed through the Belltown Creek diversion under the 10-year, 24-hour storm (typical annual discharge of 707 million gallons [Mgal]) and meets the storm water retention capacity requirements of a 10-year, 24-hour rainfall event (438 acre-feet; SAIC, 2003b) utilizing the surge pond behind Dam No. 5 and storm water retention in Ponds 1, 2, 3, and 4. Removal of sediment accumulated behind the dams (primarily Dam No. 5) will be required periodically to maintain the storm water capacity of the system. The removed sediment will be treated with lime to reduce acidity and contaminant mobility prior to or after disposal onsite at Carroll Hill. The pump station at Dam No. 5 is capable of pumping 5,200 gpm to the Cantrell Flats plant for treatment. The continued operation of the Cantrell Flats plant would be expected to result in meeting RAO's for the Ocoee River. Actions proposed under Alternative DMC-2 would be expected to reduce risks posed to human and ecological receptors.

Monitoring of effluent quality from the waste water treatment plant will be conducted in accordance with the specifications of the NPDES permit. Additional monitoring of conditions in the Ocoee River downstream of Davis Mill Creek (within the Copper Basin Reach), which is conducted pursuant to the Record of Decision for the Ocoee River (EPA, 2011), will be used to protect the quality of the river for its designated uses and classifications.

9.3 Alternative DMC-3 – DMC Removal Actions plus Institutional and Engineering Controls

Alternative DMC-3 includes all components of Alternative DMC-2 plus institutional controls to restrict inappropriate uses of surface water and sediment and engineering controls to restrict access and exposure to surface water at the French drain and NPC diversion tunnel outlets. In addition, Alternative DMC-3 allows for upgrades and refurbishment of the Cantrell Flats treatment plant as may be required in future years to maintain operational function and efficiency. Components of the Alternative DMC-3 are depicted in Figure 10.

Institutional controls, in the form of deed restrictions and notifications, will be implemented to limit exposure to residual contaminants by restricting inappropriate uses of surface water or sediment in the OU3 channel.

Engineering controls include encapsulating the surface water discharges at the French drain and NPC diversion tunnel, installing a fence barrier at the diversion tunnel portal, and covering the resulting exposed sediment. Remedial goals for surface water are exceeded in the middle section of DMC (manganese), at the NPC diversion tunnel outlet (aluminum, cobalt, and manganese), and at the French drain outlet (cobalt, manganese, and zinc). Exposed surface water discharging from the diversion tunnel and French drain outlets will be encapsulated in a pipe and conveyed to OU3. To prevent mammalian or avian entry into the diversion tunnel, where potential contact with the contaminated water could occur, fencing and/or netting (or a similar approach) will be installed across the tunnel opening. Because these actions would result in a loss of water cover for the sediment in the French drain and diversion tunnel drainages, exposed sediment would be covered with clean borrow.

Although the Cantrell Flats treatment plant was refurbished in 2002, additional upgrades and refurbishment are anticipated to meet a 30 year life expectancy. Alternative DMC-3 includes funds to upgrade the plant as necessary beyond routine maintenance to maintain or improve operational efficiency.

9.4 Alternative DMC-4 – DMC Removal Actions plus Institutional and Enhanced Engineering Controls

Alternative DMC-4 includes all the components of Alternative DMC-3 plus enhanced engineering controls (i.e., fencing) in the upper section of OU3 near the Headwaters calcine area. Components of Alternative DMC4 are depicted in Figure 11.

Surface water in a portion of the upper section of OU3 contains high concentrations of manganese that exceed the remedial goal and pose a risk to current and future recreational trespassers from contact with this water. The segment that exceeds the manganese remedial goal is estimated at 1,300 feet in length. Alternative DMC-4 achieves risk reduction by the installation of a fence along both sides of Davis Mill Creek near the Headwaters calcine area to discourage access by trespassers.

10.0 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 developed for OU3 relative to the other alternatives. The comparative analysis is summarized below.

10.1 Overall Protection of Human Health and the Environment

The threshold criterion of overall protection of human health and the environment addresses whether each alternative adequately protects 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 institutional controls.

With the exception of the No Action Alternative (DMC-1), all of the alternatives would meet the RAO for protection of the Ocoee River. Capture and treatment of surface water in Davis Mill Creek (up to the 10-year, 24-hour storm event) and the West Drainage Channel (up to 500 gpm) would prevent mine-impacted surface water, sediment, and sediment pore water originating in the watershed from negatively impacting the Ocoee River. Storm flows above the 10-year, 24-hour event could result in the discharge of untreated water directly to the Ocoee River, potentially resulting in exceedances of Tennessee Water Quality Criteria within the river.

Neither the No Action alternative (DMC-1) nor the Davis Mill Creek Removal Actions alternative (DMC-2) would mitigate on-site risk resulting from exposure to surface water by human and terrestrial receptors. Alternative DMC-3, Davis Mill Creek Removal Actions plus Institutional and Engineering Controls would reduce the hazard indices for current recreational trespassers and future industrial workers to acceptable levels (i.e., HI<1) and future recreational trespassers to 3 by encapsulating surface water from the French Drain and the North Potato Creek diversion tunnel outlets. Alternative DMC-4, Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls would provide the greatest risk reduction by additionally fencing areas in the upper section of Davis Mill Creek where surface water concentrations exceed the RG for manganese. Alternative DMC-4 would result in hazard indices of 1 or less for all human exposure scenarios evaluated.

Under Alternatives DMC-3 and DMC-4, institutional controls (e.g., deed restrictions) and engineering controls (e.g., encapsulation and fencing) would ensure that appropriate future uses are selected for the site property and that those barriers are in place to reduce trespasser access to the site. Institutional controls would also prevent use and access to water and prevent disturbance of sediment. These controls would provide additional unquantifiable risk mitigation benefit. Institutional and engineering controls are not included under Alternatives DMC-1 and DMC-2.

The current hydrology of Davis Mill Creek would not be changed by alternatives DMC-2, DMC-3, and DMC-4. Consequently, exposure pathways for subaqueous sediment are expected to remain incomplete under each proposed alternative except where the NPC diversion tunnel and French drain waters would be encapsulated. In these areas, sediment exposed by loss of water cover would be covered with clean soil borrow.

10.2 Compliance with ARARs

Section 121(d) of CERCLA and 40 CFR §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites 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 section 121(d)(4). "Applicable" requirements, as defined by 40 CFR §300.5, 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, as defined by 40 CFR §300.5, 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.

Pursuant to 40 CFR §300.400(g)(5), only those state standards that are promulgated, are identified in a timely manner, and 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 9234.2- 05/FS, *CERCLA Compliance with State Requirements* (EPA, 1989b)).

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 CFR § 00.400(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,* (EPA,1988; 1989c), Section 1.4).

The No Action Alternative (DMC-1) would not meet all chemical-specific ARARs in Table 13-1 because surface water exceeding Tennessee Water Quality Criteria would discharge directly to the Ocoee River. Additionally, the No Action Alternative would not comply with either the action-specific ARAR for the Safe Dams Act at Dam No. 4 or the waste treatment and disposal requirements for sludge and sediment listed in Table 13-2. Under the No Action Alternative, no location-specific ARARs are applicable. Surface water RGs within DMC, the French drain outlet, and the NPC diversion tunnel outlet would not be met. As a result, Alternative DMC-1 failed threshold performance criteria, and therefore, was not considered further in the comparative evaluation.

Alternatives DMC-2, DMC-3, and DMC-4 provide similar levels of ARAR compliance. Chemical-, action - and location -specific ARARs (as outlined in Tables 13-1, 13-2, and 13-3, respectively) would be met under each of the action alternatives. Alternative DMC-4 would attain all RGs for protection of the Ocoee River, and human health and terrestrial wildlife within OU3. Alternatives DMC-2 and DMC-3 would not attain surface water RGs for protection of human health and terrestrial organisms within the upper section of Davis Mill Creek (DMC-2 and DMC-3) or the French drain and North Potato Creek diversion tunnel (DMC-2 only).

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, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Balancing criteria were not evaluated for DMC-1 (No Action) because the alternative failed to meet RAOs and satisfy the Threshold Criteria of "Overall Protectiveness of Human Health and the Environment" and "Compliance with ARARs."

Alternative DMC-2 is the least effective long-term solution because it relies on continued operation of an aging water treatment plant to protect the Ocoee River and would not mitigate human health or terrestrial organism risk related to surface water exposure at the French drain and North Potato Creek diversion tunnel outlets, and in the upper section of Davis Mill Creek.

Alternative DMC-3 would be the second most effective long-term alternative. This alternative includes provisions for additional refurbishment/replacement of water treatment components, piping, and pumps to ensure the long-term effectiveness of treatment of Davis Mill Creek and West Drainage Channel surface water. Human health and terrestrial organism risk would be reduced by encapsulation of surface water from the French drain and North Potato Creek diversion tunnel outlets. Provided these components are properly maintained, piping and fencing are expected to be effective in limiting exposures over the long-term. Deed restrictions and notifications would further limit exposure to residual contaminants by restricting inappropriate uses of surface water or sediment in the OU3 channel. However, this alternative does not include fencing along the upper section of Davis Mill Creek. Thus, potentially unacceptable

human and terrestrial receptor exposures to Davis Mill Creek surface water would remain in the upper section of the creek.

Alternative DMC-4 would provide the highest degree of long-term effectiveness. In addition to all actions taken under Alternative DMC-3, this alternative includes provisions for fencing the upper section of Davis Mill Creek to minimize exposures. Provided the fencing is properly maintained, it is expected to be effective in limiting exposures over the long-term.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

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.

All three action alternatives (DMC-2, DMC-3, and DMC-4) would effectively divert approximately 707 million gallons per year (base flow) of unimpacted water from Belltown Creek and the Gypsum Ponds away from contamination and prevent it from mixing with impacted waters within OU3. The three action alternatives would result in treatment of approximately 770 million gallons per year of mine-impacted water from Davis Mill Creek, the French drain, the NPC diversion tunnel, and the West Drainage Channel. No other reductions in mobility, toxicity, or volume would be achieved by any of the alternatives.

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.

The primary components of all three action alternatives are composed of interim removal actions that have already been completed (i.e., the Belltown Creek and Gypsum Ponds diversions, installation of retention dams on Davis Mill Creek, the Dam No. 5 pump station, and refurbishment and operation of the Cantrell Flats treatment plant). Potential impacts to the community or environment as a result of operating and maintaining these removal actions are minimal. Potential impacts to workers are mitigated through an existing Health and Safety Plan. Additional impacts to workers or the environment could potentially arise during installation of piping to encapsulate the French Drain and North Potato Creek diversion tunnel surface water (Alternatives DMC-3 and DMC-4) and construction of a fence in the upper section of Davis Mill Creek (Alternative DMC-4). Similar projects completed previously in the watershed were found to create minimal exposures to workers or the environment. The encapsulation and fencing projects could be completed within one year.

10.6 Implementability

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

Because the primary components of all three action alternatives are composed of interim removal actions that have already been completed, all three alternatives are considered readily implementable. Alternative DMC-2 requires no further construction or actions and is the most easily implemented. Both Alternatives DMC-3 and DMC-4 include provisions to refurbish/replace water treatment components, piping, and pumps at Cantrell Flats treatment plant as equipment fails. This work would be similar to the refurbishment completed in 2002 and no additional permits or coordination are expected to be required. Alternative DMC-3 is easily implemented due to the perceived ability to gain agency approval, ease of construction of the French drain and diversion tunnel encapsulation and the reliability of the piping conveyance. Alternative DMC-4 is also relatively easy to implement, but the large areal extent and complex topography in the upper watershed area could make installation and maintenance of the fence moderately difficult.

10.7 Cost

Present worth cost analysis was used to compare expenditures for each alternative as suggested by OSWER Directive 9355.3-20 (EPA, 1993b) and the preamble to the NCP (55 FR 8722). Costs were evaluated at both the 5 percent and 7 percent discount rates. Costs are discussed herein using the 5 percent rate, which is more conservative. Cost estimates, including direct and indirect capital cost and long-term operations and maintenance (O&M) cost, were prepared in accordance with EPA and USACE (2000). For OU3, it was assumed that capital expenditures and implementation of each alternative would be completed in less than 5 years. It was assumed that treatment would be required indefinitely and that 30 years represents an acceptable time frame for operation of a water treatment plant and maintenance of existing piping and dams.

Alternative DMC-2 would be the least costly alternative. The capital, O&M and total present worth costs of alternative DMC-2 would be $9.5M, $18.7M, and $28.2M, respectively.
The estimated costs associated with implementation of DMC-3 and DMC-4 are nearly identical; however, Alternative DMC-3 would be the next lowest cost alternative. The capital, O&M and total present worth costs of alternative DMC-3 would be $9.7M, $22.7M, and $32.3M, respectively. Alternative DMC-4 is the most costly alternative. The capital, O&M and total present worth costs of alternative DMC-4 would be $9.8M, $22.7M, and $32.5M, respectively.

11.0 Principal Threat Wastes

The NCP at 40 CFR §300.430(a)(I)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. Principal threat wastes combine concepts of both hazard and risk (OSWER 9380.3-06FS; EPA, 1991). 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, low level 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. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

The human health risk assessment concluded that unacceptable risks are locally posed to current and future recreational trespassers from exposures to cobalt and manganese in surface water in OU3. In addition, the ecological risk assessment identified potential risks to terrestrial wildlife receptors from exposure to aluminum and zinc in surface water at some locations in OU3. The risk assessments determined that sediment in OU3 does not pose an exposure risk to humans or terrestrial wildlife as long as it remains beneath a cover of surface water, soil, or rock.

Studies conducted during the remedial investigation of the Davis Mill Creek watershed (SAIC, 2003a: BWSC, 2012a) demonstrate that contaminants in OU3 surface water and sediment are derived principally from mine waste and by-product piles located in OU4. These piles are considered to be the primary contaminant sources in the Davis Mill Creek watershed. While sediment in the OU3 channel may be considered as a secondary contaminant source to surface water, analytical results demonstrate that it is not highly toxic. Based on these considerations, the residual contaminants within OU3 do not constitute a principal threat waste; therefore, preference for treatment does not need to be met.

Completion of the Davis Mill Creek Removal Actions, specifically the storm water retention dams, Dam No. 5, and the Dam No. 5 pump station have contained OU3 surface water and sediment and halted their downstream migration to the Ocoee River. Continuing actions to excavate and recycle waste and by-product materials in OU4 are expected to reduce contaminant contributions from these sources over time.

12.0 Selected Remedy

12.1 Summary and Rationale for Selected Remedy

The selected remedy for OU3 is Alternative DMC-4 – Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls. The selected remedy meets the Threshold Criteria and provides the best balance of tradeoffs among the other alternatives with respect to balancing and modifying Criteria. It addresses mine-impacted surface water and sediment in Davis Mill Creek and is expected to meet the statutory requirements under CERCLA Section 121(b) as discussed below.

The Selected Remedy will capture and treat mine-impacted surface water in OU3 up to the 10-year, 24-hour storm event. This will prevent discharges of contaminated water to the Ocoee River which could degrade aquatic resources in the river. Areas of surface water with concentrations exceeding remedial goals will be captured and encapsulated in pipes (French drain and NPC diversion tunnel) or fenced (upper section of OU3 and NPC diversion tunnel portal) to prevent exposure by humans and terrestrial wildlife. Deed restrictions and notifications will be used to assist in reducing trespasser access to the site. Combined, these actions will achieve the RAOs set forth in Section 8 and meet the site-specific RGs specified in Tables 8-1 and 8-2.

Compliance with ARARs will be achieved by the selected remedy. Capturing water and sediment to prevent its discharge to the Ocoee River and discharging treated water in compliance with NPDES effluent limits developed by the State of Tennessee will allow State water quality criteria for the Ocoee River to be met. Maintenance of the retention dams will ensure that Dam No. 4 complies with Tennessee safe dam requirements. Disposal of treatment sludge will comply with the State's underground injection requirements. Collection and treatment of storm water runoff will comply with the State's storm water requirements.

Although the selected remedy is the most expensive of the alternatives evaluated in the Feasibility Study, it is the only alternative which is expected to attain acceptable levels of risk to human and ecological receptors in Davis Mill Creek. The cost benefits of the selected remedy are best illustrated by comparison to the lowest cost alternative (DMC-2 – DMC Removal Action) as presented in Table 12-1 and discussed below.

Capital costs for the selected remedy are presented in Table 12-2. Ninety-seven percent of the capital costs (i.e., $9.5 million of the total estimated $9.8 million) associated with implementation of the selected remedy has already been spent during completion of previous removal actions (initial refurbishment of the Cantrell Flats water treatment plant; modification/construction of Dam Nos. 1, 2, 3, 4, and 5 and the Belltown Creek dam; diversion of unimpacted water from Belltown Creek and the Gypsum Ponds; and construction of the Dam No. 5 pump station) to protect the Ocoee River. As designed, these actions are reliably preventing discharge of mine-impacted water less than the 10-year, 24-hour storm event to the Ocoee River. The remaining capital expenditures, estimated to be less than $300,000, are

required to prevent human and ecological receptors from coming into contact with surface water and sediment in Davis Mill Creek that may cause unacceptable risk.

The difference in present worth cost between the lowest cost alternative (DMC-2 – DMC Removal Actions) and the selected alternative is approximately $4 million (using a 5 percent discount rate; see Table 12-1 for the 7 percent discount rate). As illustrated in Tables 12-2 and 12-3, this difference is primarily due to inclusion of an allowance for on-going replacement and refurbishment of the Cantrell Flat water treatment plant. Without additional refurbishment or replacement of aging components, the 30-year old treatment plant would be unreliable over the long-term.

The modifying criteria of State and Community Acceptance have been incorporated into the selected remedy. The State of Tennessee, as represented by TDEC, has been the support agency during the RI/FS process. TDEC provided input during the process in accordance with 40 CFR §300.430 and concurs with the selected remedies for OU3 (Appendix E). The community has participated in review of the Proposed Plan, and, based on the comments received, supports the Selected Remedies (Appendix C).

12.2 Description of the Selected Remedy

Alternative DMC-4, DMC Removal Actions plus Institutional and Enhanced Engineering Controls, is the selected alternative for OU3. Under the selected remedy, DMC-4, the Davis Mill Creek collection, conveyance, and treatment system as constructed pursuant to AOC Docket No. 01-12-C and AOC Docket No. CER-04-2003-3521 will be operated and maintained. This will permit treatment of OU3 water up to the 10-year, 24-hour storm event at the Cantrell Flats water treatment plant. Components of Alternative DMC-4 are depicted in Figure 11. As part of this alternative, uncontaminated surface discharge from Belltown Creek and the Gypsum Ponds up to the 10-year, 24-hour storm and storm flow in the West Drainage Channel exceeding 500 gpm, will be diverted to the Ocoee River. Treated water from the Cantrell Flats plant will be discharged to the Ocoee River through Outfall 009 in accordance with NPDES permit No. TN0002411 issued to Intertrade Holdings, Inc. Sludge generated during waste water treatment at Cantrell Flats will be piped and disposed in the Calloway mine as a slurry under UIC permit No. 83-12.

Alternative DMC-4 diverts 668 acre-feet of clean water out of the Davis Mill Creek watershed through the Belltown Creek diversion during the 10-year, 24-hour storm (calculated) and meets the storm water retention capacity requirements of a 10-year, 24-hour rainfall event (calculated at 438 acre-feet; SAIC, 2003b) utilizing the surge pond behind Dam No. 5 and storm water retention capacity behind Dam Nos. 1, 2, 3, and 4. Removal of sediment accumulated behind the dams (primarily Dam No. 5) will be required periodically to maintain the storm water capacity of the system. The removed sediment will be treated with lime to reduce acidity and contaminant mobility prior to or after disposal on Site at Carroll Hill. The pump station at Dam No. 5 is capable of pumping 5,200 gpm to the Cantrell Flats plant for treatment.

Although the Cantrell Flats treatment plant was refurbished in 2002, additional upgrades and refurbishment are anticipated to meet a 30 year life expectancy. The selected remedy includes funds to upgrade the plant as necessary beyond routine maintenance to maintain or improve operational efficiency.

The continued operation of the Cantrell Flats plant would be expected to result in meeting RAOs related to the Ocoee River. Monitoring of effluent quality from the waste water treatment plant will be conducted in accordance with the specifications of the NPDES permit.
Additionally, EPA and GSH will develop, with input from TDEC, and GSH will implement a monitoring program for the Copper Basin Reach of the Ocoee River that will document changes in identified risks in the river and document recovery processes. The program is expected to include monitoring of river water quality, sediment quality, sediment toxicity, benthic macroinvertebrate communities, and fish communities between Copperhill (RM 38) and the slack water of the Ocoee No. 3 Reservoir (RM 33.5). Results from the monitoring program will be compared to the RGs that have been developed for the Site and an iterative process will be developed to evaluate goal achievement. Monitoring will be conducted annually for at least 5 consecutive years to determine if the RAOs and RGs defined in Section 8.0 and Table 8-1 are being met. Should trends in monitoring data indicate that RAOs are being achieved, sampling frequencies may be reduced to an appropriate period as indicated by the data.

The selected remedy includes encapsulating and conveying to Davis Mill Creek the exposed surface water discharging from the North Potato Creek diversion tunnel and French drain outlets. To prevent mammalian or avian entry into the diversion tunnel, where potential contact with the contaminated water could occur, fencing and/or netting (or a similar approach) will be installed across the tunnel opening. Because these actions would result in a loss of water cover for the sediment in the French Drain and diversion tunnel drainages, exposed sediments would be covered with clean borrow.

Surface water in a portion of the upper section of OU3 contains high concentrations of manganese that exceed the remedial goal and pose a risk to current and future recreational trespassers from contact with this water. The segment that exceeds the manganese remedial goal is estimated at 1,300 feet in length. The selected remedy achieves risk reduction by the installation of a fence along both sides of Davis Mill Creek near the Headwaters calcine area to discourage access by trespassers.

Based on predicted site-wide average exposure concentrations after this remedy is implemented, hazard indices associated with surface water exposure pathways would be 1, <1, and <1 for the future recreational trespasser, current recreational trespasser and future industrial worker scenarios, respectively. The hazard index for all exposure scenarios would be less than the applicable target.

A summary of total capital costs associated with implementation of the Selected Remedy for the Site is presented in Table 12-2; operations and maintenance costs are summarized in Table 12-3. Capital costs for the selected remedy include enclosing the DMC Headwaters with a fence, encapsulation of the French drain and diversion tunnel outlet streams in pipes, covering sediment exposed by encapsulation with clean borrow, initial refurbishment of the Cantrell Flats plant,

implementing institutional controls, and costing interim removal actions (completed as of 2010). Costs include $133,000 for enclosing the DMC Headwaters with a fence. The Selected Remedy has a total capital cost of $9.8M and present worth O&M cost of $22.7M at a 5 percent discount rate. The total present worth cost for Alternative DMC-4 is $32.5M at a 5 percent discount rate.

13.0 Statutory Determinations

Based on the information currently available, EPA believes the chosen Preferred Alternative for OU3 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 Sections 121(b) and 121(d):

- 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 would meet the RAO for protection of the Ocoee River. Capture and treatment of OU3 water prior to reaching the river would prevent surface water and sediment pore water with high concentrations of metals from reaching the Ocoee River untreated. Conversion of Dam Nos. 1, 2, and 3 to storm water retention structures and construction of the Dams No. 4 and 5 serve to slow the flow of water through Davis Mill Creek and prevent mine-impacted sediment and interstitial pore water from reaching the Ocoee River. Since treatment of OU3 surface water was begun in 2002, vegetation on sediment bars in the Ocoee River near and downstream of the mouth of Davis Mill Creek has noticeably increased through natural recruitment. Additionally, up to a foot of clean sediment has been trapped by vegetation on many of the river bars immediately downstream of Davis Mill Creek. These changes have been attributed in part to improved water quality in the river resulting from treatment of OU3 waters.

The human health risk assessment determined that current and future recreational trespassers would face unacceptable hazards due to exposures to surface water in Davis Mill Creek. Exposures to cobalt in the French drain and manganese in the French drain, North Potato Creek Diversion Tunnel (in the middle section of Davis Mill Creek), and waters adjacent to the Headwaters iron calcine pile (the pile is located in OU4 adjacent to the upper section of the creek) were the primary contributors to risk. The HHRA concluded that exposure to OU3 sediment (also called subaqueous sediment) was not complete under current conditions per EPA Region 4 guidance (i.e., the sediment is not accessible for contact due to inundation by surface water). Evaluation of a future trespasser scenario where subaqueous sediment is dewatered and exposed resulted in an HI of 11 primarily due to cobalt, copper, iron, and lead, and an excess cancer risk of 1E-4 primarily due to arsenic.

The ecological risk assessment showed unacceptable risk primarily from exposure of terrestrial fauna to exposed sediment, soil and waste piles in OU4. Surface water in OU3 adjacent to and downstream of the Headwaters calcine pile (pile is within OU4) and surface water discharges

from the French drain and North Potato Creek diversion tunnel were found to pose unacceptable risk to terrestrial wildlife using NOAEL toxicity values. Surface water-related risk for mammalian species (maximum HI of 3.5) was attributable principally to aluminum. The HI for avian surface water exposure did not, however, exceed 1 for any species. Terrestrial wildlife exposure to permanently inundated sediment was considered incomplete and was not evaluated.

The selected remedy eliminates contact by humans and larger terrestrial organisms with surface water containing high concentrations of aluminum, cobalt, manganese, and/or zinc at the French drain, NPC diversion tunnel, and in OU3 adjacent to the Headwaters iron calcine pile. Exposure pathways for subaqueous sediments would remain incomplete for both human and terrestrial receptors because the current hydrology of DMC would not be changed. Based on predicted site-wide average exposure concentrations after this alternative is implemented, hazard indices associated with surface water exposure pathways would be 1, <1, and <1 for the future recreational trespasser, current recreational trespasser, and future industrial worker scenarios, respectively. The hazard index for all exposure scenarios would be less than the applicable target.

Institutional and security controls implemented as a part of the selected remedy would ensure that appropriate future uses are selected for the site conditions and assist in reducing trespasser access to the site. These controls would provide additional unquantifiable risk mitigation benefit.

13.2 Compliance with ARARs

The Selected Remedy will be designed to comply with all of the applicable or relevant and appropriate provisions of the statues, rules, regulations, and requirements presented in Tables 13-1 through 13-3. The selected remedy would comply with the chemical-specific ARARs (TDEC Water Quality Criteria in the receiving water body, i.e., the Ocoee River by ensuring that chemical-specific concentrations in the discharge of treated Davis Mill Creek and West Drainage Channel surface water pursuant to the requirements in NPDES Permit No. TN0002411 are attained.). Storm events above the 10-year, 24-hour flood are expected to exceed the storm water retention capacity in OU3 and may result in a discharge of untreated Davis Mill Creek water over the top of Dam No. 5. Additionally flow greater than 500 gpm from the West Drainage Channel would be diverted to the Belltown Creek Diversion and discharge untreated to the Ocoee River. In the event that storm flow exceeds the 10-yr, 24-hr storm event, the upset conditions of the NPDES permit would apply but chemical-specific ARARs for the protection of the Ocoee River may be temporarily exceeded during high flow conditions.

Location-specific ARARs for floodplains, wetlands, and historical structures would be met. Action-specific ARARs, including characterization and treatment of wastes, discharge of treated wastewater by NPDES Permit and underground disposal of waste water treatment sludge by UIC permit, would be met.

13.3 Cost Effectiveness

EPA has determined that the Selected Remedy is cost-effective and that the overall protectiveness of the remedy is proportional to the overall cost. As specified 40 CFR §300.430(f)(1)(ii)(D), the cost-effectiveness of the Selected Remedy was assessed by comparing the protectiveness of human-health and the environment in relation to three balancing criteria (i.e., long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; and short-term effectiveness) with the other alternatives considered.

The basis for EPA's determination of cost-effectiveness is summarized in Table 13-4. While more than one remedial alternative can be considered cost-effective, CERCLA does not mandate that the most cost-effective or least expensive remedy be selected. The estimated total cost (i.e., capital plus present worth of O&M costs) of the Selected Remedy is $32,500,000 at a five percent discount rate.

13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Although EPA recommends development of at least one alternative that would eliminate the need for long-term management at the site, no feasible permanent remedial alternatives for OU3 were identified due to the large volume of source material present in OU4. Many sources in OU4 are being removed, recycled, and reclaimed under terms of the 1990 Agreement and Covenant Not to Sue. As a result, conditions in OU4 are expected to improve, but long-term management may still be required.

13.5 Preference for Treatment as a Principal Element

The NCP at 40 CFR §300.430(a)(I)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. The selected remedy provides significant reductions in surface water metal loading to the Ocoee River from OU3. This alternative would annually divert approximately 707 Mgal of unimpacted water from Belltown Creek and the Gypsum Ponds away from contamination and prevent it from mixing with impacted waters in Davis Mill Creek. Based on treatment volumes reported for 2011, an estimated 774 Mgal of mine impacted water from Davis Mill Creek, the French drain, the North Potato Creek diversion tunnel, and the West Drainage Channel are captured and treated annually at the Cantrell Flats water treatment plant. These measures are estimated to prevent approximately 2,300 lbs/day of iron, 210 lbs/day of manganese, 390 lbs/day of zinc; and 6,750 lbs/day of acidity from reaching the Ocoee River.

13.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, and will take more

than five years to attain remedial action objectives and cleanup levels, a statutory review as required by CERCLA Section 121(c) will be conducted within five years after initiation of remedial actions to ensure that the Remedy is, or will be, protective of human health and the environment. Five-Year Reviews as specified by 40 CFR §300.430(f)(4)(ii) will be used to ensure the Site remains protective.

14.0 Documentation of Significant Changes

Pursuant to CERCLA 117(b) and NCP 300.430(f)(3)(ii), the ROD must document any significant changes made to the Preferred Alternative discussed in the Proposed Plan. The Proposed Plan for OU3 was released for public comment in July 2012. The Proposed Plan identified Alternative DMC-4, DMC Removal Actions plus Institutional and Enhanced Engineering Controls, as the Preferred Alternative for OU3. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

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TABLES

Table 1-1. General Description and Status of Actions Required in the Davis Mill Creek Watershed Under the 1990 Agreement and Covenant Not to Sue

Task or Subtask	Required Action	Status
Task 1. Davis Mill Creek Drainage Basin		
1.a	Divert the storm water ditch adjacent to State Highway 68-A from Davis Mill Creek to the Ocoee River.	Complete.
	Divert the East Acid Branch from the Ocoee River to the spill containment and storm water collection structure(s) as discussed in Task 1.d.	Completed in 1993.
1.b	Install a ditch around the Gypsum Pond to intercept surface water.	Completed in 1994; ditch was subsequently breached in seven locations to facilitate the Gypsum Pond diversion under EPA AOC Docket No. 01-12-C.
1.c	Divert the flow in Davis Mill Creek at a point above the Cantrell Flats water treatment plant directly to the Ocoee River, or near the Ocoee River below the main Chemical Plant in order to separate Davis Mill Creek base and storm flows, including the base and storm flows from Belltown Creek, from the wastewater discharges from the Chemical Plant.	Completed under EPA AOC Docket No. CER-04-2003-3521, as amended.
1.d	Construct spill containment and storm water collection structure(s) in the lower Davis Mill Creek drainage area. Treat collected water, including surface runoff from the Copperhill industrial area, process cooling water, and process wastewater at the Cantrell Flats plant prior to discharge to the Waters of the State.	Completed in 1993.
	Continue to implement "Spill Control and Response" procedures as long as the chemical plant continues operation.	Completed in 1993. No longer applicable since chemical production ceased in 2008.
	Implement Best Management Practices for "Toxic pollutants from oil and hazardous substances" contained in the NPDES permit, Part IV.	Completed in 1994.
	Implement N,N-dimethylaniline (DMA) monitoring and notification procedures for discharge 001 as specified in the draft NPDES permit. Continue to operate the "DMA seep" collection and treatment system until remediation efforts under Tasks 4.a and 4.b are completed.	Ongoing.
1.e	Discharge all non-contact cooling water from the Chemical Plant directly to the Ocoee River.	Completed in 1994. No longer applicable since chemical production ceased in 2008.

Table 1-1. General Description and Status of Actions Required in the Davis Mill Creek Watershed Under the 1990 Agreement and Covenant Not to Sue

Task or Subtask	Required Action	Status
1.f	Convert the existing diversion dam on Davis Mill Creek above CFWWTP (Dam 3) into a sedimentation trap.	Completed in 1995. Dam 3 subsequently reconfigured under EPA AOC Docket No. CER-04-2003-3521, as amended.
	Install two new sedimentation traps (Dams 1 and 2) to capture sediment which is in Davis Mill Creek.	Completed in 1995. Dams 1 and 2 subsequently reconfigured as storm water detention structures under EPA AOC Docket No. CER-04-2003-3521, as amended.
1.g	Upgrade the Cantrell Flats water treatment plant so that the effluent from the plant complies with discharge limits, including those for DMA process wastewaters.	Completed in 1994.
1.h	Treat the base flow in Davis Mill Creek in the Cantrell Flats water treatment plant for a period of two years. During this period, effluent from discharge 01A will meet the interim discharge limits.	Completed. Base flow treated through 1996.
Task 2. Reforesting of the Davis Mill Creek Watershed		
2	Beginning with the effective date of this Agreement and continuing for a period of five years, "reforest" approximately 20% of the Davis Mill Creek watershed each year, except for those portions which contain active manufacturing or reclaiming activities, are privately owned, or are otherwise covered in this SOW, until the watershed has been 100% reforested.	Partially complete. Areas of active or planned recycling (Carroll Hill, Mudflats slag, calcine stockpiles) will be reclaimed under EPA-approved work plans. Current owner continuing reforestation and forest management.
Task 3. North Potato Creek Drainage Basin		
3.d	Seal the Diversion Tunnel and upgrade the North Potato Creek Diversion Dam at the Diversion Tunnel. In conjunction with sealing the Diversion Tunnel, the North Potato Creek Diversion Dam will be upgraded to meet all applicable standards pursuant to the Tennessee Safe Dams Act.	Completed in 1992. The tunnel portal on Davis Mill Creek remains open; portal on North Potato Creek is sealed.
Task 4. Remediation of the Main TCC Manufacturing Area		
4.a	Investigate the source of the DMA in soils and take appropriate control measures to prevent the physical migration of the DMA offsite and/or to surface waters	Completed in 1993.
4.b	Construct any new wastewater treatment equipment or make any modifications to existing wastewater treatment equipment which may be needed to remove DMA from recovered ground water.	Continuing.

Table 1-1. General Description and Status of Actions Required in the Davis Mill Creek Watershed Under the 1990 Agreement and Covenant Not to Sue

Task or Subtask	Required Action	Status
4.c	Install equipment to collect and treat petroleum contaminated ground water. Remediate petroleum contamination in surface water to a "no visible sheen" standard.	Completed in 1999.
Task 5. Voluntary Reforestation		
5	Participate voluntarily with TVA, the Soil Conservation Service and others in the reforestation program for those portions of the existing TCC property which Boliden does not acquire.	Letters notifying of voluntary reforestation program were sent to other parties in 1990.
Task 6. Other Operations		
6	Use BMPs to control surface water runoff from these active copper slag and iron calcine recovery areas to minimize the impact of these activities on the Davis Mill Creek watershed and to reclaim (sloped, graded, filled with soil where necessary and stabilized using a permanent vegetative cover to prevent erosion) the active recovery areas when all usable materials have been recovered from them.	Ongoing.
Task 7. Gypsum Pond		
7	Close the Gypsum Pond at the end of its useful operating life, or by the end of the tenth year after the effective date of this Agreement, whichever comes first. The Gypsum Pond will be closed by draining standing water, stabilizing materials in the pond and reclaiming it. The Gypsum Pond, or any portion of it, will be "reclaimed" when surface water does not pond on it and a permanent vegetative cover has been established.	Not completed. The Gypsum Pond is an area of active waste recycling.
Other Actions not Specified in 1990 Agreement		
Mine Safety		Fencing 200 feet of Mary Mine and 1,650 feet around old Calloway mine were included to limit public access the mine areas.

Table 1-2. Summary of Alternative Components Screened in 2003 Focused Feasibility Study

Water Source/Contributing Factor	Alternative Component	Screening
Belltown Creek	No action	Retained
	Diversion specified by AOC 01-12-C	Retained
	Partial diversion	Retained
Sediment Ponds	No action	Retained
	Conversion to storm water retention ponds	Represented by conversion to storm water ponds and raising the height of dams 1 & 2 by 5 feet
	Conversion to storm water retention ponds and raising pond 2 dam by 5 feet and pond 1 dam height (5, 10, 20, or 30 feet)	Retained (up to 5 feet increase in height) Rejected (10, 20, and 30 ft increases) – effectiveness and implementability
Davis Mill Creek	No action	Retained
	Capture and treat flow above West Drainage Channel	Rejected – effectiveness
	Capture and treat flow below West Drainage Channel	Retained
	Capture and treat flow above and below West Drainage Channel	Rejected – effectiveness
	Channel and substrate stabilization	Retained
	Sediment removal	Rejected – effectiveness
West Drainage Channel	No action	Retained
	Capture and treat West Drainage Channel	Retained
	Divert upper/Capture and treat lower West Drainage Channel	Retained
Increase Storm Water Storage Capacity	No action	Retained
	Additional storm water capacity at Cantrell Flats	Retained
	Additional storm water capacity at Carroll Hill	Represented by additional storm water capacity at Cantrell Flats
	Additional storm water capacity at railroad yard	Represented by additional storm water capacity at Cantrell Flats
Cantrell Flats Water Treatment Plant	Cantrell Flats plant operating	Retained
	Cantrell Flats plant not operating	Retained

Table 5-1. Maximum Concentrations for Surface Water Samples in OU3

		Davis Mill Creek OU3			Surface Water Inflows to OU3			
		Origin to Dam No. 1	Dam No. 1 to Dam No. 3	Dam No. 3 to Ocoee River[1]	Gypsum Pond Tributary	French Drain	NPC Diversion Tunnel	West Drainage Channel
Aluminum (diss)	µg/L	54,400	9,310	2,050	1,280	18,000	70,000	15,300
Antimony (diss)	µg/L	0.42 U	0.084 U	0.13	0.084 U	2 U	63 UJ	0.47 U
Arsenic (diss)	µg/L	11.3 J	3.6 J	0.22	1.1	85 J	73 J	3.4
Cadmium (diss)	µg/L	38.7	13.3 J	2.1	10.3	130	41 J	14.9 J
Chromium (diss)	µg/L	18.2 U	2.5	2.3	1.8 U	69.9	1.5 U	2.5
Cobalt (diss)	µg/L	2,000 J	1,730	94.5	274	21,200	4,900	551
Copper (diss)	µg/L	1,040	437	366	4.2	4,510	1,700	2,000
Iron (diss)	µg/L	2,120,000 J	438,000	13,100 J	172	3,760,000 J	330,000	2,210
Lead (diss)	µg/L	11.1	9.5	0.46	0.82	59.8	34	9.1
Manganese (diss)	µg/L	80,700	43,700	3,390	14,800	390,000	110,000	13,700
Mercury (diss)	µg/L	0.48 U	0.048 U	0.42 J	0.048 U	0.20 U	0.20 U	0.055 U
Nickel (diss)	µg/L	302	127	19	39.6	1,300	420 J	64.2
Selenium (diss)	µg/L	175 J	42.6 J	1.6	17.4	17 J	6.6	22.7 J
Zinc (diss)	µg/L	15,800 J	70,800	2,550	1,770	1,150,000 J	110,000	6,160
Sulfate (total)	mg/L	6,510 J	2,120	153	774	15,500	2,600	374
Acidity (total)	mg/L	4,070 J	1,300	268	20.6	8,000	1,580	114
pH	units	2.26 *	2.48 *	4.05 *	5.01 *	3.42 *	2.42 *	3.83 *

1 At the time of sampling, creek water was removed for treatment above Dam No. 3 and the Belltown diversion discharged below Dam No. 3
* minimum value
U – nondetected, value shown is detection limit; J – value is an estimate
Data are from Tables 5.3.15, 5.5.18, 5.5.19, 5.5.22, 5.5.24, and 5.5.27 in BWSC (2012a).

Table 5-2. Contaminant Mass Loads in Surface Water in OU3

		Davis Mill Creek OU3 *			Inflows to OU3			
		Load Increase [1] Origin to Dam No. 1	Load Increase [2] Dam No. 1 to Dam No. 3	Load Increase [3] Dam No. 3 to Ocoee River	Gypsum Pond Tributary	French Drain	NPC Diversion Tunnel	West Drainage Channel
Aluminum	Lb/day	17.8	26.8	21.1	0.0	1.0	10.0	5.8
Antimony	Lb/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic	Lb/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium	Lb/day	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Chromium	Lb/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt	Lb/day	1.8	6.5	1.5	0.0	0.9	0.6	0.2
Copper	Lb/day	1.1	1.0	6.2	0.0	0.1	0.1	0.8
Iron	Lb/day	760	1,340	213	0.0	167	48.3	0.3
Lead	Lb/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manganese	Lb/day	78.1	131	63.4	0.9	19.8	9.1	5.5
Mercury	Lb/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nickel	Lb/day	0.2	0.4	0.3	0.0	0.1	0.1	0.0
Selenium	Lb/day	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Zinc	Lb/day	40.8	299	47.7	0.2	53.5	11.4	2.7
Ca+Mg+Na+K	Lb/day	824	693	858	170	101	51.5	45.7
Sum of Metals	Lb/day	1,724	2,498	1,211	171.1	343.4	131.1	61

Table 5-2. Contaminant Mass Loads in Surface Water in OU3

		Davis Mill Creek OU3 *			Inflows to OU3			
		Load Increase [1] Origin to Dam No. 1	Load Increase [2] Dam No. 1 to Dam No. 3	Load Increase [3] Dam No. 3 to Ocoee River	Gypsum Pond Tributary	French Drain	NPC Diversion Tunnel	West Drainage Channel
Sulfate	Lb/day	4,622	5,304	2,833	375	777	432	169
Acidity	Lb/day	1,146	5,084	537	<6	452	252	47.2

* Mass load in Davis Mill Creek includes load contributions from other surface water inflows shown on table.
[1] Load at station DP1W-01 on 11/9/2005; Table 5.5.21 (BWSC, 2012a)
[2] Load at station DP1W-04 on 11/9/2005 minus load at station DP1W-01; Table 5.5.25 (BWSC, 2012a)
[3] Load at station D1106 on 11/7/2009 minus load at station BC-1 (Belltown Creek discharge); Table 5.5.27 (BWSC, 2012a)
Gypsum Pond tributary load assumes 100 gpm and concentrations at station DGTW-03 (Table 5.5.18, BWSC (2012a))
French drain load assumes 5 gpm and median concentrations for station D1098 (Table 5.5.22, BWSC (2012a))
Diversion Tunnel load assumes 15 gpm and median concentrations for station D1108 (Table 5.5.22, BWSC (2012a))
West Drainage Channel assumes 50 gpm and median concentrations for station D1294B (Table 5.3.15, BWSC (2012a))

Table 5-3. Maximum Concentrations and Average Constituent Loads for Surface Water Samples in Belltown Creek (diverted to Ocoee River)

	Maximum Concentration		Average Load	
Aluminum (diss)	µg/L	85.5 U	Lb/day	<0.3
Antimony (diss)	µg/L	0.43 U	Lb/day	0.0
Arsenic (diss)	µg/L	0.42 J	Lb/day	0.0
Cadmium (diss)	µg/L	0.14 U	Lb/day	0.0
Chromium (diss)	µg/L	1.1 U	Lb/day	0.0
Cobalt (diss)	µg/L	7.9 U	Lb/day	0.0
Copper (diss)	µg/L	1.9	Lb/day	0.0
Iron (diss)	µg/L	1,060	Lb/day	2.3
Lead (diss)	µg/L	1.6 J	Lb/day	0.0
Manganese (diss)	µg/L	109	Lb/day	0.4
Mercury (diss)	µg/L	0.11	Lb/day	0.0
Nickel (diss)	µg/L	4.4 U	Lb/day	0.0
Selenium (diss)	µg/L	0.71 U	Lb/day	0.0
Zinc (diss)	µg/L	179	Lb/day	0.7
Sulfate (total)	mg/L	42.8	Lb/day	199
Acidity (total)	mg/L	5 U	Lb/day	<58
pH	units	5.51	---	---
Ca+Mg+K+Na (diss)	---	---	Lb/day	156

* Minimum value
U – Nondetected, value shown is detection limit; J – value is an estimate.
Data for 16 samples from station BC-1, Table 5.3.16 (BWSC, 2012a)

Table 5-4. Maximum Concentrations for Sediment Samples in OU3

		Davis Mill Creek OU3			Inflows to OU3			
		Origin to Dam No. 1	Dam No. 1 to Dam No. 3	Dam No. 3 to Ocoee River	Gypsum Pond Tributary	French Drain	NPC Diversion Tunnel	West Drainage Channel
Aluminum	mg/kg	45,700 J	26,500 J	55,200	60,900	3,700	15,700 J	19,500
Antimony	mg/kg	50 J	0.39 J	1.42 J	10 J	0.49 UJ	0.17 J	0.12 J
Arsenic	mg/kg	36.4 J	12 J	25.6 J	100 U	11	6.3	2.8 J
Cadmium	mg/kg	20 U	19	6.4 J	10 U	20 U	2.3 J	0.63
Chromium	mg/kg	70 U	39.5 J	58.2 J	53	9.7	25.9 J	37.2
Cobalt	mg/kg	159 J	84	66.1	128 J	54	29.4	41.4
Copper	mg/kg	4,860	2,350	15,400 J	1,450	460	837 J	7,430
Iron	mg/kg	521,000	547,000	479,000 J	198,000	410,000	113,000	82,900
Lead	mg/kg	7,190 J	613	815	9,110	90	279	199
Manganese	mg/kg	2,250	1,340 J	1,850	2,310	606	374 J	877 J
Mercury	mg/kg	0.18	0.2	1.14 J	0.2	2.5 U	0.15	0.03 J
Nickel	mg/kg	26.5	24	67.4	28	8.3	9.6	6.73 J
Selenium	mg/kg	32 J	30 J	8.9 J	39	6 J	3.1	1.4 J
Zinc	mg/kg	12,400 J	11,700	11,600	4,410	4,510	2,530	2,670 J
BaP Equiv.	mg/kg			3.49				

U – nondetected, value shown is detection limit; J – value is an estimate
Data are from Tables 5.2.12, 5.2.19, 5.2.39, 5.2.57, 5.2.60, 5.3.5, 5.3.25, 5.4.20, 5.4.25, and 5.4.30 in BWSC (2012a) and Appendix Table D-7 in SAIC (2003a).

Table 5-5. Maximum Concentrations for Sediment Pore Water Samples in OU3

		Davis Mill Creek OU3			Surface Water Inflows to OU3		
		Origin to Dam No. 1	Dam No. 1 to Dam No. 3	Dam No. 3 to Ocoee River[1]	Gypsum Pond Tributary	French Drain	NPC Diversion Tunnel
Aluminum (diss)	µg/L	69,000	112,000	14,200	84	14,000 J	72,100
Antimony (diss)	µg/L	16 J	0.24 U	1.23	0.084 U	30 J	0.25 U
Arsenic (diss)	µg/L	14.4	13.9	14	0.54	19 J	23.5
Cadmium (diss)	µg/L	615	97.7	73.9	0.39 U	14 J	83
Chromium (diss)	µg/L	51.7	21	9.6	1.8 U	12 J	23.6
Cobalt (diss)	µg/L	5,460	15,500	3,880 J	11.3	5,500 J	12,000
Copper (diss)	µg/L	5,570	8,420	50,000	3.0	42 J	13.1
Iron (diss)	µg/L	1,920,000	4,000,000	754,000	29.2 U	1,400,000	972,000
Lead (diss)	µg/L	200	23.5	384	0.43	37 J	17.6
Manganese (diss)	µg/L	291,000	385,000	143,000	662	160,000 J	248,000
Mercury (diss)	µg/L	0.26	0.057	0.2 U	0.048 U	0.2	0.048 U
Nickel (diss)	µg/L	941	1,050	643	4.3 U	320 J	803
Selenium (diss)	µg/L	180	91.2	97.7 U	21.6 J	31 J	228
Zinc (diss)	µg/L	48,600	855,000	150,000	159	320,000 J	340,000 J
Sulfate (total)	mg/L	4,210	16,100	4,300 J	272	6,230	6,460
Acidity (total)	mg/L	4,100	8,300	1,520	5 U	3,200	1,710
pH	units	3.07 *	3.07 *	3.88 *	4.34 *	4.57 *	4.39 *

* minimum value
U – nondetected, value shown is detection limit; J – value is an estimate
Data are from Tables 5.2.18, 5.2.20, 5.2.24, 5.2.40, 5.2.41, 5.2.54, 5.2.55, 5.3.6, 5.3.23, 5.4.27, 5.4.28, and 5.4.33 in BWSC (2012a).

Table 5-6. Summary of Daily Mass Loads in Surface Water in OU3

	Total Load Collected in OU3 (lb/day)	Percent of Total Metals	Percent of Total Load Collected in Upper Section	Percent of Total Load Collected in Middle Section	Percent of Total Load Collected in Lower Section
Aluminum	65.7	1.2	27.1	40.8	32.1
Cadmium	0.1	0.0	---	---	---
Cobalt	9.8	0.2	18.4	66.3	15.3
Copper	8.3	0.2	13.3	12.0	74.7
Iron	2,313	42.6	32.9	57.9	9.2
Manganese	272.5	5.0	28.7	48.1	23.3
Nickel	0.9	0.0	---	---	---
Selenium	0.2	0.0	---	---	---
Zinc	387.5	7.1	10.5	77.2	12.3
Ca+Mg+Na+K	2,375	43.7	34.7	29.2	36.1
Sum of Metals	5,433	---	31.7	46.0	22.3
Sulfate	12,759	---	36.2	41.6	22.2
Acidity	6,767	---	16.9	75.1	7.9

Based on loads shown in Table 5-2 calculated for base flow sampling in November 2005.

Table 7-1. Chemicals of Potential Concern in Davis Mill Creek

COPC	Surface Water	Sediment
Arsenic		•
Benzo(a)pyrene		•
Cobalt	•	•
Copper		•
Iron	•	•
Lead		•
Manganese	•	•
Mercury		•

Table 7-2. Summary of HHRA Exposure Scenarios to Sediment and Surface Water (Ingestion and Dermal Contact)

Scenarios	General Exposure Assumptions
Sediment	
Current Onsite Industrial Worker	Adult exposure: 250 days/yr for 25 years.
Future Onsite Industrial Worker	Adult exposure: 250 days/yr for 25 years.
Current Recreational Trespasser (Adolescent/Adult)	Adolescent exposure: 39 days/yr (3 times per week for 13 weeks) for 10 years .Adult exposure: 26 days/yr for 30 years.
Future Recreational Trespasser (Child/Adolescent/Adult)	Child exposure: 26 days/yr (2 times per week for 13 weeks) for 6 years. Adolescent exposure: 39 days/yr (3 times per week for 13 weeks) for 10 years. Adult exposure: 26 days/year for 14 years.
Surface Water	
Current Onsite Industrial Worker	Adult exposure: 50 days/yr (1 hr/day @1 day per week in the creek) for 25 years.
Future Onsite Industrial Worker	Adult exposure: 50 days/yr..
Current Recreational Trespasser (Adolescent/Adult)	Adolescent exposure: 39 days/yr @ 2 hrs/day for 10 years. Adult exposure: 26 days/year @ 2 hrs/day for 30 years.
Future Recreational Trespasser (Child/Adolescent/Adult)	Child exposure: 26 days/yr (2 times per week for 13 weeks) @ 2 hrs/day for 6 years. Adolescent exposure: 39 days/yr (3 times per week for 13 weeks) @ 2 hrs/day for 10 years. Adult exposure: 26 days/year @ 2 hrs/day for 14 years.

Table 7-3. Summary of HHRA Risks from Exposure to Surface Water and Sediment

Scenarios	Surface Water			Exposed Sediment		
	Hazard Index	Cancer Risks	Chemicals of Concern	Hazard Index	Cancer Risks	Chemicals of Concern
Current Industrial Worker	1	NA	None	0.08	2E-6	Arsenic
Future Industrial Worker	1	NA	None	0.9	2E-5	Arsenic, BaP_{EQ}, Lead
Current Recreational Trespasser	3	NA	Cobalt, Manganese	2	4E-6	Lead, Arsenic
Future Recreational Trespasser	5	NA	Cobalt, Iron, Manganese	11	1E-4	Cobalt, Copper, Iron, Manganese, Mercury, Arsenic, BaP_{EQ},

NA – Not Applicable
BaP_{EQ} – Benzo(a)pyrene equivalence

Table 7-4. Media Concentrations Protective of Human Health (Remedial Goal Options)

COC	Surface Water (µg/L)	Sediment (mg/kg)
Arsenic	--	3.9
Benzo(a)pyrene	--	0.15
Cobalt	2,600	23
Copper	--	2,875
Iron	4,849,000	54,597
Lead	--	1,082[a]
Manganese	35,000	3,362
Mercury	--	23

HHRA - Human Health Risk Assessment
COC - Chemical of Concern
-- - Not a COC
a – based on exposure by an adolescent female

Table 7-5. Summary of Final Ecological Chemicals of Potential Concern

COPC	Surface Water	Exposed Sediment[1]
Terrestrial Wildlife		
Aluminum	●	
Antimony	●	●
Arsenic	●	●
Cadmium	●	●
Chromium Total	●	●
Cobalt	●	●
Copper		●
Lead	●	●
Manganese	●	●
Mercury	●	●
Nickel	●	●
Selenium	●	●
Zinc	●	●
HMW-PAHs		●

[1] As represented by soil and waste samples
HMW-PAHs – High molecular weight polycyclic aromatic hydrocarbons

Table 7-6. Concentrations Protective of Ecological Receptors

Parameter	Mammalian		Avian	
	NOAEL Basis	LOAEL Basis	NOAEL Basis	LOAEL Basis
Exposed Sediment (mg/kg)				
Antimony	0.405	14.4	NA	NA
Arsenic	97	675	103	228
Cadmium	0.575	9.0	1.13	7.1
Chromium Total	52.3	1,275	43.7	256
Cobalt	380	985	242	585
Copper	74	915	43	372
Lead	94	8,500	19.3	975
Manganese	10,250	38,000	11,500	23,500
Mercury	1.52	2.17	1.03	5.6
Nickel	11	96	37	103
Selenium	1.08	8.6	2.2	8.6
Zinc	245	13,200	115	1580
HMW-PAHs	1.63	102	4.7	47
Surface Water (µg/L)				
Aluminum	12,900	129,000	720,000	7,200,000
Antimony	395	14,000	NA	NA
Arsenic	6,920	30,500	14,600	29,400
Cadmium	5,150	46,000	9,600	41,500
Chromium Total	16,000	390,000	17,400	102,000
Cobalt	49,000	126,000	50,000	120,000
Lead	31,500	1,240,000	10,700	290,000
Manganese	345,000	970,000	1,170,000	2,280,000
Mercury	510	730	445	2,420
Nickel	11,300	99,000	44,000	122,000
Selenium	950	4,400	1,900	5,350
Zinc	504,000	1,975,000	432,000	1,120,000

HMW-PAH – High molecular weight polycyclic aromatic hydrocarbons
NA – Not applicable
NOAEL – No observed adverse effects level
LOAEL – Lowest observed adverse effects level

Table 8-1. Remedial Goals for Surface Water and Sediment in OU3

Surface Water Remedial Goals (µg/L)		
COC	**RG for Human Health [a]**	**RG for Terrestrial Wildlife [b]**
Aluminum	--	**59,900**
Antimony	--	**2,400**
Arsenic	--	**14,500**
Cadmium	--	**15,400**
Chromium Total	--	**42,100**
Cobalt	**2,600**	77,500
Iron	**4,849,000**	--
Lead	--	**56,000**
Manganese	**35,000**	578,000
Mercury	--	**600**
Nickel	--	**33,400**
Selenium	--	**2,000**
Zinc	--	**696,000**
Sediment Remedial Goals (mg/kg)		
COC	**RG for Human Health [a]**	**RG for Terrestrial Wildlife [b]**
Antimony	--	**2.4**
Arsenic	**3.9**	153
Benzo(a)pyrene Equivalence	**0.15**	--
Cadmium	--	**2.3**
Chromium Total	--	**106**
Cobalt	**23**	376
Copper	2,875	**126**
Iron	54,597	--
Lead	1,082[c]	**137**
Manganese	**3,362**	16,439
Mercury	23	**1.8**
Nickel	--	**32.5**
Selenium	--	**426**
Zinc	--	**426**
HMW - PAHs	--	**12.9**

-- - Not a COC.
Bolded number indicates final RG.
a - From Table 7.1.88 of the HHRA.
b – Derived from Table 7.2.29. All RGs are below the LOAEL and largely based on the geometric mean between NOAEL and LOAEL.
c – Based on exposure by an adolescent female from Table 7.1.91 of the HHRA.
HMW- PAHs - High molecular weight polycyclic aromatic hydrocarbons.

Table 8-2. Remedial Goals for Surface Water and Sediment Discharging Directly into the Ocoee River

Constituent[1]	Surface Water Quality Goal		Sediment
	Acute	Chronic	Copper Basin Reach
	(µg/L)	(µg/L)	(mg/kg)
Copper	2.5	2.0	640
Iron	--	1000	53,000
Lead	--	--	250
Zinc	26	26	970

[1] copper and zinc goals for surface water are for the dissolved phase and based on a hardness of 17 mg/L ($CaCO_3$) as determined in the Ocoee River RI (Black & Veatch, 2008); iron goal is for the total phase.

Table 12-1. Comparison of Capital and O&M Costs and Components between Lowest Cost Alternative and Selected Remedy

	DMC-2 -- DMC Removal Action	DMC-4 -- Selected Alternative
Estimated Capital Costs for Components	***$9.5 Million***	***$9.8 Million***
Deed Notification/Deed Restriction		•
Refurbish Cantrell Flats Water Treatment Plant	•	•
Design and Construct Dam 4	•	•
Divert Belltown Creek and Gypsum Pond	•	•
Install Dam 5 Pump Station	•	•
Encapsulate French Drain and Diversion Tunnel		•
Install Fencing at Headwaters Calcine Pile		•
Estimated Present Worth Cost for O&M Components	***$18.7 Million (@5%)[1]*** ***$15.1 Million (@7%)[1]***	***$22.7 Million (@5%)[1]*** ***$18.3 Million (@7%)[1]***
Cantrell Flats Operation	•	•
Cantrell Flats Refurbishment/Maintenance		•
Dam 4 Sediment Clean Out and O&M	•	•
Dam 3 Sediment Clean Out	•	•
Dam 1 and 2 Sediment Clean Out	•	•
Dam 5 Sediment Clean Out	•	•
Belltown Diversion O&M	•	•
Maintain Dam 5 Pump Station	•	•
French Drain and Diversion Tunnel Encapsulation O&M		•
Headwaters Calcine Fencing O&M		•
Five Year Review	•	•

[1] Discount rate

Table 12-2. Capital Cost Estimate Summary for the Selected Alternative

Component	Capital Cost	Status
Deed Notification/Deed Restriction	$89,600	Completed
Refurbish Cantrell Flats Water Treatment Plant	$289,600	Completed
Design and Construct Dam 4	$1,500,000	Completed
Divert Belltown Creek and Gypsum Pond	$6,600,000	Completed
Install Dam 5 Pump Station	$1,144,000	Completed
Encapsulate French Drain and Diversion Tunnel	$43,800	Not Completed
Install Fencing at Headwaters Calcine Pile	$133,000	Not Completed
Capital Cost of Completed Components		$9,600,000
Capital Cost of Components Yet to be Completed		$200,000
Total Capital Costs[1]		***$9,800,000***

[1]Numbers may not add up exactly due to rounding

Table 12-3. O&M Cost Estimate and Present Worth Summary for the Selected Alternative DMC-4

Annual Operation and Maintenance Costs					
Description	**Frequency**	**Total Events**	**Cost/Event**	**Present Worth**	
				5% Discount Rate	7% Discount Rate
Cantrell Flats Operation	Annually	30	$1,100,000	$16,900,000	$1,365,000
Cantrell Flats Refurbishment/ Maintenance	Annually	30	$260,000	$3,996,800	$3,226,400
Dam 4 Sediment Clean Out and O&M	Annually	30	$2,000	$30,700	$29,800
Dam 3 Sediment Clean Out	Every 5 Years	6	$5,000	$13,900	$10,800
Dam 1 and 2 Sediment Clean Out	Once	1	$20,000	$4,600	$2,600
Dam 5 Sediment Clean Out	Annually	30	$2,000	$30,700	$24,800
Belltown Diversion O&M	Annually	30	$4,400	$67,600	$54,600
Maintain Dam 5 Pump Station	Annually	30	$100,000	$1,537,200	$1,240,900
French Drain and Diversion Tunnel Encapsulation O&M	Annually	30	$500	$9,900	$8,000
Headwaters Calcine Fencing O&M	Annually	30	$1,600	$25,000	$20,200
Five Year Review	Every 5 Years	6	$20,000	$61,500	$49,600
Summary of Present Worth for Selected Remedy					
Present Worth Cost of O&M[1]				$22,688,000	$18,312,700
Total Present Worth of Capital and O&M Costs[1]				$32,488,000	$28,112,700

[1]Numbers may not add up exactly due to rounding

Table 13-1. Chemical-Specific ARARs Copper Basin Mining District Site - OU3

Action/Media	Requirements	Prerequisite	Citation(s)
Protection of Waters of the State (DMC at discharge point to the Ocoee River)	Requires water quality within the Ocoee River be protective of the following uses: Fish and Aquatic Life, Industrial Water Supply, Recreational, Livestock Watering and Wildlife, and Irrigation.	Discharge of pollutants to surface waters – **applicable**	TDEC 1200-4-4-.08
Treated wastewater discharge to Ocoee River	The criteria and standards provide that all discharges of sewage, industrial waste, and other waste shall receive the degree of treatment or effluent reduction necessary to comply with water quality standards, or state or federal laws and regulations pursuant thereto, and where appropriate will comply with the "Standards of Performance" as required by the Tennessee Water Quality Control Act, (TCA §§69-3-101, et seq.). Discharge of treated OU3 water to the Ocoee River must comply with the requirements of NPDES Permit No. TN0002411. *Daily Max Monthly Ave* *mg/L mg/L* *Flow report report* *pH 6-9 6-9* *Cadmium (T) 0.07 0.037* *Chromium (T) 0.38 0.10* *Copper 0.35 0.20* *Lead 0.24 0.22* *Nickel 0.49 0.20* *Zinc 1.40 0.50* *Hardness report report*	Discharges of sewage, industrial waste, and other waste – **applicable**	TDEC 1200-04-03-.05(6)

Table 13-1. Chemical-Specific ARARs Copper Basin Mining District Site - OU3

Action/Media	Requirements	Prerequisite	Citation(s)
Protection of Waters of the State classified for *Fish and Aquatic Life* (DMC at discharge point to the Ocoee River)	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 and animals, or impair the safety of conventionally treated water supplies. The following criteria are for the protection of fish and aquatic life: *Compound* — *Maximum Concentration (µg/l)* — *Continuous Concentration (µg/l)* *Cadmium*** — *2.0* — *0.25* *Chromium, III*** — *570* — *74* *Chromium, VI** — *16* — *11* *Copper*** — *13* — *9* *Lead*** — *65* — *2.5* *Nickel*** — *470* — *52* *Zinc*** — *120* — *120* * Criteria for these metals are expressed as dissolved. ** Criteria for these metals are expressed as dissolved and are a function of total hardness (mg/L). Hardness-dependent metals criteria may be calculated from values displayed at TDEC 1200-4-3-.03(3)(g)	Discharge of pollutants to surface waters – **relevant and appropriate**	TDEC 1200-4-3-.03(3)(g) Toxic Substances
	The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.		TDEC 1200-4-3-.03(3)(h) Other Pollutants

Table 13-1. Chemical-Specific ARARs Copper Basin Mining District Site - OU3

Action/Media	Requirements	Prerequisite	Citation(s)
	The waters shall not contain iron at concentrations that cause toxicity or in such amounts that interfere with habitat due to precipitation or bacteria growth.		TDEC 1200-04-03(3)(i) Iron
Protection of Waters of the State classified for *Industrial Water Supply* (DMC at discharge point to the Ocoee River)	The waters shall not contain toxic substances whether alone or in combination with other substances, which will adversely affect industrial processing.	Discharge of pollutants to surface waters – **relevant and appropriate**	TDEC 1200-04-03(2)(i) Toxic Substances
	The waters shall not contain other pollutants in quantities that may adversely affect the water for industrial processing.		TDEC 1200-04-03(2)(j) Other Pollutants
Protection of Waters of the State classified for *Recreational* (DMC at the discharge point to the Ocoee River)	The waters shall not contain toxic substances, whether alone or in combination with other substances, that will render the waters unsafe or unsuitable for water contact activities including the capture and subsequent consumption of fish and shellfish, or will propose toxic conditions that will adversely affect man, animal, aquatic life, or wildlife.	Discharge of pollutants to surface waters – **relevant and appropriate**	TDEC 1200-04-03(4)(j) Toxic Substances
	The waters shall not contain other pollutants in quantities which may have a detrimental effect on recreation.		TDEC 1200-04-03(4)(k) Other Pollutants
Protection of Waters of the State classified for *Livestock Watering and Wildlife* (DMC at the discharge point to the Ocoee River)	The waters shall not contain substances whether alone or in combination with other substances, which will produce toxic conditions that adversely affect the quality of the waters for livestock watering and wildlife.	Discharge of pollutants to surface waters – **relevant and appropriate**	TDEC 1200-04-03(6)(f) Toxic Substances
	The waters shall not contain other pollutants in quantities which may be detrimental to the water for livestock watering and wildlife.		TDEC 1200-04-03(6)(f) Toxic Substances

Table 13-1. Chemical-Specific ARARs Copper Basin Mining District Site - OU3

Action/Media	Requirements	Prerequisite	Citation(s)
Protection of Waters of the State classified for *Irrigation* (DMC at the discharge point to the Ocoee River)	The waters shall not contain toxic substances whether alone or in combination with other substances which will produce toxic conditions that adversely affect the quality of the waters for irrigation.	Discharge of pollutants to surface waters – **relevant and appropriate**	TDEC 1200-04-03-(5)(f) Toxic Substances
	The waters shall not contain other pollutants in quantities which may be detrimental to the waters used for irrigation.		TDEC 1200-04-03-(5)(f) Other Pollutants

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulation*
EPA = U.S. Environmental Protection Agency
TCA = *Tennessee Code Annotated*
TDEC = Rules of the Tennessee Department of Environment and Conservation, Chapter as noted

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

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:	Fugitive emissions from demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land – **applicable**	TDEC 1200–3–8–.01(1)
	• use, where possible, of water or chemicals for control of dust, and		TDEC 1200–3–8–.01(1)(a)
	• application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts;		TDEC 1200–3–8–.01(1)(b)
	Shall not cause or allow fugitive dust to be emitted in such a manner as to exceed 5 minute/hour or 20 minute/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 1200–4–10–.03(2)
	• does not violate water quality criteria as stated in TDEC 1200–4–3–.03 including but not limited to prevention of discharges that cause 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	Storm water discharges from construction activities; Discharge compliance with state water quality standards – **TBC**	*NPDES General Permit No. TNR100000* Section 5.3.2(a)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
	• does not contain distinctly visible floating scum, oil, or other matter;		*NPDES General Permit No. TNR100000* Section 5.3.2(b)
	• does not cause an objectionable color contrast in the receiving stream; and		*NPDES General Permit No. TNR100000* Section 5.3.2(c)
	• 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.		*NPDES General Permit No. TNR100000* Section 5.3.2(d)
Waste characterization and storage–primary wastes (contaminated media) and secondary wastes (wastewaters, sludge, spent treatment media, etc.)			
Characterization of *solid waste* (all primary and secondary wastes)	Must determine if solid waste is a hazardous waste using the following method: • Should first determine if waste is excluded from regulation under 40 CFR261.4; and • Must then determine if waste is listed as a hazardous waste under subpart D 40 CFR part 261.	Generation of solid waste as defined in 40 CFR261.2 – **applicable**	40 CFR262.11(a) and (b) TDEC 1200–1–11–.03(1)(b)(1)
	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 CFR260.21; <u>or</u> (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 1200–1–11–.03(1)(b)(3)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
	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 1200–1–11–.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 CFR268 *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 1200–1–11–.10(1)(i)(1)
	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 1200–1–11–.10(1)(i)(1)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
	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 1200–1–11–.10(1)(g)(1)(i)
	Must comply with the special requirements of 40 CFR 268.9 in addition to any applicable requirements in CFR 268.7.	Generation of waste or soil that displays a hazardous characteristic of ignitability, corrosivity, reactivity, or toxicity for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) TDEC 1200–1–11–.10(1)(g)(1)(i)
Treatment/disposal of wastes – primary (contaminated media) and secondary wastes (wastewater treatment sludge, 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 CFR268.40 before land disposal.	Land disposal, as defined in 40 CFR268.2, of restricted RCRA waste – **applicable**	40 CFR 268.40(a) TDEC 1200–1–11–.10(3)(a)(1)
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR 268.48 Table UTS prior to land disposal	Land disposal of restricted RCRA characteristic wastes (D001 –D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **applicable**	40 CFR 268.40(e) TDEC 1200–1–11–.10(3)(a)(5)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
	Must be treated according to the alternative treatment standards of 40 CFR268.49(c) or according to the UTSs [specified in 40 CFR268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR268.2, of restricted hazardous soils – **applicable**	40 CFR 268.49(b) TDEC 1200–1–11–.10(3)(j)(2)
Disposal of RCRA wastewaters into CWA wastewater treatment unit	Are not prohibited, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR268.40, or are D003 reactive cyanide	Restricted RCRA characteristic hazardous wastewaters managed in a wastewater treatment system which is NPDES permitted – **applicable**	40 CFR 268.1(c)(4)(iv) TDEC 1200–1–11–.10(1)(a)(3)(iv)(IV)
Discharge of Wastewater from Treatment Unit			
Disposal of RCRA characteristic wastewaters	Are not prohibited, if the wastes are managed in a treatment system which subsequently discharges to Waters of the U.S. pursuant to a permit issued under 402 of the CWA (i.e., NPDES permitted) unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40, or are D003 reactive cyanide. ***Discharge of treated OU3 water to the Ocoee River will comply with the requirements of NPDES Permit No. TN0002411.***	Land disposal of hazardous wastewaters that are hazardous only because they exhibit a hazardous characteristic and are not otherwise prohibited under 40 CFR Part 268 – **applicable**.	40 CFR 268.1(c)(4)(i)
	Are not prohibited, if the wastes are treated for purposes of the pre-treatment requirements of section 307 of the CWA unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40, or are D003 reactive cyanide.		40 CFR 268.1(c)(4)(ii)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
Transport and conveyance of collected RCRA wastewater to WWTU located on the facility	Any dedicated tank systems, conveyance systems, and ancillary equipment used to treat, store or convey wastewater to an on-site NPDES-permitted wastewater treatment unit (WWTU) are exempt from the requirements of RCRA Subtitle C standards.	On-site wastewater treatment unit [as defined in 40 CFR 260.10] subject to regulation under §402 or §307(b) of the CWA (i.e., NPDES permitted) that manages hazardous wastewaters – **applicable**	40 CFR 264.1(g)(6)
General duty to mitigate for discharge of WWTU	Take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of effluent standards which has a reasonable likelihood of adversely affecting human health or the environment.	Discharge of pollutants to surface waters – **applicable**	40 CFR § 122.41(d)
	Properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve compliance with the effluent standards. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures.	Discharge of pollutants to surface waters – **applicable**	
Technology-based treatment requirements for wastewater discharge	To the extent that EPA promulgated effluent limitations are inapplicable, State shall develop on a case-by-case basis under § 402(a)(1)(B) of the CWA, technology based effluent limitations by applying the factors listed in 40 CFR § 125.3(d) and shall consider: the appropriate technology for this category or class of point sources; and any unique factors relating to the discharger.	Discharge of pollutants to surface waters from other than a POTW – **applicable**	40 CFR § 125.3(c)(2)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
Water quality based-effluent limits for wastewater discharge	Must develop water quality-based effluent limits that ensure that: The level of water quality to be achieved by limits on point sources(s) established under this paragraph is derived from, and complies with all applicable water quality standards; and Effluent limits developed to protect narrative or numeric water quality criteria are consistent with the assumptions and any available waste load allocation for the discharge prepared by the State and approved by EPA pursuant to 40 CFR § 130.7.	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a State water quality standard established under §303 of the CWA – **applicable**	40 CFR § 122.44(d)(1)(vii)
Monitoring requirements for discharges from WWTU	In addition to §122.48 and to assure compliance with effluent limitations, one must monitor, as provided in subsections (i) thru (iv) of §122.44(i)(1). *Note: Monitoring parameters, including frequency of sampling, will be developed as part of the CERCLA process and included in a Remedial Design, Remedial Action Work Plan, or other appropriate CERCLA document.*	Discharge of pollutants to surface waters – **applicable**	40 CFR §122.44(i)(1)
	All effluent limitations, standards and prohibitions shall be established for each outfall or discharge point, except as provided under §122.44(k)		40 CFR §122.45(a)
Underground Disposal of Wastewater Treatment Sludge			
Disposal of wastewater treatment sludge into underground mine workings (Class V injection well)	No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons.	Injection of fluids into or above an Underground Source of Drinking Water –**applicable**	40 CFR 144.12(a) TDEC 1200-04-06-.04(1)

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
	Any fluid injected into or above a USDW shall meet the standards in TDEC 1200-04-06-.05 (1)(a)-(j) unless specific alternate standards are established by the Department for the individual discharge based on hydrogeologic setting, character of the injectate, risk to the environment and persons utilizing the ground water resource and compliance with 1200-04-06-.05(1)(j).	Injection of fluids into or above an Underground Source of Drinking Water **–applicable**	40 CFR 144.1(c) TDEC 1200-04-06-.05(1)
	Class V wells defined to include: (o) Subsurface fluid distribution systems disposing of waste other than sanitary waste; (p) Dry wells used for the injection of wastes into a subsurface formation.[4]	Injection wells or systems not included in Classes 1, II, III, or IV – **applicable**	TDEC 1200-04-06-.06(5)
	All injection wells and activities must be authorized by permit or by rule. Continued injection into an existing Class V well is authorized by rule provided compliance with TDEC 1200-04-06-.5 (1) and any other applicable rules of this Chapter are maintained.	Injection of fluids into existing Class V well **–applicable**	TDEC 1200-04-06-.07(1) and (4)
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)

[4] *Class V* = Injection wells not included in Class I, II, III, IV or VI. Typically, Class V wells are wells used to place a variety of non-hazardous fluids directly below the land surface. However, if the fluids you place in the ground qualify as a hazardous waste under the Resource Conservation and Recovery Act (RCRA), your well is either a Class I or Class IV well, not a Class V well. See further examples of Class V wells are described in 40 CFR § 144.81.

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
Transportation of hazardous waste *off site*	Must comply with the generator requirements of 40 CFR262.20–23 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 1200–1–11–.03(1)(a)(8)
Transportation of hazardous waste ***on–site***	The generator manifesting requirements of 40 CFR262.20–262.32(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) TDEC 1200–1–11–.03(3)(a)(6)
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: • The sample is being transported to a laboratory for the purpose of testing; • The sample is being transported back to the sample collector after testing; and • The sample collector ships samples to a laboratory in compliance with U.S.DOT, 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.	Generation of samples of hazardous waste for purpose of conducting testing to determine its characteristics or composition – **applicable**	40 CFR 261.4(d)(1)(i) and (ii) TDEC 1200–1–11–.02(1)(d)(4)(i) 40 CFR 261.4(d)(2) TDEC 1200–1–11–.02(1)(d)(4)(ii)
Construction, Alteration, and Operation of Surface Water Impoundment Dams			

Table 13-2. Action-specific ARARs and TBC Guidance, Copper Basin Mining District Site - OU3

Action	Requirements	Prerequisite	Citation(s)
Construction of Dams	Must obtain a certificate of approval and safety prior to constructing, enlarging, repairing, altering, removing, maintaining, or operating a dam.	Activities involving construction, enlargement, repair, alteration, removal, maintenance, or operation of a dam - **applicable**	TN 1200-5-7-.04
	Must meet minimum dam design and engineering standards for construction of new dams.		TN 1200- 5-7-.06 - .08
	Certificate of Inspection must be renewed every five years.	Operation of a dam - **applicable**	T.C.A 69-11-110

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
TBC = to be considered
TCA = *Tennessee Code Annotated*
TDEC = Rules of theTennessee Department of Environment and Conservation, Chapter noted
USDW = Underground Source of Drinking Water
UTS = Universal Treatment Standard

Table 13-3. Location-Specific ARARs/TBCs, Copper Basin Mining District Site - OU 3

Location	Requirements	Prerequisite	Citation(s)
Water bodies			
Presence of Wetlands	Shall take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance beneficial values of wetlands.	Federal actions that involve potential impacts to, or take place within, wetlands – **TBC**	Executive Order 11990 Section 1.(a) *Protection of Wetlands*
	Shall avoid undertaking construction located in wetlands unless: (1) there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use.		Executive Order 11990, Section 2.(a) *Protection of Wetlands*
Within area impacting stream or any other body of water – *and* - presence of wildlife resources (e.g., fish)	The effects of water-related projects on fish and wildlife resources and their habitat should be considered with a view to the conservation of fish and wildlife resources by preventing loss of and damage to such resources.	Action that impounds, modifies, diverts, or controls waters, including navigation and drainage activities — **relevant and appropriate**	Fish and Wildlife Coordination Act (16 *USC* 661 *et seq.*)
Floodplains			
Presence of Floodplains designated as such on a map	Shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.	Federal actions that involve potential impacts to, or take place within, floodplains – **TBC**	Executive Order 11988 Section 1. *Floodplain Management*
	Shall consider alternatives to avoid, to the extent possible, adverse effects and incompatible development in the floodplain. Design or modify its action in order to minimize potential harm to or within the floodplain		Executive Order 11988 Section 2.(a)(2) *Floodplain Management*
Historical Significance			
Presence of Historical buildings or structures	Shall take into account the effect of any federal-assisted undertaking or licensing on any district site, building structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.	Federal actions that involve potential impacts to historical structures – **TBC**	40 CFR 6

TBC = To Be Considered

Table 13-4. Matrix of Cost and Effectiveness Data

Alternative	Present Worth Cost	Incremental Cost	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness
DMC-1 (No Action)	$61,000[1] $50,000[2]	---	• No improvement in Ocoee River surface water; RAO for river would not be met • No reduction in human health or ecological risk within OU3 • Residual Risk: o FRT = 5 o CRT = 3 o FIW = 1	• No reduction in surface water loadings to the Ocoee River • No reduction in toxicity, mobility, or volume within OU3	• No short-term health risk to public, workers, or ecological organisms
DMC-2 (DMC Removal Actions)	$28,200,000[1] $24,600,000[2]	$28,100,000[1] $24,500,000[2]	• Significant risk reduction in Ocoee River by surface water treatment at Cantrell Flats; RAO for river would be met • No reduction in human health or ecological risk within OU3 • Residual Risk: o FRT = 5 o CRT = 3 o FIW = 1	• Significant reduction in surface water loadings to the Ocoee River • No reduction in toxicity, mobility, or volume within OU3	• Minimal risks to workers mitigated through Health and Safety Plan • Minimal risk to environment mitigated by use of best management practices
DMC-3 (DMC Removal Actions plus Institutional and Engineering	$32,300,000[1] $28,000,000[2]	$4,100,000[1] $3,400,000[2]	• Significant risk reduction in Ocoee River by surface water treatment at Cantrell Flats; RAO for river would be met • Moderate reduction in human health or ecological	• Significant reduction in surface water loadings to the Ocoee River • No reduction in toxicity, mobility, or volume within OU3	• Minimal risks to workers mitigated through Health and Safety Plan • Minimal risk to environment mitigated by use of best management practices

Table 13-4. Matrix of Cost and Effectiveness Data

Alternative	Present Worth Cost	Incremental Cost	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness
Controls)			risk within OU3 • Residual Risk: o FRT = 3 o CRT = 2 o FIW = 1		
DMC-4 (DMC Removal Actions plus Institutional and Enhanced Engineering Controls)	$32,500,000[1] $28,100,000[2]	$200,000[1] $100,000[2]	• Significant risk reduction in Ocoee River by surface water treatment at Cantrell Flats; RAO for river would be met • Significant reduction in human health or ecological risk within OU3 • Residual Risk: o FRT = 1 o CRT = <1 o FIW = <1	• Significant reduction in surface water loadings to the Ocoee River • No reduction in toxicity, mobility, or volume within OU3	• Minimal risks to workers mitigated through Health and Safety Plan • Minimal risk to environment mitigated by use of best management practices

[1] 5 percent discount rate
[2] 7 percent discount rate

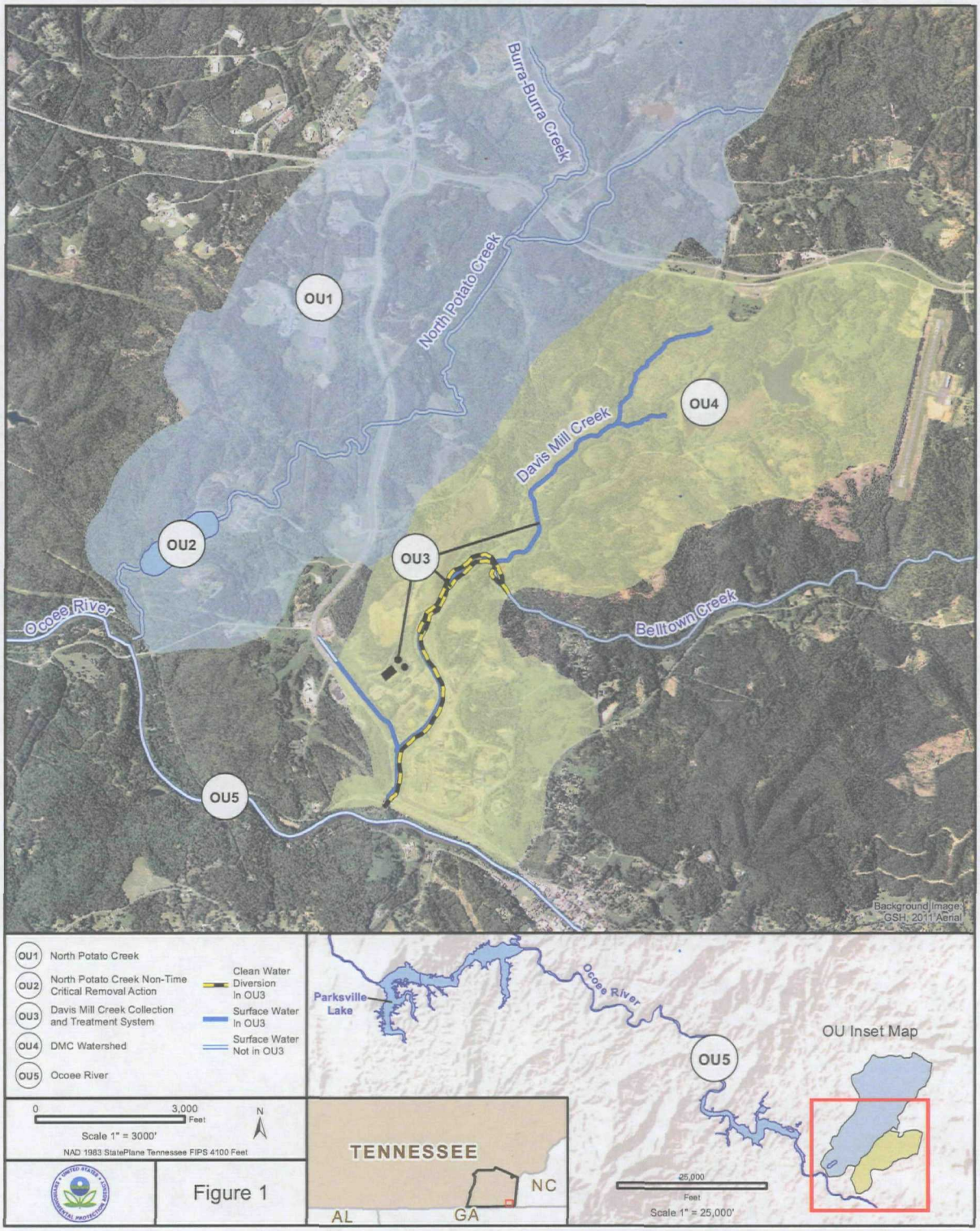

Burra-Burra Creek
North Potato Creek
OU1
OU2
OU3
OU4
OU5
Davis Mill Creek
Ocoee River
Belltown Creek
Background Image: GSH, 2011 Aerial
OU1 North Potato Creek
OU2 North Potato Creek Non-Time Critical Removal Action
OU3 Davis Mill Creek Collection and Treatment System
OU4 DMC Watershed
OU5 Ocoee River
Clean Water Diversion In OU3
Surface Water In OU3
Surface Water Not in OU3
0
3,000 Feet
Scale 1" = 3000'
N
NAD 1983 StatePlane Tennessee FIPS 4100 Feet
Parksville Lake
Ocoee River
OU5
OU Inset Map
TENNESSEE
NC
AL
GA
25,000 Feet
Scale 1" = 25,000'

Figure 1

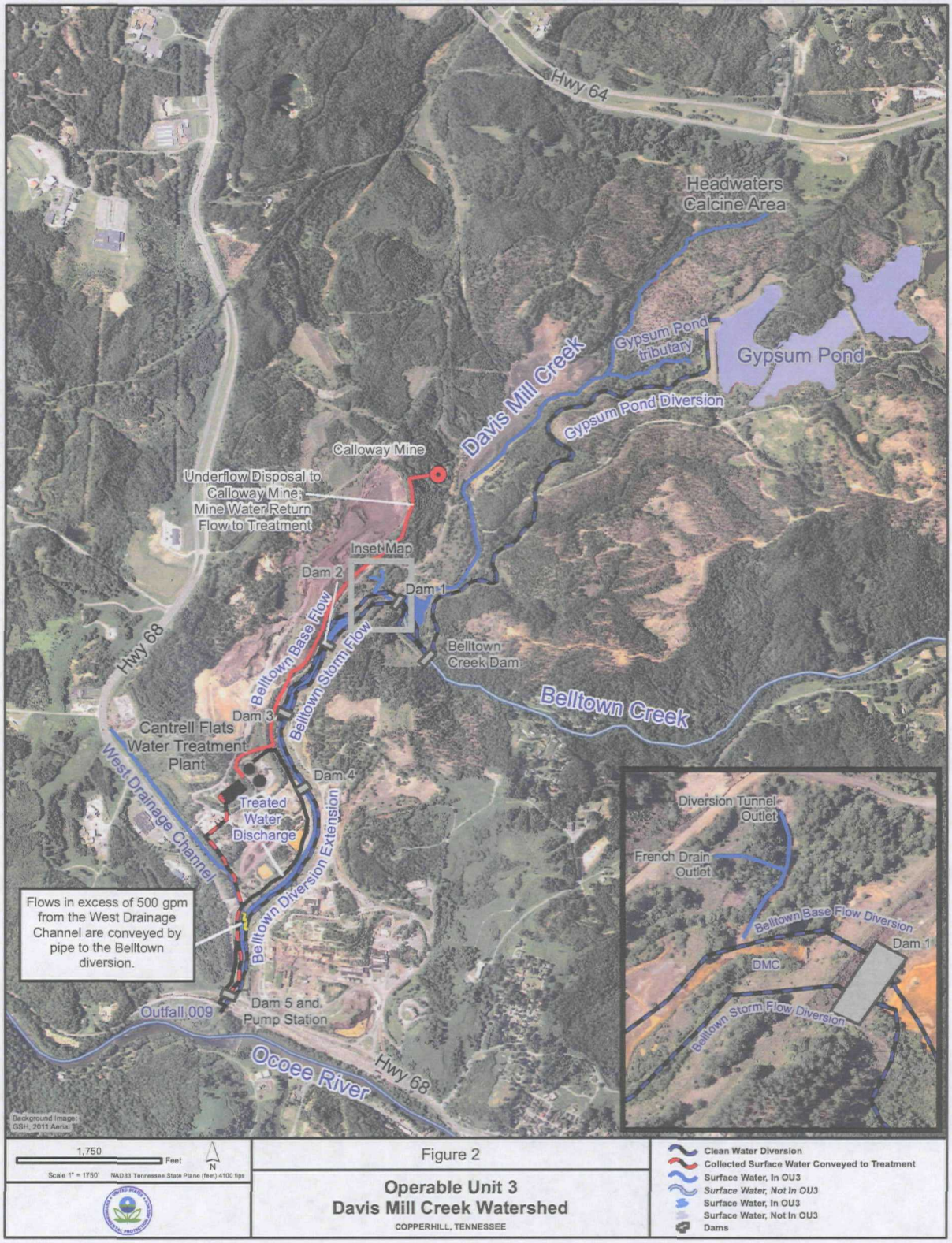
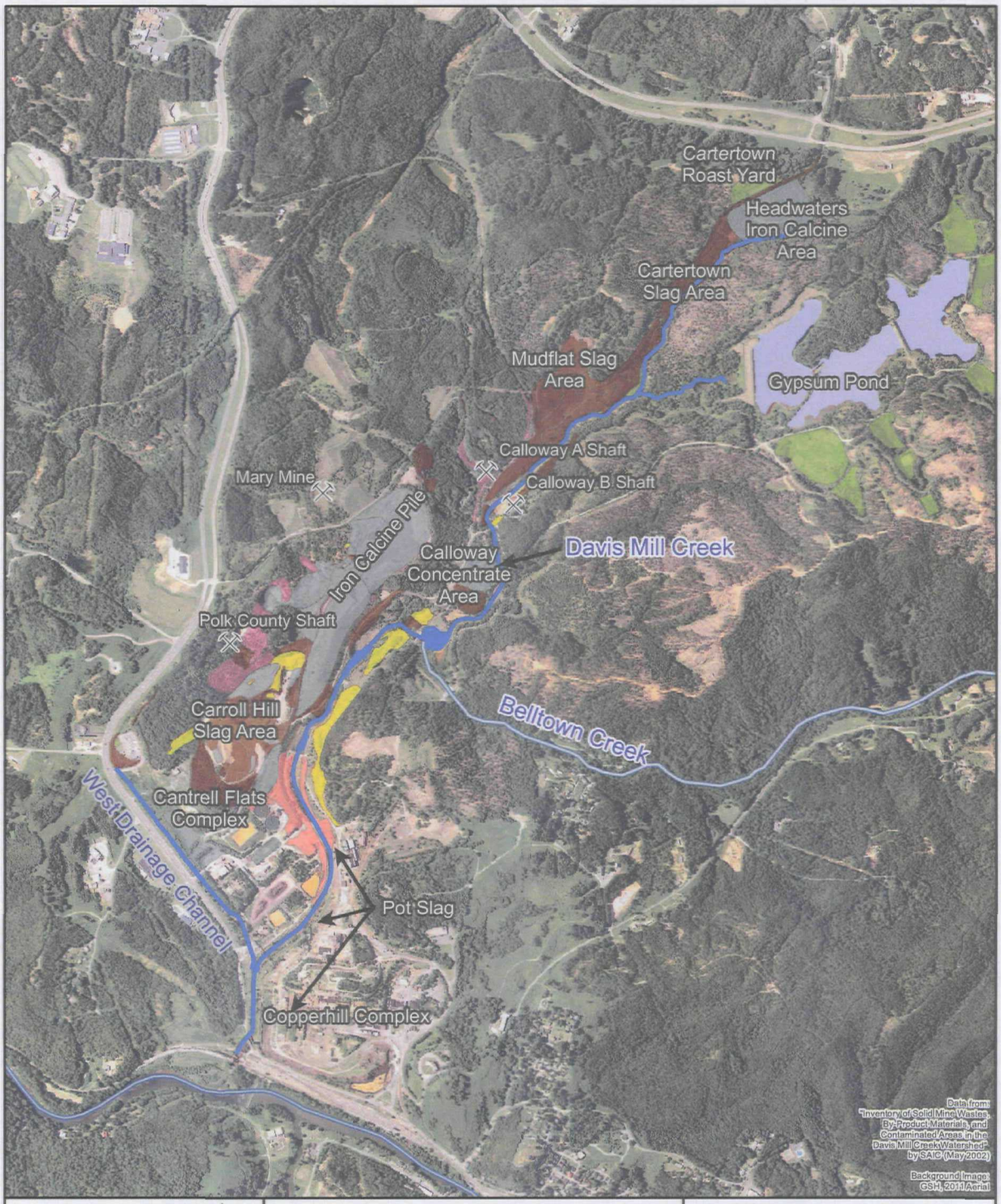


Figure 2

Operable Unit 3
Davis Mill Creek Watershed
COPPERHILL, TENNESSEE



1,750 Feet

Scale 1" = 1750' NAD83 Tennessee State Plane (feet) 4100 fips

Figure 3

Features of the Davis Mill Creek Watershed

COPPERHILL, TENNESSEE

- By-Products
- Slag Waste and By-Product
- Mined Rock Waste
- Mixed Waste
- Mixed Soil Fill
- Other Wastes

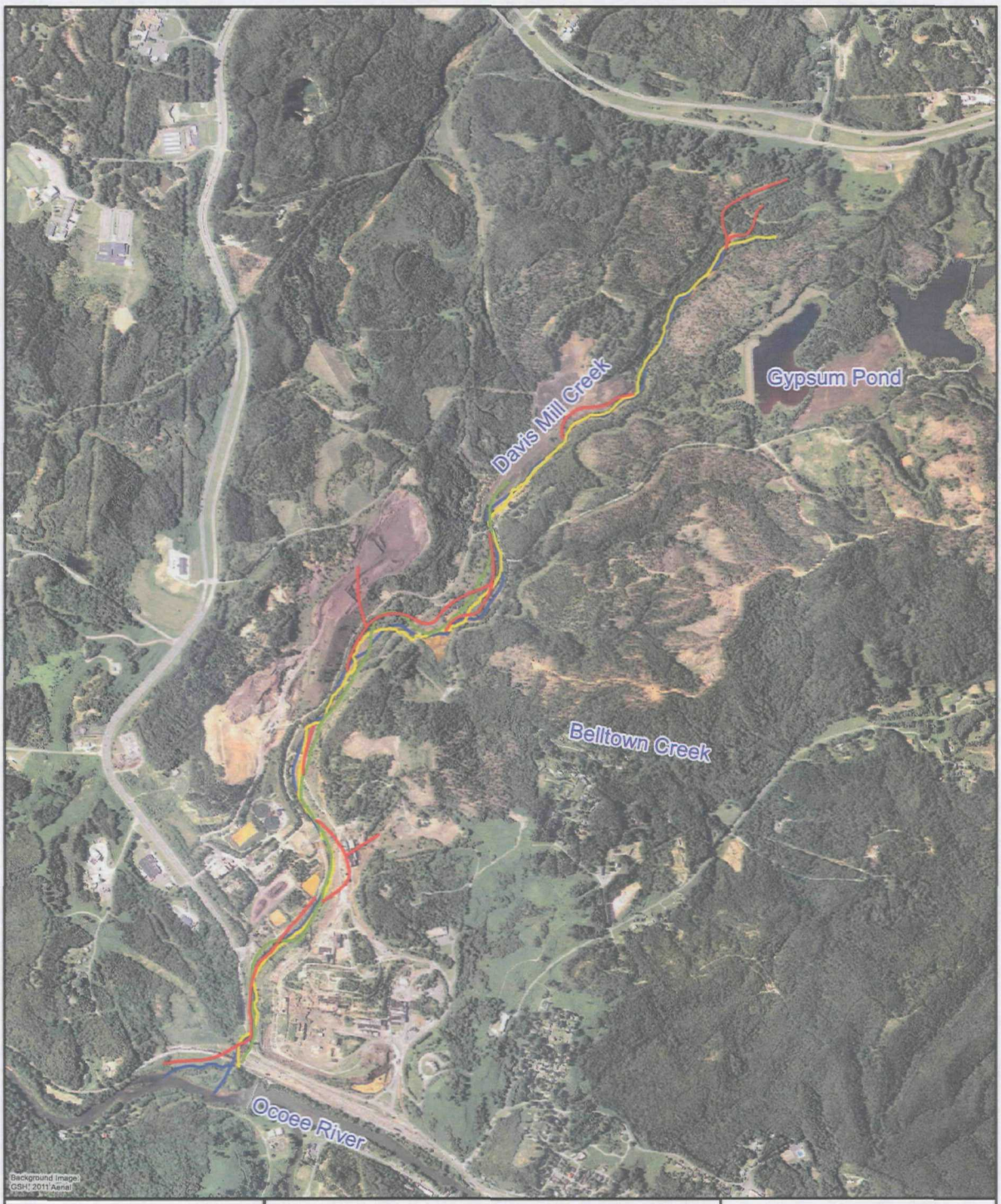


Figure 4

Historic Positions of the Davis Mill Creek Channel
Davis Mill Creek OU3
COPPERHILL, TENNESSEE

1906 DMC
1914 DMC
1944 DMC
Current DMC

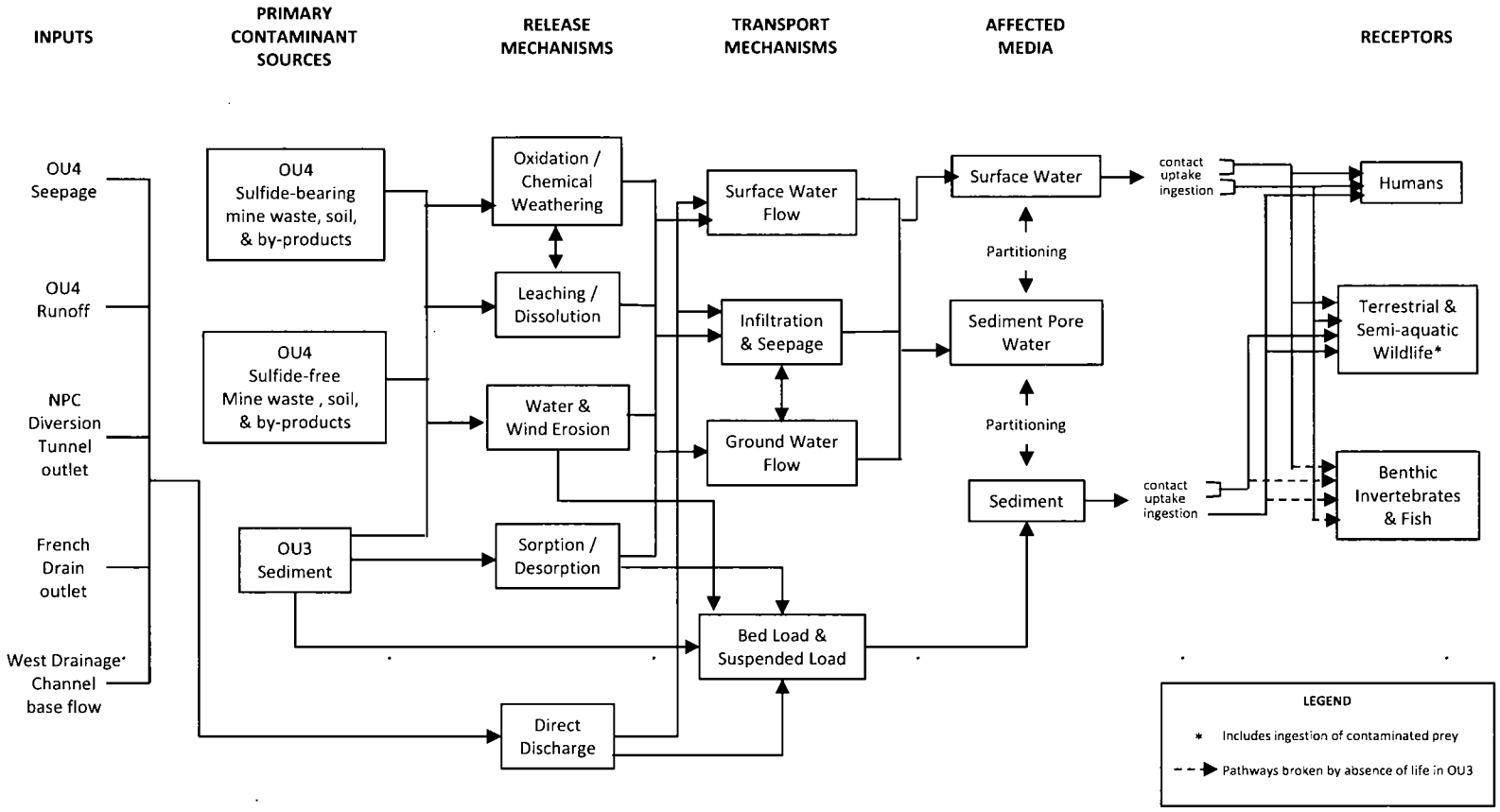


Figure 5
Conceptual Site Model
OU3 – Davis Mill Creek Collection & Treatment System

Figure 6. Photo showing a pool of red, iron-rich water at the outlet portal to the North Potato Creek diversion tunnel. Floating sheen on the water, which originates as seepage within the 2,400-foot-long tunnel, is a bacterial scum. This water flows a few hundred feet to its confluence with Davis Mill Creek in the middle section of OU3.

Figure 7. Photo looking downstream along OU3 in the upper section of Davis Mill Creek. The Mudflat slag pile, which is within OU4, occupies the right bank of OU3 in this location. The orange substrate in OU3 is caused by iron oxyhydroxide and hydroxysulfate precipitates.

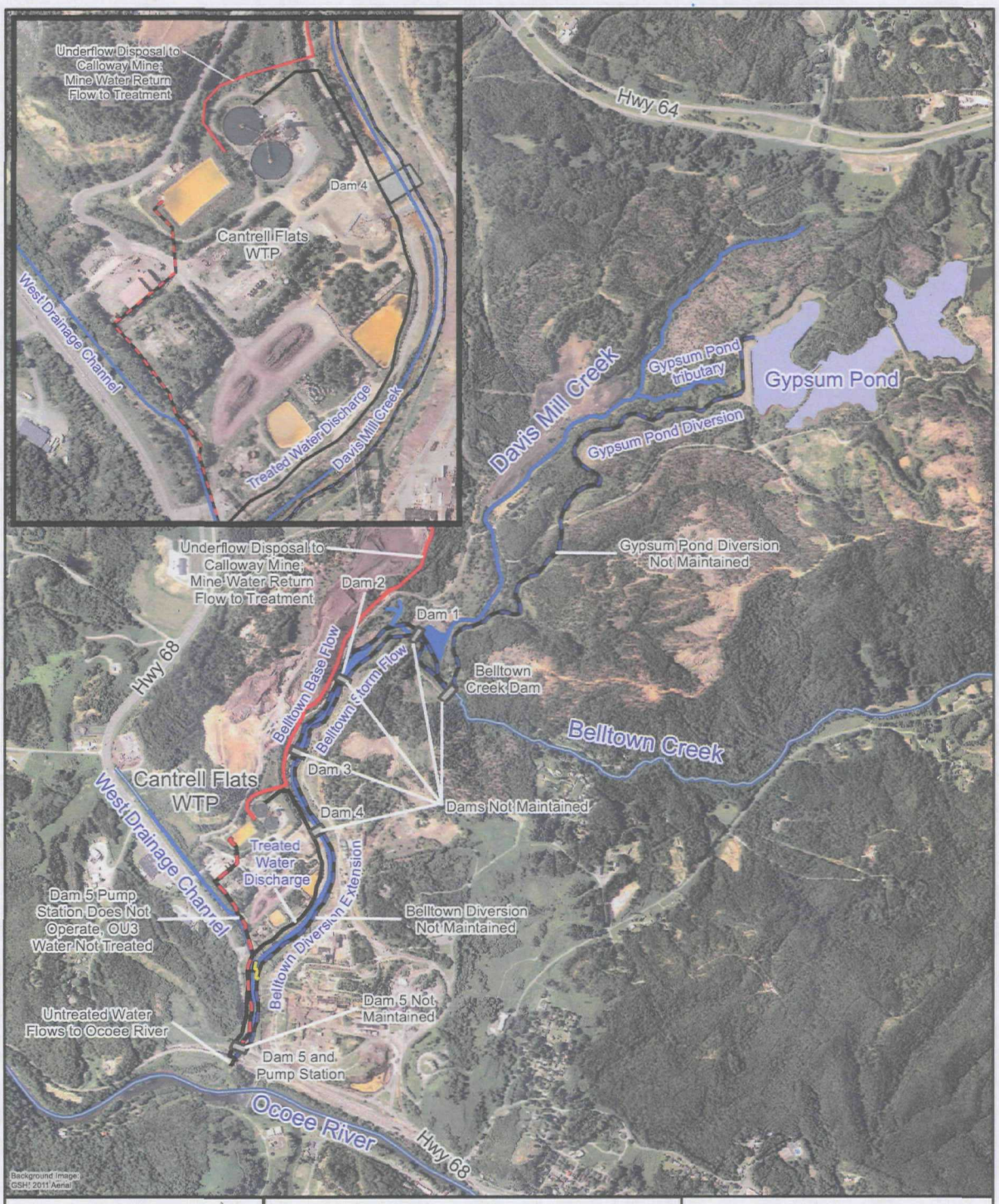


Figure 8

Features of Alternative DMC-1 (No Action)

Davis Mill Creek OU3
COPPERHILL, TENNESSEE

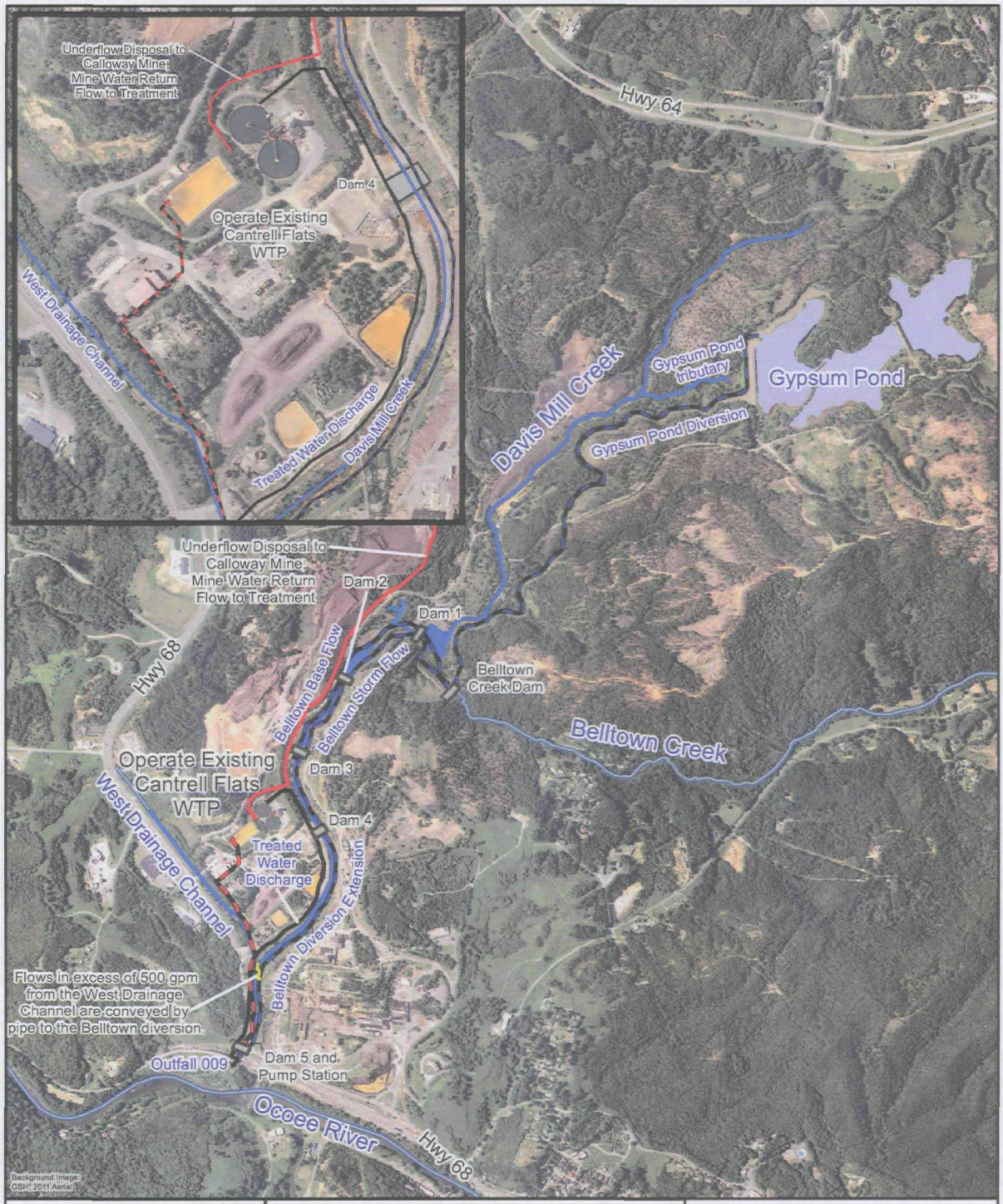


Figure 9

Features of Alternative DMC-2 (OU3 Removal Actions)

Davis Mill Creek OU3
COPPERHILL, TENNESSEE

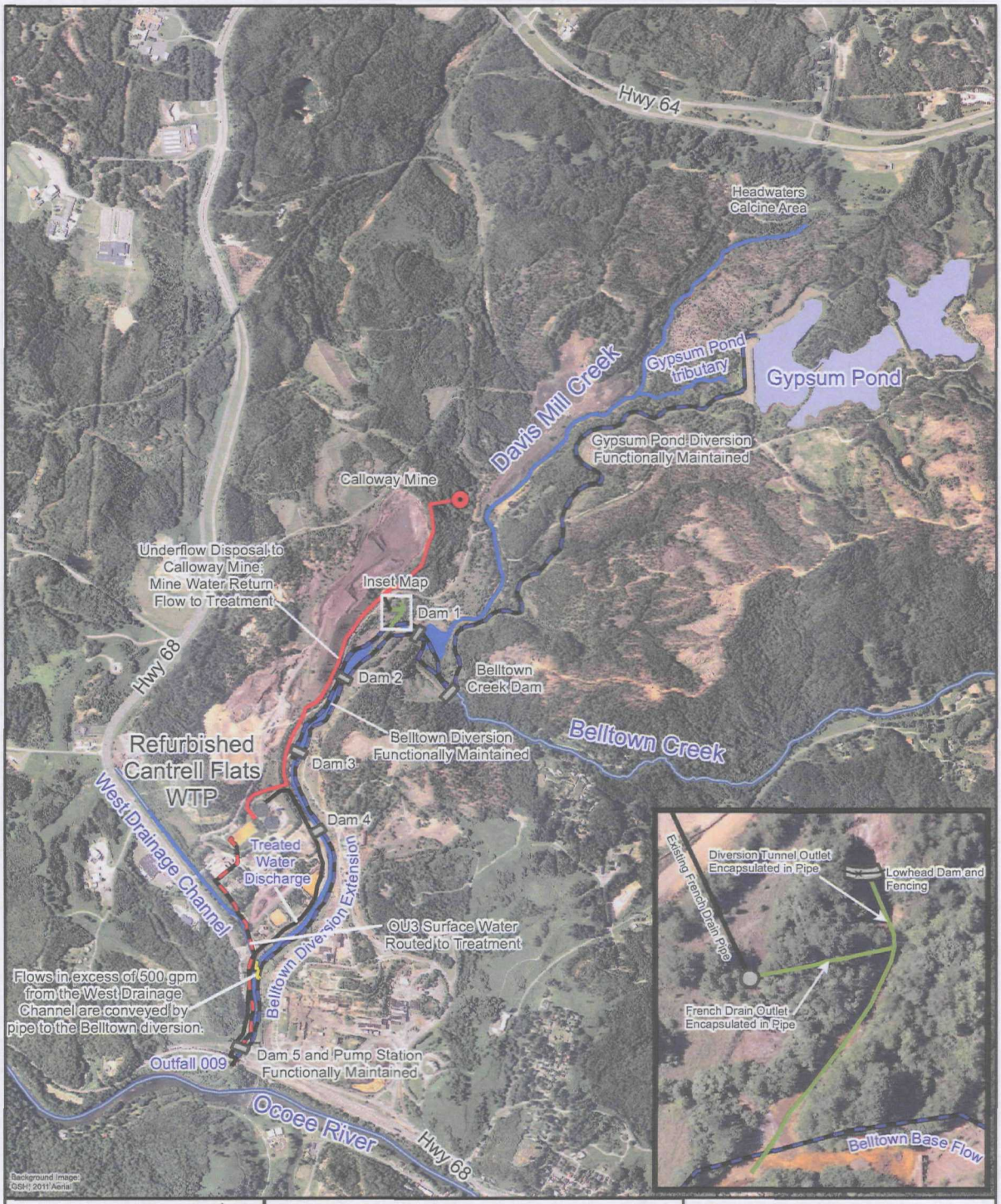


Figure 10

Features of Alternative DMC-3 (OU3 Removal Actions with Institutional and Engineering Controls)

Davis Mill Creek OU3

COPPERHILL, TENNESSEE

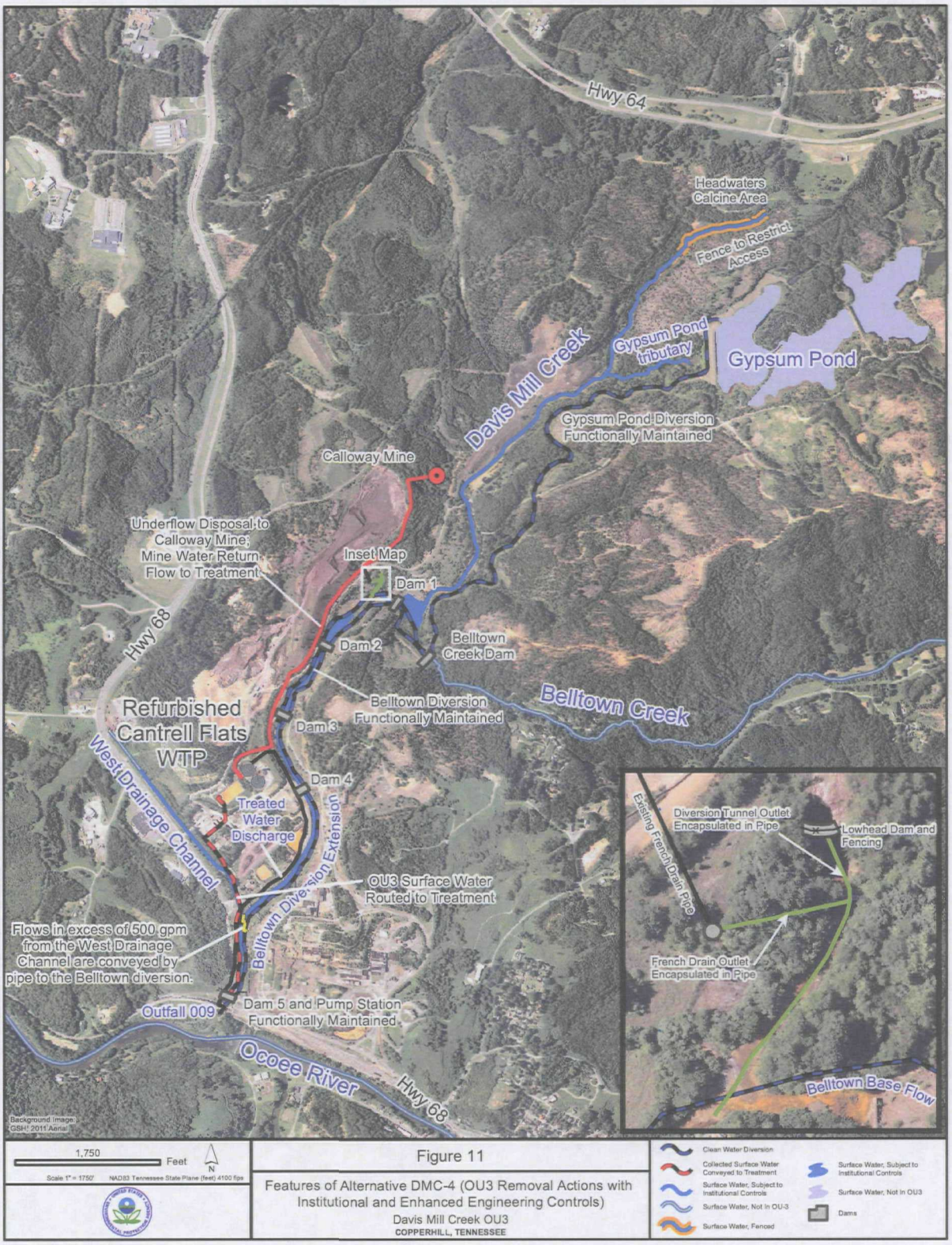


Figure 11

Features of Alternative DMC-4 (OU3 Removal Actions with Institutional and Enhanced Engineering Controls)

Davis Mill Creek OU3

COPPERHILL, TENNESSEE

Part 3:

Responsiveness Summary

This Responsiveness Summary is the third and final part of the Record of Decision for the Davis Mill Creek collection and treatment system (Copper Basin Mining District Site, Operable Unit 3). The general purpose of the Responsiveness Summary is to

- Present stakeholder concerns about the site and preferences regarding the remedial alternatives
- Explain how those concerns were addressed and preferences were factored into the remedy selection process.

As discussed in Section 3.0 (Community Participation), over 500 copies of the Proposed Plan Fact Sheet were distributed to the site mailing list in early-July 2012. The Administrative Record and information repositories were also updated with supporting documents. A formal 30-day public comment period on the Proposed Plan was held from July 13 to August 13, 2012. EPA held a public meeting on July 19, 2012 at the GSH office in Ducktown, TN to present the results of the Remedial Investigation/Feasibility Study, its reasoning for the Preferred Alternative presented in the Proposed Plan, and to answer questions from the community. Approximately 25 people attended the meeting. A verbatim transcript of the July 19th public meeting is attached as Appendix D. No major issues or opposition to the Proposed Plan were expressed by the meeting participants. The majority of questions posed by the public during this meeting related to the iron calcine trucking operations in the Copper Basin and issues related to the Ocoee River. One member of the public asked about the potential for OU3 to contaminate drinking water and another asked about schedule for the cleanup. One member supported EPA's proposed remedy.

EPA received only three comments from members of the community during the 30-day public comment period (Appendix C). Two comments concurred with EPA's Preferred Alternative stating it is was the best solution with the best economics. The third comment asked who would be responsible for paying to clean up naturally occurring contamination.

The Tennessee Department of Environment and Conservation (TDEC) did not submit written comments during the comment period, but has issued its formal approval in a concurrence letter attached as Appendix E.

GSH also did not submit written comments during the comment period.

APPENDICES

Appendix A
DMC Removed from Waters of the U.S. – EPA & State

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

SITE: Copper Basin
BREAK: 17.5
OTHER: V39

July 24, 2007

Paul E. Davis, Director
Division of Water Pollution Control
Tennessee Department of Environment and
Conservation
401 Church Street
Nashville, Tennessee 37243

SUBJECT: Copper Basin Mining District Site—Davis Mill Creek

Dear Mr. Davis:

Over the past year we have been discussing the regulatory status of Davis Mill Creek. During these discussions, the Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) have been looking at the history of the Creek, and the related clean up at the Copper Basin Mining District Site. After reviewing the history of the Creek and the Site, as discussed below, EPA believes that for purposes of the Clean Water Act (CWA) Davis Mill Creek is not a jurisdictional water of the United States.

For over 100 years before the CWA became law, the Copper Basin Mining District Site was used to dispose of various industrial wastes from the mining, processing, and chemical activities on the site. During that time industrial wastes were placed in, on, and around the historic Davis Mill Creek, as well as other places in the watershed, transforming what was once Davis Mill Creek into a waste disposal area and conveyance area. As a result, its original remnants no longer remain.

Section 303(a) of the CWA mandated that existing state water quality standards (WQSs) that were in effect in 1972 would remain in effect unless EPA found those WQS to be inconsistent with the CWA. In addition, section 303(a) required the state to develop WQS if they did not exist, and submit all new and existing WQS to EPA for review. Pursuant to section 303(a) of the CWA, in 1974 the Tennessee Water Control Board developed a use classification rule that lists waters that were to be covered by state water quality standards. In the 1970s and 1980s, Tennessee gradually added to the list of rivers and creeks that were specifically named in the use classification rule for Tennessee surface waters. In the Copper Basin, North Potato Creek and Burra Burra Creek were specifically named in the rule. Davis Mill Creek has never been explicitly listed in the use classification rule. There are TDEC documents from this period that show that Davis Mill Creek was specifically considered and intentionally not included in the use classification rule.

In addition to specifically listing waters in Tennessee's use classification rule, the rule also included a "catch-all" provision that in its early versions stated, "all other tributaries of the Lower Tennessee River Basin, named and unnamed, which have not been specifically treated shall be classified...." Absent other evidence, the catch-all provision may have captured Davis Mill Creek as a classified water, but actions by the state lead to a different conclusion. At about the same time, the Tennessee Division of Water Quality (TNDWQ) issued the first NPDES permit (TN0002411) to Tennessee Chemical Company on March 1, 1983. That permit clearly identified the point where Davis Mill Creek entered the Ocoee River as an effluent outfall where the discharge from that portion of the wastewater conveyance and treatment system entered waters of the United States. Additionally, in order to address the quality of the water entering the Ocoee River, in approximately 1985 TDEC issued an order related to the NPDES permit that required the company to construct a collection dam and pump station on what was still being called Davis Mill Creek and transport the base flow to the Cantrell Flats Wastewater Treatment Plant (WWTP), incorporating the Davis Mill Creek wastewater conveyance and treatment system into the WWTP. This order also required Belltown Creek to be diverted through a pipeline to a point below the collection dam. All of these events indicate that there was a specific intent in this case that Davis Mill Creek was not a waters of the state, and thus the "catch-all" provision would not apply.

Additionally, in 1990, EPA and TDEC developed an Agreement and Covenant Not To Sue with Boliden Intertrade, A.G., TCC Holdings, B.A., and TCC Acquisition, Inc. that required the construction of two sediment ponds within Davis Mill Creek to provide additional treatment within the Davis Mill Creek system. This action was consistent with Davis Mill Creek being a waste treatment system and not jurisdictional water protected by state water quality standards.

The above history is not consistent with certain recent actions regarding Davis Mill Creek. In 1998, the State included tributaries of the Ocoee River, including Davis Mill Creek, on the State's section 303(d) list of impaired waters, which was approved by EPA. Given the earlier history, it would appear that Davis Mill Creek was not jurisdictional water and should not be considered as a tributary to the Ocoee River. To clarify this, given the historical status of Davis Mill Creek as a non-jurisdictional water, the State could simply remove the water from the list during the next cycle, since the water was not a jurisdictional water of the US.

To further clarify the jurisdictional status of Davis Mill Creek, since a substantial portion of the waste flow from Davis Mill Creek is being treated at the Cantrell Flats WWTP, during the next NPDES permit cycle the fact sheet for the NPDES permit for Cantrell Flats WWTP could be clarified to discuss the sources of the wastes being treated at Cantrell and the history of Davis Mill Creek as part of a waste water treatment and conveyance system. Alternatively, in the future, if any additional waste flows from Davis Mill Creek are treated in Cantrell Flats, the permit will likely need to be modified to include that flow, and at that time the fact sheet could be amended to reflect this history.

In conclusion, based on the above history, EPA believes Davis Mill Creek is not a waters of the United States for purposes of the Clean Water Act.

Sincerely,

James D. Giattina, Director
Water Management Division

To: Loften Carr/R4/USEPA/US@EPA
From: "Richard Urban" <Richard.Urban@tn.gov>
Date: 06/23/2011 07:53AM
Subject: Voice Mail question
(See attached file: Richard Urban1.vcf)

Loften,

I got tied up on several issues yesterday afternoon so couldn't get back with you concerning your question about the status of Belltown Creek and the Gypsum Ponds at Intertrade. You are correct Belltown and the Gypsum Ponds are waters of the US and the State. When I proposed the removal of Davis Mill Creek as water of the State it was only that portion of the watershed that was part of the contaminated water collection and treatment system that was to be removed as jurisdictional waters. In other words, those portions of the original Davis Mill Creek Watershed with uncontaminated water which is directed to the Belltown Diversion remain waters of the US and the State.

This is why there is concern about how Buddy Haynes is planning to remove the Iron Calcine out of Pond #2 of the Gypsum Ponds.

Dick

Richard D. Urban, Ph.D.
Environmental Field Office Manager
Tennessee Division of Water Pollution Control
540 McCallie Ave., Suite 550
Chattanooga, TN 37402
Phone: 423-634-5745
Fax: 423-634-6389
E-mail: Richard.Urban@tn.gov

Appendix B
Proposed Plan Fact Sheet
OU3 Davis Mill Creek Collection and Treatment System

U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPOSED PLAN FACT SHEET

Davis Mill Creek

Collection and Treatment System OU3

Polk County, Tennessee

July 2012

This fact sheet is not to be considered a technical document. It has been prepared to provide the general public with an understanding of the activities that have been occurring at the Copper Basin Mining District Site. For technical information, please review the documents in the information repositories.

Introduction

The U.S. Environmental Protection Agency (EPA), in consultation with the Tennessee Department of Environment and Conservation (TDEC), is releasing this Proposed Plan Fact Sheet for the environmental cleanup of Copper Basin Operable Unit (OU) 3, the Davis Mill Creek Collection and Treatment System, near Copperhill, Tennessee (Figure 1). This fact sheet summarizes investigative findings documented in the reports on which the cleanup is based. These include a Remedial Investigation (RI), which contains a Baseline Risk Assessment, and a Feasibility Study (FS). A complete set of documents is contained in the Administrative Record on file at the Copper Basin Information Repository.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.430(f)(2), of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In consultation with TDEC, EPA will select a final remedy for OU3 after receiving and considering all information submitted during the 30-day public comment period. EPA may modify the Preferred Alternative or select another alternative presented in the Proposed Plan based on new information or public comment. Therefore, the public is encouraged to review and comment on all information presented in this Proposed Plan.

30-Day Public Comment Period

July 13, 2012 to August 13, 2012

Open House and Public Meeting

Office of Glenn Springs Holdings, Inc.
127 Main Street, Ducktown
July 19, 2012
5 pm to 7 pm

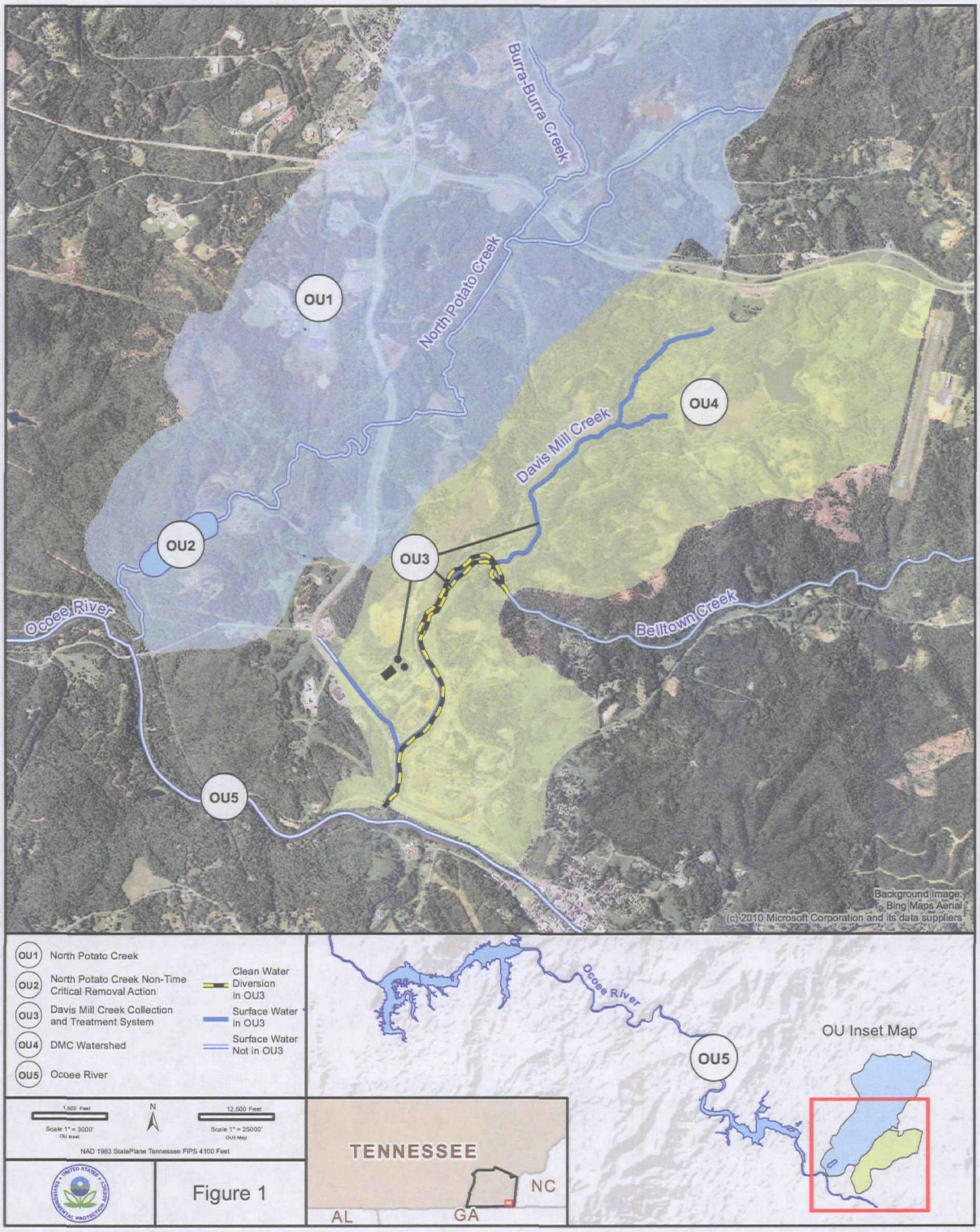
As part of public involvement during the 30-day public comment period, the community is invited to an Open House and Public Meeting. An informal open house will be held from 5 to 6 pm on July 19th. At 6:00 pm, EPA will present its understanding of the site, describe its reasoning for the Preferred Alternative presented in this Proposed Plan, and answer questions from the community. EPA invites the community to submit oral and written comments at the public meeting.

For Additional Information:

Copper Basin Information Repository
Ducktown City Hall
340 Main Street
Ducktown, Tennessee
Phone 423-496-3546
Contact: Marty Fowler
Hours: 8:30 am – 4 pm, M, T, Th, F
http://www.epa.gov/region04/superfund/sites/npl/tennessee/copbastn.html

Loften Carr

Remedial Project Manager
U.S. Environmental Protection Agency
Phone: 404-562-8804
E-mail: Carr.Loften@epa.gov


Burra-Burra Creek
North Potato Creek
OU1
OU2
OU3
OU4
OU5
Davis Mill Creek
Ocoee River
Belltown Creek
Background image: Bing Maps Aerial
(c) 2010 Microsoft Corporation and its data suppliers
OU1 North Potato Creek
OU2 North Potato Creek Non-Time Critical Removal Action
OU3 Davis Mill Creek Collection and Treatment System
OU4 DMC Watershed
OU5 Ocoee River
Clean Water Diversion in OU3
Surface Water in OU3
Surface Water Not in OU3
1,500 Feet
Scale 1" = 3000'
OU Inset
N
12,500 Feet
Scale 1" = 25000'
OU5 Map
NAD 1983 StatePlane Tennessee FIPS 4100 Feet
Figure 1
Ocoee River
OU5
OU Inset Map
TENNESSEE
NC
AL
GA

Over the years, meetings and other outreach activities have been held to share information about site activities with the local community. In June 2011, a public meeting was held to discuss EPA's proposed remedy for the Ocoee River (OU5 of the Copper Basin). During this meeting, community members had an opportunity to review and comment on EPA's strategy to protect the Ocoee River. In addition to public meetings, Glenn Springs Holdings, Inc. (GSH) has held annual site tours for the public and, in conjunction with EPA and TDEC, issued quarterly project updates.

What is a Proposed Plan?

A Proposed Plan is a step in the Superfund process used to solicit public input into the remedy selection process for a site. It presents EPA's preliminary recommendation on how best to address contamination at the site, describes the alternatives that were evaluated, and explains the reasons EPA recommends the Preferred Alternative.

What are the Next Steps in the Process?

An open house and public meeting will be held July 19, 2012 between 5:00 pm and 7:00 pm at the office of Glenn Springs Holdings, Inc., 127 Main Street, Ducktown, Tennessee. EPA will invite public comment on the Proposed Plan at that time.

Copper Basin Site History

The Copper Basin Mining District site is divided into three areas: the North Potato Creek watershed, the Davis Mill Creek watershed, and the Ocoee River. From the late 1800s until the 1980s, the creek watersheds hosted copper mining, processing, and chemical production activities, and the river received water from these contaminated areas.

The Copper Basin is a Superfund Alternative site which is being addressed through the cooperative efforts of EPA, TDEC, and OXY USA Inc. In a Memorandum of Understanding among EPA Region 4, TDEC, and OXY USA Inc. (through their affiliate GSH) that was signed on January 11, 2001, EPA agreed to complete a Remedial Investigation/Feasibility Study (RI/FS) for the Davis Mill Creek watershed. In addition, EPA and OXY USA Inc. and their affiliate GSH agreed to two EPA Consent Orders under which GSH would implement a series of interim removal actions in the Davis Mill Creek watershed aimed at reducing impacts of contamination on the Ocoee River. In 2005, GSH further agreed to conduct RI/FS activities in the watershed.

As part of the 2001 Agreements, EPA also agreed to complete an RI/FS for the Ocoee River. EPA issued a Record of Decision for the Ocoee River on September 28, 2011. In addition, OXY USA Inc. and GSH agreed to clean up the North Potato Creek watershed under a TDEC Commissioner's Order issued in 2001 and to construct a water treatment plant in lower North Potato Creek under an EPA Consent Order. Work under the Commissioner's Order is proceeding; the treatment plant was completed and began operation in 2005.

The Davis Mill Creek watershed is located north of Highway 68 on property owned by Intertrade Holdings, Inc., about one half mile northwest of Copperhill, TN. EPA designated two operable units (OU) in the Davis Mill Creek watershed which are illustrated in Figure 2. Operable Unit 3, the Davis Mill Creek Collection and Treatment System, comprises surface water, sediment, and sediment pore water contained within the streambed of Davis Mill Creek from its origin at the Headwaters iron calcine pile downstream to and including dam No. 5. It includes portions of the Gypsum Pond tributary, West Drainage channel, and other seepage and discharge areas as well as the Cantrell Flats water treatment plant, five storm water retention dams along Davis Mill Creek, the dam No. 5 pump station, and the Belltown Creek and Gypsum Ponds diversion pipelines. Operable Unit 4, the Davis Mill Creek Watershed, comprises all upland areas of the watershed to the site boundary including waste and by-product piles and former Copperhill industrial areas.

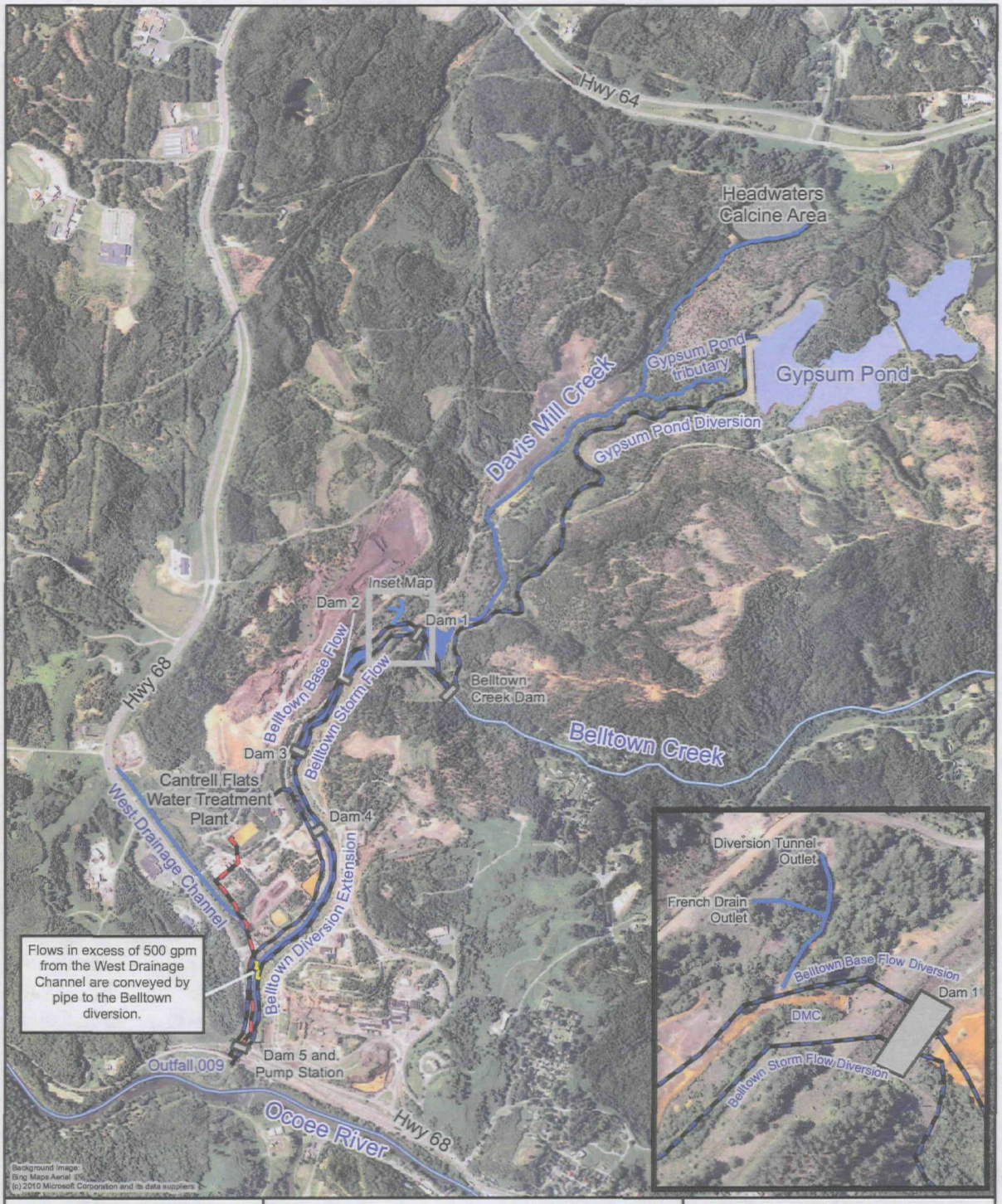


Figure 2

Operable Unit 3
Davis Mill Creek Watershed
COPPERHILL, TENNESSEE

Davis Mill Creek History

Three underground mines (Polk County, Mary, and Calloway) and the Copperhill industrial area were active in the Davis Mill Creek watershed (Figure 3). The industrial area consisted of copper smelting facilities; iron roasters; lead chamber and contact sulfuric acid plants; copper sulfate and iron sulfate production facilities; an organic chemical plant; other chemical production facilities; and supporting infrastructure including rail lines, a rail shop, power plants, landfills, and waste disposal sites. Mining and processing wastes, in the form of granulated slag, pot slag, mine waste rock, demolition debris, wastewater treatment plant sludge, and other materials were disposed of throughout the watershed. In addition, stockpiles of iron calcine and iron sulfide concentrate were maintained in various parts of the drainage.

Open roasting of ore in the late 1800s caused the Copper Basin area to become nearly devoid of vegetation. The ensuing soil erosion, which deposited large amounts of sediment in the creek channel, changed the character and position of Davis Mill Creek. The stream was altered further by channelization to protect industrial facilities and transportation infrastructure, the placement of waste piles on stream banks, and the disposal of process wastewater and sediment into the creek. As a result, Davis Mill Creek was transformed from a stream into an industrial disposal area and conveyance providing drainage and treatment for industrial wastes and wastewaters. In 1974, the Tennessee Water Quality Control Board classified Davis Mill Creek as a "wastewater stream" implying that the creek consisted primarily of industrial discharge. A National Pollutant Discharge Elimination System (NPDES) permit issued in 1983 defined the creek as an effluent outfall where it met the Ocoee River. In 2007, recognizing the past history of Davis Mill Creek and its previous classification as a wastewater stream, EPA and TDEC reviewed the status of the creek to determine whether it should be included as "waters of the United States." EPA and TDEC determined that the portion of Davis Mill Creek comprising OU3 is not considered jurisdictional waters of the United States under the Clean Water Act.

Investigations in Davis Mill Creek

Numerous investigations have been conducted in Copper Basin OU3 and OU4. These studies identified and described the types and volumes of waste and by-product materials in the watershed. They also provided analytical results for samples of soil, waste and by-product materials, surface water, sediment, sediment pore water, and shallow ground water.

EPA completed an RI and Focused FS for the lower portion of OU3 in 2003. The RI characterized the quality of surface water, sediment, pore water, and seeps in the lower creek. The Focused FS developed and evaluated alternatives to reduce the flow of contaminants to the Ocoee River. The alternatives examined mechanisms to capture and treat creek water up to the 10-year, 24-hour storm event and to divert the base flow of the West Drainage Channel, which joins Davis Mill Creek upstream of the Ocoee River.

In 2012, GSH completed an RI for the Davis Mill Creek watershed which presented additional data and sample results. This report identified residual risks present within the watershed. GSH also completed an FS for OU3 in 2012 which developed and evaluated alternatives to ensure protection of the Ocoee River and to reduce or eliminate residual risk in OU3.

Interim Actions in OU3

Interim actions have been conducted in OU3 since 1990 when Boliden Intertrade, A.G., TCC Holding S.A., and TCC Acquisition, Inc. entered into an Agreement and Covenant Not to Sue with the United States and State of Tennessee. The Agreement included actions to reforest upland areas; cover and vegetate barren piles; install sedimentation ponds along Davis Mill Creek; capture and treat storm runoff from the industrial site; separate and divert base flow and storm flow in the drainage; and treat the base flow of Davis Mill Creek for two years or until the actions were completed.

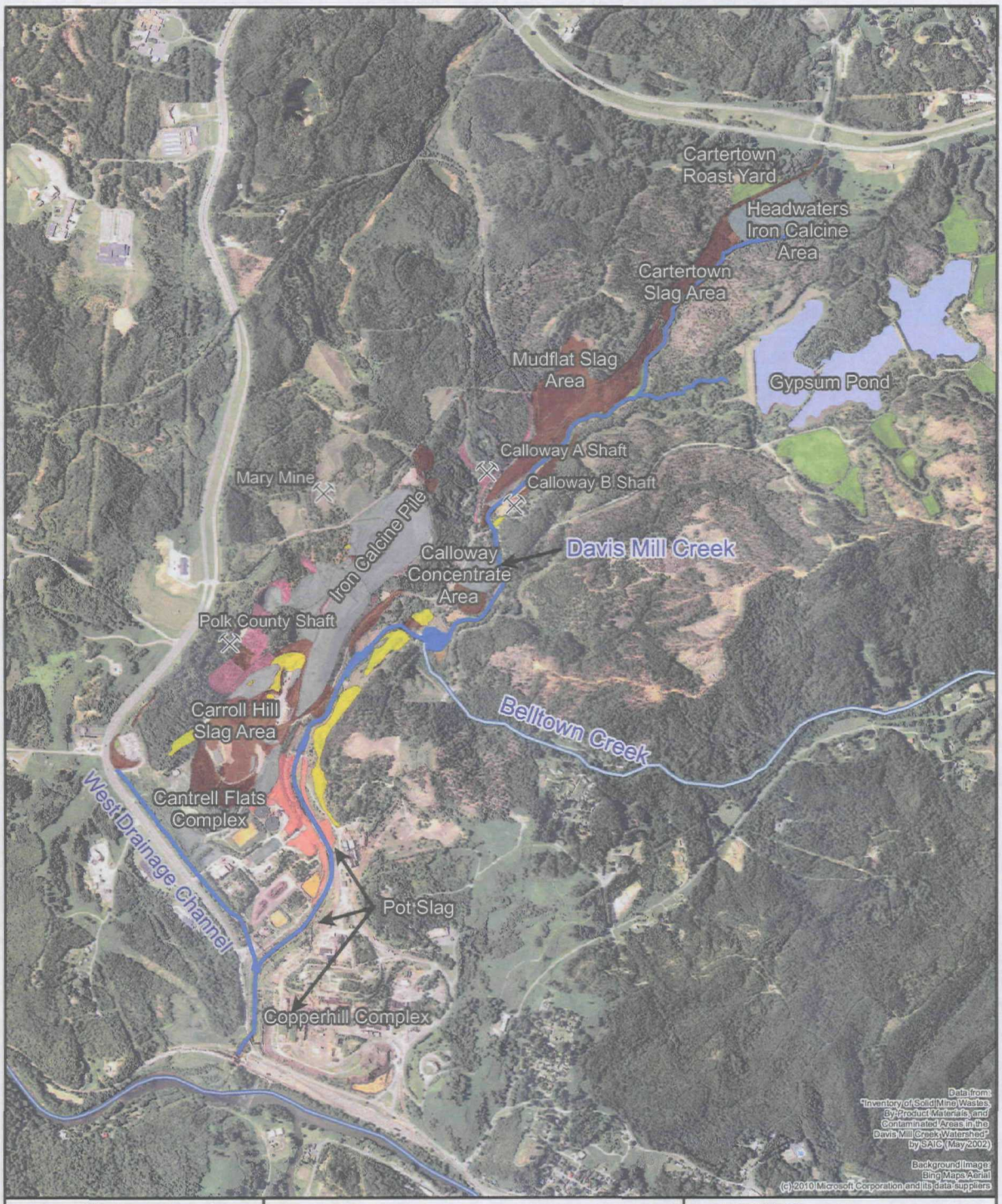


Figure 3

Features of the Davis Mill Creek Watershed

COPPERHILL, TENNESSEE

Under the 1990 Agreement, Intertrade Holdings, Inc. is responsible for collecting storm water runoff from the Copperhill industrial site; maintaining this collection system; and ensuring treatment of the collected storm water.

Other interim removal actions intended to provide additional protection for the Ocoee River have been completed in OU3 in accordance with various Consent Orders between EPA and GSH. These actions have included:

- Refurbishing the Cantrell Flats water treatment plant.
- Treating water from Davis Mill Creek at the Cantrell Flats water treatment plant (initially base flow and eventually increasing to include storm flow).
- Diverting unimpacted base flow and storm flow from the Gypsum Ponds and Belltown Creek via pipe to the Ocoee River.
- Treating base flow from the West Drainage Channel tributary and diverting storm flows via pipe to the Ocoee River.
- Converting sedimentation ponds No. 1 and 2 to storm water retention dams and raising their height to increase storage capacity.
- Constructing new storm water retention dam No. 4.
- Constructing new dam No. 5 and the dam No. 5 pump station to capture base flow and storm flow in Davis Mill Creek and route it to the Cantrell Flats water treatment plant.

Description of OU3

Copper Basin OU3 consists of two main parts (Figure 2):

- The Davis Mill Creek collection system, which includes clean water diversions, and
- The Cantrell Flats water treatment plant.

Davis Mill Creek Collection System. The Davis Mill Creek collection system was constructed through actions taken under the 1990 Agreement and Covenant Not to Sue and EPA Consent Orders 01-12-C and CER-04-2003-3521. The historic headwaters of Davis Mill Creek were impounded to form the Gypsum Ponds (OU4) in 1972. Consequently, present-day Davis Mill Creek originates as spring discharge from beneath the Headwaters iron calcine pile. The OU3 channel collects seepage from OU4 as it flows about 7,000 feet until it enters the first of four storm water retention structures which combined have the capacity to retain nearly 190 acre-feet of water (Figure 2). Additional seepage and contaminated inflows are collected by the channel as it flows through and below these impoundments. A few hundred feet upstream of the Ocoee River, the channel is impounded by dam No. 5. The entire flow in the channel at this point (typical base flow of 1,000 to 2,100 gpm) is routed to the Cantrell Flats water treatment plant by the dam No. 5 pump station.

In 2005, the unimpacted flow of the Belltown Creek tributary, up to the 10-year, 24-hour storm[1], was captured and diverted via pipe to a point below dam No. 3; the diversion was extended to the Ocoee River in 2009. Included in this diversion are uncontaminated overflow from the Gypsum Ponds and storm water flow from the West Drainage Channel greater than 500 gpm (Figure 2). The Belltown Creek diversion dam holds the flow of Belltown Creek up to the 10-year, 24-hour storm and diverts the creek into a pipeline that follows Davis Mill Creek. The pipe increases in size from 63 inches in diameter at its upstream end to 84 inches in diameter at its downstream end. The pipe passes through dam No. 5 and discharges to the Ocoee River.

Cantrell Flats Water Treatment Plant. The Cantrell Flats water treatment plant was constructed in 1974 and was most recently refurbished in 2001-2002 by GSH under EPA Consent Order 01-12-C. Untreated water is pumped to a 2 million gallon surge pond and fed to the plant by gravity. Lime slurry is added to the water in a reaction tank to remove metals and neutralize acidity. Metal-rich sludge is separated from the treated water in a clarifier and pumped

[1] The 10-year, 24-hour storm is the amount of runoff generated by a rainfall event with an amount of precipitation over 24 hours that is statistically expected to occur once every 10 years. For the Copper Basin, this is equivalent to 5.7 inches of rain.

underground into the Calloway Mine for disposal under TDEC Underground Injection Control permit No. 83-12; overflow water from the mine is routed back into the treatment system. Treated water is discharged to the Ocoee River through Outfall 009, immediately downstream of the Davis Mill Creek confluence in accordance with the provisions of NPDES permit No. TN0002411, issued by the State of Tennessee in April, 2012. Effluent limits for pH and several metals imposed by the permit are protective of aquatic life in the river. Treatment of Davis Mill Creek water is conducted by GSH under EPA Consent Order 01-12-C and implemented by Intertrade Holdings, Inc. via subcontract.

Scope and Role of the OU3 Remedy

Operable Unit 3 is the second OU to be addressed by EPA in the Copper Basin and the first of two to be addressed in the Davis Mill Creek watershed. In September 2011, EPA issued a Record of Decision for the Ocoee River (OU5). The Ocoee River remedy uses Monitored Natural Recovery in conjunction with engineering controls to reduce chronic risk to aquatic receptors in the river. The remedy proposed by EPA for OU3 is intended to protect the Ocoee River, allow natural processes in the river to continue to mitigate the chronic risk, and limit human and terrestrial wildlife exposure to the surface water and sediment in OU3.

The OU3 remedy does not address the upland areas of the Davis Mill Creek watershed that are included in OU4. These are areas of active waste and by-product recycling. Actions in OU4 are governed by the 1990 Agreement and Covenant Not to Sue between Boliden Intertrade, the United States, and State of Tennessee. EPA will make a remedy decision on OU4 at an appropriate time following completion of the recycling activities.

Summary of Findings Relevant to OU3 from the 2012 Davis Mill Creek Remedial Investigation

The 2012 RI report included data and information pertaining to both OU3 and OU4 collected from 2005 through 2009. The following discussion summarizes significant findings relevant to OU3. Environmental media present in OU3 include surface water, sediment, and sediment pore water.

Davis Mill Creek and its main tributary Belltown Creek drain an area of 5.2 square miles. The OU3 channel flows about 2.4 miles to its former confluence with the Ocoee River; it is joined midway by Belltown Creek (now diverted to the Ocoee River). OU3 has been modified extensively by sedimentation, waste and by-product disposal, transportation corridors, manufacturing facilities, impoundments, and diversions. Consequently, the present creek does not occupy its historic channel.

Along its entire length, the OU3 channel is coated with a layer of yellowish orange iron minerals precipitated from the water column. Surface water in OU3 has low pH and high concentrations of metals and sulfate.

Surface Water. The upper reach of OU3 (headwaters to dam No. 1; Figure 2) flows past piles of slag, waste rock, sulfide mineral concentrate, and other materials (Figure 3). Surface water pH varies from 2.6 to 3.1 (pH values less than 7 are considered acidic) and it has high concentrations of aluminum, cadmium, copper, iron, manganese, and zinc. Stream flow increases by about 400 gpm through seepage and shallow ground water gain from OU4. The upper section of OU3 collects and conveys about 1,720 pounds per day of dissolved metals (mostly calcium, iron, magnesium, manganese, sodium and zinc); 4,620 pounds per day of sulfate; and 1,150 pounds per day of acidity.

The middle section of OU3 (dam No. 1 to dam No. 3) flows past rail grades and large stockpiles of iron calcine which cover mines and waste rock piles associated with the historic Mary and Polk County mines (OU4) (Figure 3). Entering this reach is a small amount of flow from the North Potato Creek (NPC) diversion tunnel as well as discharges from a French drain and other seeps. Although these inflows do not measurably increase the amount of surface water discharge, they significantly affect surface water quality. Surface water pH decreases from 2.7 to 2.5 and the OU3 channel gains an additional 2,500 pounds per day of dissolved metals (mostly calcium, iron,

magnesium, manganese, and zinc); 5,300 pounds per day of sulfate; and 5,080 pounds per day of acidity.

The lower reach of OU3 (dam No. 3 to dam No. 5) bisects the Copperhill industrial site and flows past a large cliff of pot slag (Figure 3). Numerous process and storm water discharges entered this reach during historic industrial operations. The reach continues to receive inflow from the West Drainage Channel tributary, which drains along Highway 68 and through the Intertrade industrial area. Surface water pH in the lower reach varies from about 4.1 to 7.0 and OU3 gains about 1,210 pounds per day of metals (mostly calcium, iron, magnesium, manganese, sodium, and zinc), 2,830 pounds per day of sulfate, and 540 pounds per day of acidity. The amount of copper carried by the creek increases in this reach by 6.2 pounds per day, the highest of any segment of the creek[2].

Sediment. The substrate of OU3 consists of a one to three-inch-thick surface layer of iron minerals precipitated from the water column. Below this layer, sediment in OU3 consists of rock fragments, quartz, mica, clays, and other minerals eroded from natural soil and rock exposed in the watershed mixed with a variable proportion of waste materials eroded from OU4, including granulated slag, fragmented pot slag, demolition debris, and other materials. Sediment samples have elevated concentrations of numerous metals including arsenic, cadmium, copper, iron, lead, and zinc.

Sediment Pore Water. Water contained within the pore spaces of sediment in OU3 interacts with sediment particles, surface water, and seepage that enters the streambed. Pore water contained within OU3 sediment has elevated concentrations of sulfate and metals such as cadmium, copper, iron, lead, manganese, and zinc. Pore water with the highest concentrations was found upstream of retention dam No. 2. In this area, maximum concentrations of dissolved iron and zinc were measured at 4,000,000 micrograms per liter (μg/L) and 855,000 μg/L, respectively.

Contaminant Fate and Transport. The 2012 RI report indicated that piles of waste and by-product materials located within OU4 serve as sources of contamination to the surface water, sediment, and sediment pore water in OU3. Contaminants are transferred to OU3 by several processes. In solid form, contaminants eroded from the piles by wind and water are deposited as sediment in OU3. These solid particles are carried downstream by water flow and interact with surface water and sediment pore water. Contaminants also may be released from the wastes and by-products through weathering, oxidation, and leaching. In these instances, the contaminants are carried to OU3 in dissolved form by surface runoff or infiltrating rain water that seeps to OU3. Dissolved contaminants flow downstream with the water unless chemical reactions occur that cause them to precipitate or be adsorbed. Before placing the collection and treatment system into operation, contaminants in dissolved and solid form ultimately were transported to the Ocoee River.

Intertrade Holdings, Inc. is currently excavating and recycling waste and by-product piles in OU4. This work is being done under work plans approved by EPA and TDEC in accordance with the terms and provisions of the 1990 Agreement and Covenant Not to Sue. EPA expects removal and reclamation of these piles to reduce contaminant transport to OU3, but the amount of reduction cannot be quantified at this time. Nevertheless, seepage of shallow ground water from beneath the recycled areas likely will persist and necessitate long-term treatment of OU3.

Summary of Site Risks. Risk to human health from exposure to surface water and sediment in OU3 was assessed using current and future scenarios for industrial workers and recreational trespassers. Risk associated with exposure to sediment pore water was not evaluated because there is no exposure pathway to this medium. The

[2] Note: At the time the RI was conducted, water flowing in the lower reach consisted primarily of discharge from the Belltown diversion pipeline; this diversion has since been extended to the river and no longer flows through the lower reach. Consequently, water in the lower reach now has characteristics similar to water at the downstream end of the middle reach.

human health risk assessment determined that unacceptable risks are posed to current and future recreational trespassers from exposure to cobalt in surface water from the French drain outlet and manganese in surface water from the French drain outlet, NPC diversion tunnel outlet, and the upper and middle sections of OU3. The risk assessment also determined that sediment in OU3 does not pose an exposure risk to humans as long as it remains beneath a cover of surface water, soil, or rock.

The ecological risk assessment did not quantify risks to aquatic receptors within OU3 because the channel is classified as a treatment system and is no longer considered as waters of the U.S. However, surface water and sediment in OU3 were determined to pose a significant risk to aquatic and semi-aquatic receptors based on the chemical stressors present. The ecological risk assessment identified potential risk to terrestrial wildlife receptors from exposure to aluminum and zinc in surface water from the NPC diversion tunnel and French drain outlets, respectively. Sediment in OU3 does not pose an exposure risk to terrestrial wildlife so long as it remains beneath a cover of surface water, soil, or rock.

The results of the risk assessments were used to calculate remedial goals for surface water for the constituents of concern at the site. These goals, expressed in concentrations of micrograms per liter (µg/L) are shown in the table below.

Constituents of Concern in Surface Water in OU3		
Constituent of Concern	**Remedial Goal (µg/L)**	**Basis for Remedial Goal ***
Aluminum	59,900	Eco Risk
Cobalt	2,600	HH Risk
Manganese	35,000	HH Risk
Zinc	696,000	Eco Risk

* Eco Risk – value developed from ecological risk assessment.
HH Risk – value developed from human health risk assessment.
µg/L – concentration in micrograms per liter.

Remedial goals for surface water were exceeded in the upper and middle sections of the OU3 channel (manganese), the NPC diversion tunnel outlet (aluminum, cobalt, manganese), and the French drain outlet (cobalt, manganese, zinc).

Summary of Findings from the 2008 Ocoee River Remedial Investigation Relevant to OU3

Water quality in the Ocoee River now generally meets Tennessee Water Quality Criteria. This is primarily the result of the interim removal actions conducted in the Davis Mill and North Potato Creek watersheds which reduce transport of contaminants to the river. An assessment of risk to aquatic life in the river concluded that sustained interruption in the treatment of Davis Mill Creek (OU3) would be expected to cause adverse impacts to fish, invertebrates, and habitat in the river downstream of the former creek confluence.

Remedial Action Objectives

Remedial Action Objectives (RAOs) describe what a proposed site cleanup is expected to accomplish. The RAOs for the Davis Mill Creek Collection and Treatment System are:

- Prevent or control the transport of metals-contaminated sediment from OU3 to the Ocoee River.
- Prevent discharges of contaminated surface water from OU3 at levels that may cause exceedances of ambient water quality criteria in the Ocoee River or at levels that will adversely affect the quality of the river for its designated uses and classifications.
- Limit human exposure to the surface water and sediment within OU3 that would result in a Hazard Index (HI) greater than or equal to one; an excess cancer risk greater than 1 in 100,000; or unacceptable fetal blood lead levels.
- Limit exposure of terrestrial wildlife receptors to surface water and sediment within OU3 that would result in a HI greater than or equal to one.

In addition to the constituents of concern for which remedial goals were developed, TDEC developed effluent limits[3] for the Cantrell Flats water treatment plant which will be protective of the designated uses of the Ocoee River. These limits are specified in the National Pollutant Discharge Elimination (NPDES) permit under which the plant operates.

Summary of Remedial Alternatives

Based on the findings of the Davis Mill Creek remedial investigation and its associated risk assessment and consideration of the Record of Decision for the Ocoee River, EPA determined that remedial actions will be required in OU3 to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

The NCP at 40 CFR §300.430(e)(7) describes methods for screening cleanup technologies to develop applicable remedial alternatives. These procedures ensure that the best or most promising technologies and alternatives are retained for detailed analysis and comparison. As a part of the feasibility study, a variety of cleanup technologies first were screened for their implementability and effectiveness in abating the identified risks at this site. Technologies that passed the screening then were combined to develop a final set of remedial alternatives to be evaluated further. These alternatives are described below.

In evaluating the risk posed by manganese in surface water in the middle section of OU3, EPA noted that exceedances of the remedial goal for manganese in this portion of OU3 were slight (hazard indices of less than 1.4) and that exceedances occurred less than 60 percent of the time. EPA has determined that institutional controls and site security should be sufficient to manage this risk.

[3] An effluent limit is a specified numerical concentration of a pollutant that cannot be exceeded in treated water that is discharged to the environment under the Clean Water Act.

Remedial Alternatives for OU3 – Davis Mill Creek Collection and Treatment System

Four alternatives were evaluated for OU3. Table 1 summarizes their components.

Alternative DMC-1: No Action

The NCP requires the consideration of "No Action" to serve as a baseline alternative. Under this alternative, all operations and maintenance (O&M) actions currently taken with respect to the removal actions completed in OU3 would cease. This means that pumps at dam No. 5 would not operate and water from OU3 would not be sent to the Cantrell Flats plant for treatment. Because pumps at dam No. 5 would not operate, contaminated creek water eventually would overtop the dam and flow directly into the Ocoee River without treatment. Initially, the Belltown Creek, Gypsum Pond, and West Drainage Channel diversions would operate; however, without maintenance, the intakes to these diversions eventually would clog with debris and water from these sources would flow into Davis Mill Creek rather than through the pipelines. Retention dams No. 1, 2, 3, 4, and 5 and the Belltown Creek diversion dam would not be maintained. Without maintenance, the pipes that convey base flow through the retention dams eventually would clog and water would pond behind the dams until overflowing across the dam crests or the emergency spillway of dam No. 4. Absent functioning surface water diversions, the total volume of untreated water predicted to reach the Ocoee River under Alternative DMC-1 would be about 1.5 billion gallons per year under base flow conditions (non-storm) and 360 billion gallons (1,106 acre-feet) during a 10-year, 24-hour storm event (figures include Belltown Creek).

Alternative DMC-2: Davis Mill Creek Removal Actions

Under Alternative DMC-2, the Davis Mill Creek collection and treatment system, as constructed pursuant to AOC Docket No. 01-12-C and AOC Docket No. CER-04-2003-3521, would be operated and maintained. This would permit treatment of OU3 water up to the 10-year, 24-hour storm event at the Cantrell Flats plant. As part of this alternative, surface discharge from Belltown Creek and the Gypsum Ponds up to the 10-year, 24-hour storm, and storm flow in the West Drainage Channel exceeding 500 gpm, will be diverted to the Ocoee River. Treated water from the Cantrell Flats plant will be discharged to the Ocoee River through Outfall 009, in accordance with NPDES permit No. TN0002411 issued to Intertrade Holdings.

This alternative diverts more than 700 million gallons of clean water per year out of the watershed under base flow conditions (218 million gallons during the 10-year, 24-hour storm event) through the Belltown Creek diversion and meets storm water retention capacity requirements of a 10-year, 24-hour rainfall event using the surge pond behind dam No. 5 and storm water retention in Ponds 1, 2, 3, and 4. The pump station at dam No. 5 is capable of pumping 5,200 gpm to the Cantrell Flats plant for treatment.

Alternative DMC-3: Davis Mill Creek Removal Actions plus Institutional and Engineering Controls

Alternative DMC-3 includes all components of Alternative DMC-2, plus capturing surface water discharging from the NPC diversion tunnel and French drain outlets, placing this water into pipes, and conveying the water through the pipes to Davis Mill Creek. Alternative DMC-3 also includes restricting access to the NPC diversion tunnel, covering sediment that would be exposed in the French drain and diversion tunnel channels when surface water is captured, and implementing deed restrictions and notifications to limit exposure to residual contaminants in the OU3 channel. In addition, Alternative DMC-3 allows for upgrades and renovations of the Cantrell Flats treatment plant, as may be required in future years, to maintain operational function and efficiency.

Piping the surface water discharges at the French drain and NPC diversion tunnel, installing a fence barrier at the diversion tunnel portal, and covering sediment in the former French drain and diversion tunnel channels will reduce risk to humans and wildlife in the middle section of OU3. Exposure to surface water discharging from the diversion tunnel and French drain outlets will be prevented by placing this water into pipes. To prevent mammals and birds from entering the NPC diversion tunnel, where they may be exposed to contaminants, fencing and/or netting (or a similar approach) will be installed across the tunnel opening. Because piping water from the outlets directly to the OU3 channel will expose sediment by eliminating the water cover in these channels, the sediment in the French drain and NPC diversion tunnel channels will be covered with borrow soil or rock to prevent exposure to contaminants in the sediment.

Although the Cantrell Flats treatment plant was refurbished in 2001-2002, additional upgrades and renovation are anticipated to meet a 30 year life expectancy. Alternative DMC-3 includes funds to upgrade the plant, as necessary beyond routine maintenance, to maintain or improve operational efficiency.

Alternative DMC-4: Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls

Alternative DMC-4 includes all components of Alternative DMC-3 plus fencing a portion of the upper section of OU3.

Surface water in a 1,300-foot-long segment of the upper section of OU3 contains high concentrations of manganese that exceed the remedial goal. Alternative DMC-4 reduces risk to humans and wildlife by installing and maintaining a fence around this segment to discourage access by trespassers and terrestrial wildlife.

Table 1. Summary of Retained Alternatives

	Alternative DMC-1	Alternative DMC-2	Alternative DMC-3	Alternative DMC-4
	No Action	**Davis Mill Creek Removal Actions**	**Davis Mill Creek Removal Actions plus Institutional and Engineering Controls**	**Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls**
Institutional Controls	• None	• None	• Deed notification • Deed restriction • Access restriction at the NPC diversion tunnel portal	• Same as Alternative 3 • Access restriction in DMC in area of Headwaters iron calcine pile (upper section)
Dam No. 5 and Pump Station	• Not operated or maintained; accumulated water overflows to Ocoee River	• Operated and maintained; water pumped to Cantrell Flats plant; no overflow to Ocoee River	• Same as Alternative 2	• Same as Alternative 2
Cantrell Flats WTP	• No treatment of OU3 water	• OU3 water treated up to 5,800 gpm	• DMC treated up to 5,800 gpm • Refurbish and upgrade plant as required	• Same as Alternative 3
Belltown Creek and Gypsum Pond Diversions	• No maintenance of diversion pipes and inlets; diversion eventually ceases function and water flows into OU3	• Operated and maintained; flows up to 10-yr, 24-hr storm event diverted to Ocoee River	• Same as Alternative 2	• Same as Alternative 2
West Drainage Channel Diversion	• No maintenance of storm water diversion; diversion eventually ceases function and water flows into OU3	• Operated and maintained; base flow discharges to OU3, flow greater than 500 gpm discharges to Belltown Creek diversion	• Same as Alternative 2	• Same as Alternative 2
OU3 Retention Dams and Ponds	• Dams and ponds not maintained; water eventually ponds behind and overflows dams	• Operated and maintained; 190 acre-feet storm water storage capacity held for treatment	• Same as Alternative 2	• Same as Alternative 2
French Drain and NPC Diversion Tunnel Discharges	• No change	• No change	• Encapsulate in pipe from outlet to Davis Mill Creek • Cover exposed sediment • Restrict access to NPC diversion tunnel portal	• Same as Alternative 3
Monitoring	• Copper Basin Reach of the Ocoee River	• Treatment plant effluent per NPDES permit • Copper Basin Reach of the Ocoee River	• Treatment plant effluent per NPDES permit • Copper Basin Reach of the Ocoee River	• Treatment plant effluent per NPDES permit • Copper Basin Reach of the Ocoee River

Analysis of Alternatives

This section summarizes the evaluation process that resulted in the selection of a Preferred Alternative.

The NCP at 40 CFR §300.430(e)(9)(iii) establishes a framework of nine criteria for evaluating identified remedial alternatives. The evaluation criteria are:

1. ***Overall Protection of Human Health and the Environment***
2. ***Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)***
3. ***Long-Term Effectiveness and Permanence***
4. ***Implementability***
5. ***Short-Term Effectiveness***
6. ***Reduction in Toxicity, Mobility, or Volume of Contaminants through Treatment***
7. ***Cost***
8. ***State and Support Agency Acceptance***
9. ***Community Acceptance***

These criteria were used to evaluate the different remedial action alternatives individually and against each other in order to select a preferred remedy; this analysis can be found in the Feasibility Study for OU3.

If an alternative does not meet the two threshold criteria of Overall Protection of Human Health and the Environment, and Compliance with ARARs, EPA does not consider the alternative further. EPA will recommend the cleanup alternative that provides the best balance of the evaluation criteria. With concurrence from the State of Tennessee and consideration of public comments, EPA will determine the final alternative in a Record of Decision (ROD).

Overall Protection of Human Health and the Environment

The No Action alternative (DMC-1) would not meet the RAO for protection of the Ocoee River. Under Alternatives DMC-2, DMC-3, and DMC-4, this RAO would be met by capturing and treating OU3 surface water up to the 10-year, 24-hour storm event. Untreated water could be discharged to the river by storm flows exceeding the 10-year, 24-hour event, potentially causing concentrations in the river to exceed Tennessee water quality criteria.

Alternatives DMC-1 (No Action) and DMC-2 (Removal Actions) do not mitigate on-site risk to human and terrestrial receptors from surface water exposure. Alternative DMC-3 (Removal Actions plus Institutional and Engineering Controls) would reduce risks to current and future recreational trespassers and terrestrial wildlife by placing surface water from the French drain and NPC diversion tunnel outlets into pipes and restricting access to the diversion tunnel. Alternative DMC-4 (Removal Actions plus Additional Institutional and Enhanced Engineering Controls) would reduce risks to humans and terrestrial wildlife further by restricting access to surface water in the upper section of OU3.

Deed restrictions and notifications included under alternatives DMC-3 and DMC-4 would provide additional risk mitigation by ensuring that future uses assist in reducing trespasser access to the site. These controls are not included in alternatives DMC-1 and DMC-2.

The current hydrology of OU3 will not be changed under alternatives DMC-2, DMC-3, or DMC-4. Consequently, contaminated sediment in OU3 is expected to remain beneath a water cover that prohibits exposure to humans and wildlife. Under alternatives DMC-3 and DMC-4, sediment that would be exposed in the outlet channels of the French drain and NPC diversion tunnel following capture of this surface water would be covered with borrow rock or soil.

Compliance with ARARs

The No Action alternative (DMC-1) would not meet chemical-specific ARARs because surface water exceeding Tennessee water quality criteria would discharge directly into the Ocoee River. In addition, the No Action alternative would not comply with the action-specific ARAR of the Tennessee Safe Dams Act because dam No. 4

would not be maintained. Because the No Action alternative fails to satisfy the two threshold criteria of "Overall Protection of Human Health and the Environment" and "Compliance with ARARs", it was not considered further in the comparative evaluation of alternatives.

Alternatives DMC-2, DMC-3, and DMC-4 comply with all chemical-, location-, and action-specific ARARs; therefore, these alternatives provide similar levels of ARAR compliance.

Long-Term Effectiveness and Permanence

Alternative DMC-2 (Removal Actions) is the least effective long-term solution because it relies on continued operation of an aging water treatment plant to protect the Ocoee River. Moreover, the alternative does not mitigate risk to human or terrestrial receptors from exposure to surface water at the French drain and NPC diversion tunnel outlets or in the upper section of OU3.

Alternatives DMC-3 and DMC-4 include a provision for additional renovation or replacement of water treatment components at the Cantrell Flats plant to ensure long-term effectiveness of water treatment in OU3. In addition, both alternatives provide additional long-term risk reduction to human and terrestrial receptors by capturing and piping surface water at the French drain and NPC diversion tunnel outlets, fencing the NPC diversion tunnel portal opening to prevent ingress, and covering exposed sediment in the present outlet channels. Provided these components are properly maintained, alternatives DMC-3 and DMC-4 provide a higher degree of long-term effectiveness and permanence than alternative DMC-2.

Alternative DMC-4 provides the highest degree of long-term effectiveness because it includes fencing in the upper section of Davis Mill Creek to further limit surface water exposure to human and terrestrial receptors.

Implementability

The primary components of alternatives DMC-2, DMC-3, and DMC-4 (renovation and operation of the Cantrell Flats treatment plant, construction and operation of the clean water diversions and storm water retention dams, and construction and operation of dam No. 5 and its associated pump station) comprise interim removal actions which have been completed. Consequently, each of these alternatives is implementable.

Alternative DMC-2 would not require any additional construction or actions and is the easiest to implement. Alternatives DMC-3 and DMC-4 include provisions to refurbish or replace components of the Cantrell Flats treatment plant as they fail or reach the end of their useful life. This work, which would be similar to the renovation completed in 2002 or to new construction completed by GSH in the North Potato Creek watershed in 2005, would not require additional permits or coordination. Alternative DMC-3 is easy to implement due to the perceived ability to gain agency approval, ease of construction of the French drain and NPC diversion tunnel pipeline and sediment covering, and the reliability of the pipe conveyance. Similarly, Alternative DMC-4 is easy to implement, but the large length of fence required in the upper section of OU3 (1,300 feet), the complex topography of the area, and the potential for interference with waste recycling activities in the area make installation and maintenance of the fencing moderately difficult.

Criteria Used to Evaluate Remedial Alternatives

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

1. **Overall Protection of Human Health and the Environment** – Eliminates, reduces, or controls threats to public health and the environment through institutional or engineering controls or treatment.

2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** – Compliance with Federal environmental and State environmental or facility siting laws that pertain to the site.

3. **Long-Term Effectiveness and Permanence** – Maintain protection of human health and the environment over time after the cleanup is complete.

4. **Implementability** – Technical feasibility and administrative ease of conducting a remedy, including factors such as availability of services.

5. **Short-Term Effectiveness** – Potential impact of implementation of the alternative and the length of time required to achieve protection.

6. **Reduction in Toxicity, Mobility, or Volume through Treatment** – The 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).

9. **Community Acceptance** – Consideration of public comments on the Proposed Plan.

Short-Term Effectiveness

The primary components of alternatives DMC-2, DMC-3, and DMC-4 (operation of the Cantrell Flats treatment plant, construction and operation of the clean water diversions and storm water retention dams, and construction and operation of dam No. 5 and its associated pump station) are composed of interim removal actions that have been completed. Potential impacts to the environment or community from operating and maintaining these removal actions or renovating treatment plant components (alternatives DMC-3 and DMC-4) are minimal; potential impacts to workers are mitigated through a Health and Safety Plan.

Effects to workers or the environment potentially could arise during actions to capture and pipe the French drain and diversion tunnel discharges (alternatives DMC-3 and DMC-4), cover exposed sediment in these areas (alternatives DMC-3 and DMC-4), and construct a fence in the upper section of the creek (alternative DMC-4). These actions would be completed within one year. Similar projects previously completed in the watershed created minimal exposures to workers and the environment.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives DMC-2, DMC-3, and DMC-4 would divert more than 700 million gallons per year of unimpacted water from Belltown Creek and the Gypsum Ponds around the area of contamination to prevent it from mixing with impacted water in Davis Mill Creek. In addition, these alternatives would treat approximately 770 million gallons per year of contaminated water from Davis Mill Creek, the French drain, the NPC diversion tunnel, and the West Drainage Channel to prevent its flow to the Ocoee River. Treated water would be discharged to the river in accordance with the effluent limits specified in NPDES permit TN0002411 issued by the State of Tennessee to Intertrade Holdings, Inc. No other reductions in mobility, toxicity, or volume would be achieved by any of the alternatives.

Cost

The box below defines cost as estimated for each remedial alternative during the feasibility study.

Cost Definitions

- **Capital cost** is the cost to construct a remedial action.
- **Operation and maintenance (O&M) cost** is the cost to ensure or verify continued effectiveness of a remedial action estimated on an annual basis.
- **Present worth cost** is the total cost across the lifespan of the remedial action including the initial capital cost plus any continuing operation and maintenance costs estimated over 30 years.

The following table shows costs estimated for each of the four alternatives and the residual risk that would remain in OU3 after their implementation.

Alternative	Capital	O&M	Total Present Worth	Residual Risk (HI)
DMC-1	$0	$61K	$61K	FRT = 5 CRT = 3 FIW = 1
DMC-2	$9.5M	$18.7M	$28.2M	FRT = 5 CRT = 3 FIW = 1
DMC-3	$9.7M	$22.7M	$32.3M	FRT = 3 CRT = 3 FIW = 1
DMC-4	$9.8M	$22.7M	$32.5M	FRT = 1 CRT = 1 FIW = 1

HI – Hazard index
FRT – Future recreational trespasser, CRT – Current recreational trespasser, FIW – Future industrial worker

Alternative DMC-2 would be the least costly alternative with capital, operations and maintenance (O&M), and present worth costs of $9.5M, $18.7M, and $28.2M, respectively. Residual risk to human and terrestrial wildlife receptors would remain from exposure to surface water at the French drain, NPC diversion tunnel, and the upper section of OU3 after implementation.

Alternative DMC-3 has the second lowest costs and has capital, O&M, and present worth costs of $9.7M, $22.7M, and $32.3M, respectively. Residual risk to human and terrestrial wildlife receptors would remain from exposure to surface water in the upper section of OU3 after implementation.

Alternative DMC-4 is the most costly alternative. It has capital, O&M, and present worth costs of $9.8M, $22.7M, and $32.5M, respectively. Residual risk to human and terrestrial wildlife receptors from exposure to surface water would no longer be present after implementation.

State Acceptance

The State of Tennessee has been involved in evaluating conditions in OU3 and determining the cleanup alternatives presented in this Proposed Plan. At this time, the State is analyzing EPA's preferred alternative for OU3, which is summarized below. State acceptance will be described in the ROD and Responsiveness Summary.

Community Acceptance

This Proposed Plan provides the opportunity for the public to make comments to EPA on the Preferred Alternative for OU3. Community acceptance of the Preferred Alternative will be evaluated after the 30-day public comment period and will be described in the ROD and Responsiveness Summary.

EPA's Preferred Alternative

EPA's preferred alternative for OU3 is **Alternative DMC-4 – Davis Mill Creek Removal Actions plus Institutional and Enhanced Engineering Controls.** Figure 4 illustrates components of the Preferred Alternative.

Alternative DMC-4 meets the Threshold Criteria and provides the best balance of tradeoffs among the other alternatives with respect to the Balancing and Modifying Criteria. It addresses the principal threat waste of mine-impacted surface water and is expected to meet the statutory requirements of CERCLA Section 121(b) as discussed below.

Statutory Requirements of CERCLA Section 121(b)

- Be protective of human health and the environment.
- Comply with ARARs.
- Be cost effective.
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met.

- Protection of human health and the environment will be achieved by capturing and treating mine-impacted surface water in OU3 up to the 10-year, 24-hour storm. This will prevent discharges of contaminated water to the Ocoee River that could degrade aquatic resources in the river. Areas of surface water with concentrations exceeding remedial goals will be captured and encapsulated in pipes (French drain and NPC diversion tunnel) or fenced (upper section of OU3 and NPC diversion tunnel portal) to prevent exposure by humans and terrestrial wildlife. Deed restrictions and notifications will be used to assist in reducing trespasser access to the site.
- Compliance with ARARs will be achieved. Capturing water and sediment to prevent its discharge to the Ocoee River and discharging treated water in compliance with NPDES effluent limits developed by the State of Tennessee will allow State water quality criteria for the Ocoee River to be met. Maintenance of the retention dams will ensure that dam No. 4 complies with Tennessee State safe dam requirements. Disposal of treatment sludge will comply with the State's underground injection requirements. Collection and treatment of storm water runoff will comply with the State's storm water requirements.
- Long-term cost effectiveness is achieved by diverting unimpacted water directly to the Ocoee River to prevent its contamination in OU3. Maintenance of diversions and storm water retention structures will ensure their continued efficient operation while maintenance and renovation of treatment plant components will ensure proper long-term function of the treatment system. Disposal of treatment plant sludge into underground mine workings as a slurry contributes to long-term cost effectiveness by eliminating the need for dewatering and land disposal.
- Although EPA recommends development of at least one alternative that would eliminate the need for long-term management at the site, no feasible permanent remedial alternatives for OU3 were identified due to the large volume of source material present in OU4. Many sources in OU4 are being removed, recycled, and reclaimed under terms of the 1990 Agreement and Covenant Not to Sue. As a result, conditions in OU4 are expected to improve, but long-term management may still be required.
- Because OU3 collects mine-impacted surface water runoff generated throughout the watershed and gains contaminants from shallow ground water, the preferred alternative focuses on protecting the Ocoee River by capturing and treating OU3 surface water and minimizing exposures within the OU.
- The contamination collected and conveyed to treatment by OU3 originates in OU4. Many of these sources are currently being recycled in accordance with EPA-approved work plans under the authority of the 1990 Agreement and Covenant Not to Sue. Consequently, treatment of these sources is beyond the scope of the remedy for OU3.

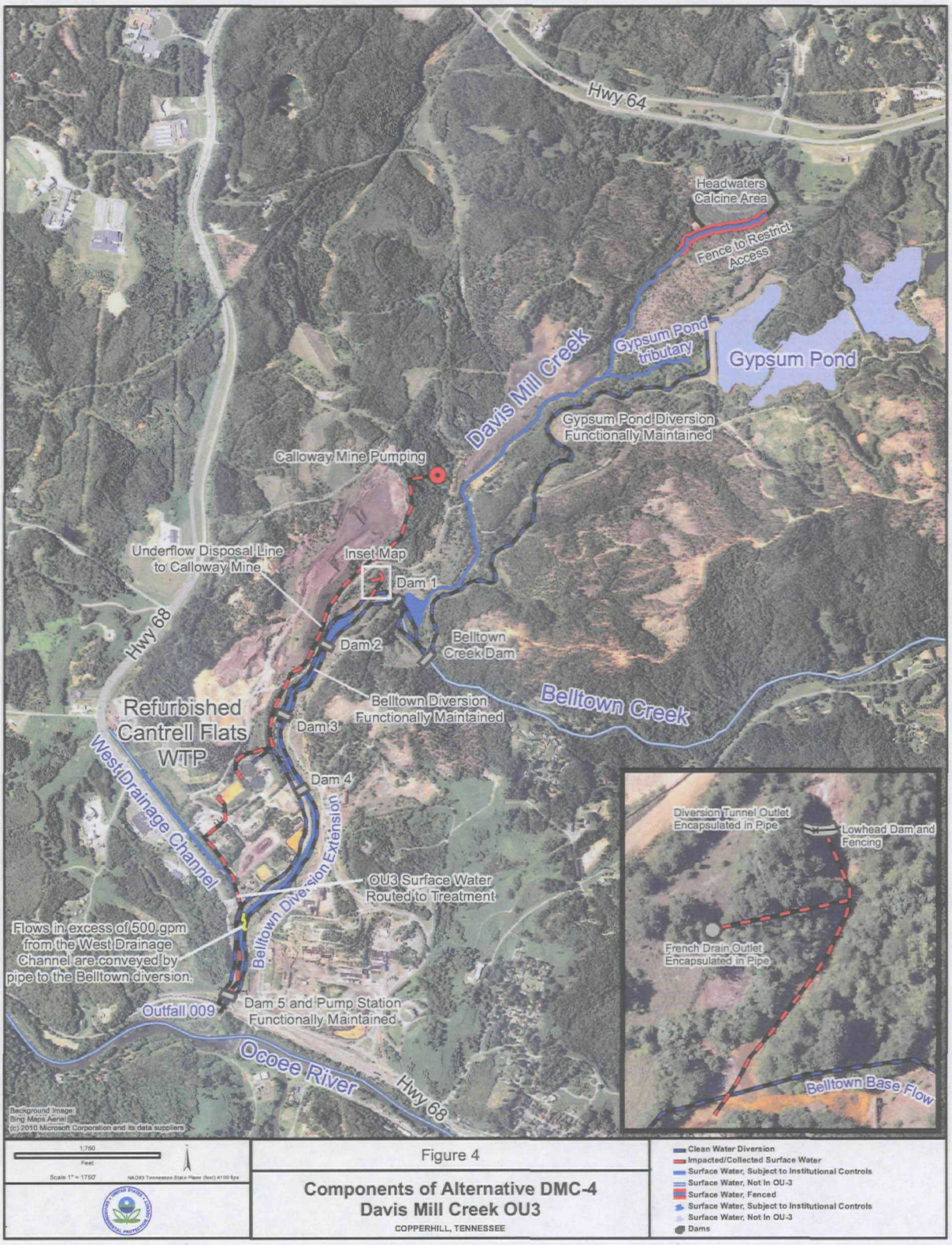


Figure 4

Components of Alternative DMC-4
Davis Mill Creek OU3

COPPERHILL, TENNESSEE

Public Input

An open house and public meeting will be held July 19th from 5:00 pm and 7:00 pm at the office of Glenn Springs Holdings, Inc., 127 Main Street, Ducktown, Tennessee. An informal open house will be held from 5 to 6 pm. The formal public meeting will begin at 6 pm. EPA will present the findings of the OU3 Remedial Investigation and the Feasibility Study and the rationale behind the Preferred Alternative.

Written comments on this Proposed Plan will be accepted from **July 13 to August 13, 2012,** and should be mailed or e-mailed to:

Mr. Loften Carr
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960
Carr.Loften@epa.gov
404-562-8804

Mr. Andy Shivas
Tennessee Department of Environment and Conservation
4th Floor, L&C Annex
401 Church Street
Nashville, TN 37243-1538
Andy.Shivas@state.tn.us
615-532-0912

Information Repositories

Information about the Copper Basin Mining District Site, including the Davis Mill Creek collection and treatment system (OU3) is available at the following locations:

Copper Basin Information Repository
Ducktown City Hall
340 Main Street
Ducktown, Tennessee
Phone 423-496-3546
Hours: M, T, Th, F 8:30 am – 4 pm

U.S. EPA Region 4 Information Center
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960
404-562-8946
Hours: M-F 8 am – 5 pm

Mailing List Additions

If you would like to be placed on the Copper Basin site mailing list, please send your request to Loften Carr, EPA Project Manager, at the address above.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Davis Mill Creek Collection and Treatment System (OU3) is important to EPA. Comments provided by the public are valuable in helping EPA select a cleanup remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked for receipt by EPA no later than August 13, 2012. If you have questions about the comment period, please contact Mr. Loften Carr, 404-562-8804. Those with electronic communications may submit their comments to EPA at the following email address: Carr.Loften@epa.gov on or before August 13, 2012.

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Name_____

Address_____

City_____

State_____ **Zip**_____

INSIDE: EPA Proposes Action on Davis Mill Creek

Mr. Loften Carr
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303

OFFICIAL BUSINESS
Penalty for Private Use $300

Place Stamp Here

Mr. Loften Carr
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303

Appendix C
Comments on the Proposed Plan

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Davis Mill Creek Collection and Treatment System (OU3) is important to EPA. Comments provided by the public are valuable in helping EPA select a cleanup remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked for receipt by EPA no later than August 13, 2012. If you have questions about the comment period, please contact Mr. Loften Carr, 404-562-8804. Those with electronic communications may submit their comments to EPA at the following email address: Carr.Loften@epa.gov on or before August 13, 2012.

I feel that alternative DMC-4 is the correct option for this section of Davis Mill Creek. It is apparent to me that this plan not only provides for the highest level of protection for the public and wildlife but it also will allow for the contaminants to be removed from the creek prior to it reaching the Ocoee. This option will also put in place the mechanisms to continue this work going forward for the next 30 years.

I am very familiar with the history of this area and the level of impact/contaminants that the past mining/smelting/chemical operations left in this watershed. US EPA has considered this data carefully, in my opinion, in making their recommendation.

Name Ken Rush

Address P. O. Box 458

City Ducktown

State TN Zip 37326

From: Gail
To: Loften Carr/R4/USEPA/US@EPA
Subject: Davis Mill Creek
Date: 07/19/2012 06:54 PM

I received the paper in the mail last week regarding the cleanup of the above area. After reading and considering the options,the only one that makes any sense is DMC-4. It seem to be the only one that addresses the entire problem. As you know, the entire area was so polluted at on time that there was no vegetation. I moved her 9 years ago and the Ocoee River was still polluted then. River guides for rafting developed sore that would not heal until they left the area. This must be stopped. Clean water is the right of every tax-paying citizen of this country. As a taxpayer I think that I am due a safe environment and water where I live.

Gail Cragg
gailc@etcmail.com

194 Lakeview Dr.
Turtletown, Tn. 37391

From: JUNE TOWERY
To: Loften Carr/R4/USEPA/US@EPA
Subject: Comments on DMC Proposal
Date: 07/12/2012 04:45 PM

Fact No. 1: Davis Mill Creek was toxic 10000 years ago, due to geochemstry considerations, before any industrial activity changed things; It would still be toxic today, absent human interference.

Question No. 1: Who are you proposing should pay up for this naturally ocurring phenomenon now, Oxy or taxpayers?

Fact No.2: Recreational trespassers are criminals; I don't agree with spending a lot of money to protect them. As for wildlife, they are smart enough to stay out of a poisonous creek.

Glenn Towery
149 Hickory Tree Drive
Copperhill TN 37317
phone 423-496-2742

Appendix D
Transcript of July 19, 2012 Public Meeting

U. S. ENVIRONMENTAL PROTECTION AGENCY

DAVIS MILL CREEK

COLLECTION AND TREATMENT SYSTEM OU3

PUBLIC MEETING

JULY 19, 2012

127 MAIN STREET

DUCKTOWN, TENNESSEE

6:00 P.M.

APPEARANCES:

LOFTEN CARR, EPA

CRAIG ZELLER, EPA

(Presentation was given by Loften Carr. The following public comment was made during presentation.)

MARTY KAHN: When you say you are putting the water down in the old mine shafts.

LOFTEN CARR: Well, we put the sludge.

MARTY KAHN: The sludge.

LOFTEN CARR: Correct.

MARTY KAHN: You have natural fractures in the rocks. That's where we get our water from.

LOFTEN CARR: Say your name.

MARTY KAHN: Marty Kahn, K-a-h-n. So you have these natural fractures in the rocks and the water goes like we drill a well. You drill in the rock and you hit a fracture and you get water. How contained is that?

MR. CARR: Well, those mines go down 3,000 feet, okay, and pumped into Stokes. Then that water comes back up. And as part of the NPDES permit and UIC permit, there are pumps in there and they

pump that water back to the plant treatment. So it's a closed loop system.

MARTY KAHN: So nothing going in these fractures can --

MR. CARR: No. Because all the mines are pumped either in another part of the watershed or at the south mine pit and all that water is collected. You know, we don't have any evidence of groundwater contamination in any wells around here from any of the sampling we've been doing. Mainly because it's really below any water that we even use. That's below sea level.

(Presentation by Mr. Carr concluded. Floor was officially opened for public questions/comment.)

LOFTEN CARR: Questions?

MARTY KAHN: What is that right there?

MR. CARR: This is an aerial photo of Davis Mill Creek. This is the rail yard and here is Highway 68 coming along here and here's a truck on Highway 68 right after it went over the bridge. Okay. That's the potslag cliff, the big

red cliffs. That's up above there where everything has been demolished and taken apart. That's not part of OU3. That's part of OU4, the parts. This white line right here is the 83-inch pipe diversion, the Belltown gypsum pond diversion coming under the railroad tracks where it discharges the clean water into the Ocoee. Those are railcars.

This is what used to be orange, Davis Mill Creek and Belltown. This removal action was done here on Apache blast and cleaned up by Glenn Springs and part of that action re-vegetated the delta. Outfall 009 is right there where the water is put back into the Ocoee, the clean water is put back into the Ocoee River.

MARTY KAHN: Marty Kahn again. We've talked about this before, and just so everyone else can hear, about the trucks transporting the calcine down the river road and about the accidents that have happened. Someone else was researching into this and tried to get

information on this and nobody -- this is evidently not your issue but law enforcement. Whoever -- you know, these accidents happened and they had to be reported, I guess, to Polk County.

MR. CARR: Okay. Well, under the Agreement Covenant Not To Sue, there's provisions in that for recycling these materials in the watershed. It's required under the Agreement Covenant Not To Sue, the legal agreement, that anything that's being recycled has to produce a work plan that's approved by EPA and TDEC.

Okay. In that work plan, there's reporting requirements for any accidents, there's clean-up requirements by the company, Tennessee Iron Products, Marion Environmental. All that is in those work plans. So when an accident happens, they're required under that work plan -- here it is. Under those work plans, there are reporting requirements. As soon as an accident happens, they have to call Dick Urban with Tennessee Water Pollution Control and that's set into motion and

they have to call the clean-up operator and the whole thing goes into motion. The clean-up contractor comes out. And, of course, DOT is called as well because the truck has got to be righted and the spill has got to be cleaned up. Clean-up of the calcine is all part of the plan and then part of it's law enforcement and other things, too.

MARTY KAHN: I think that they went through law enforcement and nobody wanted to talk about it. I think they filed a Freedom of Information Act to try to get this information. Can it be gotten? Can all of this be gotten through you?

MR. CARR: Yes.

MARTY KAHN: That's what I wanted to know.

MR. CARR: Yes, you sure can. Any other questions?

EMILY DILBECK: Yes. Emily Dilbeck with Polk County News. What's the timeline on this and what's the estimated cost?

MR. CARR: Well, the timeline that

we put in the proposed plan, we can do -- we can get this area of the french drain cleaned up and the fence put up, you know, probably within a year. This is what we estimated. That's not a lot of work. Everything else is already up and running and going.

The other part of the timeline is EPA and OXY have to sit down and negotiate the consent legal agreement and get the bond in place and all that.

CRAIG ZELLER: The big thing this does is secure long-term operation of the system. Some of it's been going on since 2002.

MR. CARR: Well, it started in 2002, yes.

CRAIG ZELLER: What this does is secure the long-term treatment of the creek water before it's discharged into the river.

MARTY KAHN: Can we talk about the Parksville Reservoir, would that be appropriate, with the contamination?

MR. CARR: Well, back in June 2011

we had a public meeting just like this right here that we talked about all that. But if you have a question, you can ask Craig. He's the project manager, like I am over this, over the Parksville Reservoir.

MARTY KAHN: The thing is, you know, we found out there's a -- not to eat the fish out of the reservoir because of the contamination or only one half of one fish meal per month.

CRAIG ZELLER: That's unrelated to the issues up here. It's atmospheric deposition of mercury and PCBs, issues that are really not thought to be related significantly to the operations up here in the basin.

MARTY KAHN: Right. But that still is a public health hazard to anybody that, shall we say, has recreational use in the reservoir. And then where does the water go once it leaves the reservoir and the dam? It's still heading somewhere else. So how is all of that contamination going to be remediated because it was caused by

these mining operations for all of that garbage to be there? So is there anything in place on that?

CRAIG ZELLER: Yes. Roughly a year ago we were in a similar situation where we were talking about our findings of risk and contamination in Parksville. An action at Parksville and also 26 miles of the river kind of starting here at Davis Mill Creek, confluence all the way down to Parksville. It's about River Mile 35 down to River Mile 11, something like that.

After we looked at a variety of alternatives, particularly with regard to Parksville, the mining related impacts of Parksville are really limited to the upper 300 acres of the lake. The Parksville Delta where you see that big, exposed kind of brown sandbar at low water, at low pool. That is material that was washed out of the basin. What the site looked like -- when it wasn't vegetated, it looked like the surface of Mars.

So a year ago we looked at a variety of alternative for Parksville and

what we eventually proposed and what we did select was to maintain a water cover, a permanent water cover over Parksville to kind of reduce the oxidation of that material.

MARTY KAHN: What is the water cover?

CRAIG ZELLER: The water cover would be to maintain a higher pool. So don't drop the water level in the wintertime. Keep it up around 828, 828 feet above sea level instead of 820. They drop it about 8 feet for --

MARTY KAHN: That's like creating another dam?

CRAIG ZELLER: No. It's really just keeping the water level up closer to summer pool so we can kind of like cover that sediment delta with water. So whichever rule of thumb, if you oxidize metal waste, when it's exposed to atmosphere of air, like rust, that's oxidation. So when you expose metals to air and they rust, that's typically a bad thing. If you don't expose it to air, in

this case cover them with water, they don't. They actively promote reducing conditions which is the opposite of oxidizing conditions and you don't get that metal release.

So we're working with TVA now and Glenn Springs as well trying to work up a legal agreement whereby TVA would keep that water level up so we don't have that.

MARTY KAHN: But then there was another issue that the upper dams above the Ocoee, where those first -- where all the sediment is --

MR. CARR: Before he goes to that one -- tell him about that, too. But they did an RI, remedial investigation study, on the Parksville delta and that whole 36-mile portion of river -- 26-mile portion of river and what they discovered about that delta was that -- we had monitoring wells in there and we collected a lot of samples and we collected them seasonally, different times of the year. When that water is down, those sediments oxidize and they create metal salts which

are soluble. Okay.

Then the water comes up in the summer and it dissolves those salts and they go into the river water and that's the problem, that cycle. So to maintain the water cover, you break that cycle and then we don't have the stuff being flushed into the river.

MARTY KAHN: So if you don't get oxygen in the water itself, you don't get oxidation, just from the air.

MR. CARR: Right.

CRAIG ZELLER: As far as sediment goes for number 2 and 3, yeah, it was, what, January of '09 that TVA did loose some sediment from Ocoee No. 3 when they were doing some maintenance activity on the turbine and infrastructure down there. So we kind of worked with TVA and did some test runs on things to avoid what happened in January of 2009. We have a set of operational procedures.

What happened in that event in 2009 is they dropped the water level to get to the turbines pretty low. They lost

control of some flow considerations coming from Blue Ridge and some rain. So while the water level was down, turbines were open, gates were open, here came essentially a big torrent of rain down the gorge and it scoured out all that mud that was in front of the turbine structures. So that's what was flushed through. There was about 30,000 cubic yards of material flushed through.

We studied and kind of did the -- hit the rewind on the tape recorder to see what happened, what caused that series of events. We now have a series of operational parameters in place that TVA will follow and make sure that that slue release, that sediment release does not happen in the future.

SUZANNE KAHN: Suzanne Kahn, K-a-h-n. I'm sure you've probably done studies I'm guessing on the reemergence of wildlife and birds and healthy fish. Is there any kind of percentages to show what the reemergence has been?

CRAIG ZELLER: On the Ocoee I can

tell you there's been some U. S. Forestry Service work in conjunction with the Tennessee Department of Environment and Conservation and people that are monitoring the fish recovery. Before water treatment was initiated up here on the basin, you couldn't find fish. The community surveys were very easy to conduct at the White Water Center because it didn't take you very long to figure out no fish live here, okay, because the water quality was not real good.

They actually do snorkel surveys where you're not actually sampling fish for, say, concentration in their fillets or their muscle tissue. But you actually put a snorkel on and stick your head in the water and see what's there. The last couple of surveys I've seen there's 14 different species of fish now in the Ocoee River.

The first species you see come back are the pollution tolerant ones. Now not only are we seeing pollution tolerant ones, the hardiest of the fish varieties,

but we're also seeing the very sensitive ones that live in areas that are not widely impacted by man, so the speak. So we've seen good diversity, good abundance, going from zero to 14 I think was the last count that I had. It's really -- it is truly amazing. That river was pretty severely impacted because of the 8,000 pounds of metals a day and the 14,000 pounds of acidity a day that was coming in off of -- most of it coming in off of Davis Mill Creek through this combination of -- we kind of call this strategy trap and treat through this series of 4 and 5 now dams. We're able to collect all that water for a 10-year, 24-hour storm, treat it with conventional water treatment that's been around since the early '70s.

One of the big things we have going for us -- sir, you alluded to the fact -- one of the most expensive parts of water treatment besides the electricity and the line and all those ingredients, is disposal. What are you going to do with

the material? Often that's a big chunk. Oftentimes it's 50 percent of the total cost.

In this case our disposal is pretty low cost. Free. That's why we can do this. That's why this remedy is fairly unique. We haven't seen a lot of parties really willing to sign up with EPA and perpetually treat water. That's what this agreement really is. This is an agreement and over the last, what, 11, 10 or 11 years there's been a lot of good work and a lot of short-term work. But this agreement really is to wrap up all that short-term work and have it adopted as a final remedy and really get the financial assurances in place to make sure that this remedy is going to operate as we have been for a long time.

SUZANNE KAHN: Any studies on like beer, deer, fox, birds?

MR. CARR: I'm not familiar with any specific studies, but I know Tennessee -- I might defer to Glenn Springs. But I know Tennessee Wildlife resources, they've

been up here. I don't know if they've done any official studies, but they've noted -- Glenn Springs has worked with them in, for instance, re-vegetating the Tailings Pond area to put in wind rows and trap more. But I am not aware of any specific, but there may be some out there.

CRAIG ZELLER: TWRA would be a good place.

MR. CARR: We have a bird study, Frank? Can you just mention that?

FRANK RUSSELL: My name is Frank Russell. We had a bird study done about six or seven years ago by TDEC or TWRA. I've forgotten the guy's name. There was a bird study done. He was amazed at the birds that were in this area.

MR. CARR: Anecdotally you see them. I mean there are turkeys everywhere, there's bear. We have motion sensor cameras deployed here and there around the basin for various reasons. We've gotten pictures of bear, grouse, all kind of different animals. Some of the other ones we've seen even come into the

Davis Mill area. That's definitely getting better.

MARTY KAHN: I've got one question for you. Would you eat the fish?

CRAIG ZELLER: Well, you know, with risk assessment. It's the doses that poison, right, as we say in this business. So it's how much you eat. If you look at those risk calculations or if you look at -- we could get you the actual exposure parameters that are used to warn the public about eating fish. But I will tell you that you have to eat a lot of fish from that one, just that one reservoir for 30 years. Those calculations are really long-term based. So eating one meal one year, one meal a year, not likely to cause you adverse impacts.

I can give you all the -- there's assumptions about the meal size, how many ounces of fish you eat, how frequently then you eat that fish and then how long you eat. Say, we usually eat -- some of the numbers -- I'm not real familiar with all the calculations used on that

watershed. Other jobs I've worked on, it's 26 meals a year, about 8 to 10 ounces of fish per meal and you've got to do that for 30 years before those cancer risks or non-cancer risks are in that unacceptable level. So a fish meal every now and then from Parksville, based on low levels of mercury and PCBs, it's not likely going to cause adverse effects.

So would I eat fish? Yeah, I eat fish. I don't eat fish from Parksville, but I do eat freshwater fish. The water quality in Parksville is superb, it really is.

MR. CARR: There's been some bald eagles even return to Parksville.

CRAIG ZELLER: Yes. The only real issue we have is kind of a longer term chronic issue with Parksville is about that 30-acre, that mud, that delta that's exposed during the wintertime. But there are plans to get it covered up.

MARTY KAHN: Can that material be removed?

CRAIG ZELLER: That's a good

question. We did look at that. We called it the scalping alternative. A year ago we were up here talking about the alternatives we looked at to address the Parksville sediment. One of the alternatives we did look at was dredging that material. From memory, it was about half a million or 500,000 cubic yards of material.

In this case the disposal alternative that we looked at, we were going to slurry that material or pipe it after we cut it up and moved it through pipelines. We proposed at that time to slurry it and dispose of it in the deep pool of Parksville. You know, where all these manmade lakes are stratified, okay, they set up where the upper portion has oxygen in it and the lower portion, the hypolimnion, has no oxygen in it. So we were going to pump that into the lower section of the lake where the 02 level was zero and nothing lives down there anyhow, no bugs, no fish, because there's simply no 02. That was one option we looked at.

We did not go with that.

We proposed and went with and signed the recommended decision to go with the wet closure and keep the high pool on Parksville all year round. So we're still trying to get the logistics of that worked out with TVA through a legal agreement. So we have two remedies. We've got to get everything wrapped up and get some long-term commitments in place through the lawyers is what we're trying to do here.

MARDEE KAUFFMAN: I'm Mardee Kauffman. I would just like to make a couple of statements. We've been here through the company closing in '87, when the Olympics were declared in '92 and y'all came in '96. I hope there's going to be in your record here maybe a chapter or two of what this company has meant to this area and the reclamation.

In the '80s when the company closed, as Jim Sheffer will agree, it was a very, very bad day. But when they came and have put forth the effort, not with all these trucks, but in the hearts of the

1 people here and the young people here, I
2 hope there will be a chapter or two in
3 your record that will say what you have
4 meant to the young people.
5 And we are 16-year volunteers with
6 the forest service and way back when
7 everybody was kind of looking at the
8 railroad. No one even asked or could have
9 seen this. I think it's very, very
10 important to realize what this has meant
11 to the community and to the young people,
12 the scholarships that have been given, the
13 opportunity that has been given.
14 I'm the last of a group called the
15 Ladies of the Red Hills, what those ladies
16 contributed with the support of the
17 company. Which in '87 it was a very, very
18 bad, black day. But there's always
19 opportunity if you look and the
20 opportunity has come here. Even like the
21 Fourth of July, the cookies and the punch.
22 Their involvement with the community has
23 been great.
24 We were in business. We had a B&B
25 here in town for 19 years, so we met the

guests coming in. Now we're at the front desk for the last 16 years at the White Water Center. I can tell you your work has been appreciated and your work is understood. We're excited. So I hope there's a chapter to say what it has meant to the community. I'm on the board with the high school committee and I know exactly what's happening.

CRAIG ZELLER: Okay. There's no question. None of this would have been accomplished. All of this, as Loften mentioned I think earlier, has been funded and has been conducted by Glenn Springs Holdings. EPA and TDEC have overseen it. Yeah, virtually everything, all the recovery you've seen out here since '87 or really since at least 2001 when we got the formalized agreement could not have been accomplished without the resources that were brought to the table. There's no question.

MARDEE KAUFFMAN: And we appreciate it and we thank you. We thank all of you.

CRAIG ZELLER: Thank Glenn Springs.

LOFTEN CARR: Glenn Springs was instrumental in most of that.

MARDEE KAUFFMAN: It's been unbelievable.

CRAIG ZELLER: We would agree.

MARTY KAHN: How long is it going to take until we say this is finished, this is done?

LOFTEN CARR: That's a very good question. I can only guess. It's like I said, you've got to eat an elephant one bite at a time. We're getting there. This is a milestone here, this ROD, this record of decision. We're going to keep plugging along.

Five years ago if you had told me somebody was going to come by the Intertrade site and would be able to recycle all the waste and material there and reuse it, get that material out of there, provide money on the side as a result of that for cleanup in that same watershed, I would have told you you were crazy. But, you know, you really don't know what the future holds. So I would

hope that we keep moving forward and keep having good things happen. All right. It's 7:00 o'clock and that was the prescribed time of the meeting. Any more questions?

(PUBLIC MEETING CONCLUDED.)

REPORTER'S CERTIFICATE

STATE OF TENNESSEE:
COUNTY OF HAMILTON:

I, Tracy A. Beamon, Certified Court Reporter and Notary Public, do hereby certify that I reported in machine shorthand the July 19, 2012, Public Meeting in the above-styled cause; that the foregoing pages, numbered from 1 to 25, inclusive, were typed under my personal supervision and constitute a true record of said proceedings.

I further certify that I am not an attorney or counsel of any of the parties, nor a relative or employee of any attorney of counsel connected with the action, nor financially interested in the outcome of the action.

Witness my hand in the City of Chattanooga, County of Hamilton, State of Tennessee, this 12th day of August, 2012.

_____
Tracy A. Beamon, CCR-1003, LCR-466
My Commission Expires on the
18th day of February, 2015.

Appendix E
State of Tennessee Concurrence with Selected Remedy

STATE OF TENNESSEE

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF REMEDIATION
401 CHURCH STREET, 4TH FLOOR L&C ANNEX
NASHVILLE, TENNESSEE 37243

September 21, 2012

Franklin E. Hill, Director
Superfund Division
US EPA - Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303

Subject: **Record of Decision Concurrence Letter**
Copper Basin Mining District Site, Operable Unit 3
Davis Mill Creek Collection and Treatment System
EPA ID # TN0001890839
TDEC/DOR ID # 70-509

Dear Mr. Hill,

The Tennessee Department of Environment and Conservation (TDEC) Divisions of Remediation and Water Pollution Control have participated with the Environmental Protection Agency (EPA) and Glenn Springs Holdings, Inc (GSHI) to address the Copper Basin Mining District Site (the Site) since before TDEC, EPA, and GSHI executed the Memorandum of Understanding for the Site in January 2001. We appreciate the cooperation between the parties and the many accomplishments achieved over the years. This is exemplified by the significant reduction in loading to the Ocoee River through treatment of Davis Mill and North Potato Creek.

The Davis Mill Creek Collection and Treatment System Record of Decision selects Alternative DMC-4 as the remedy. Alternative DMC-4 contains the following components:

- Five previously constructed storm water retention dams.
- Existing diversion of the West Drainage Channel.
- Previously constructed Dam No. 5 and the Dam No. 5 pump station that conveys water from Davis Mill Creek to the Cantrell Flats water treatment plant.
- Previously constructed Belltown Creek and Gypsum Ponds clean water diversions.
- Existing Cantrell Flats water treatment plant, including necessary refurbishment.

- Encapsulation of discharge from the North Potato Creek diversion tunnel and French drain outlets in high density polyethylene piping from their source to Davis Mill Creek; covering contaminated sediment that would be exposed by the encapsulation of these surface waters with borrow soil.
- Installation of fencing, netting, or similar materials across the portal of the North Potato Creek diversion tunnel to eliminate direct contact with surface water.
- Construction of a fence along a portion of upper Davis Mill Creek to restrict access and reduce risk by direct contact.
- Implementation of institutional controls to restrict access and use of surface water in OU3.

We agree with the remedy selected in the Operable Unit 3 Record of Decision and the statutory Five-Year Reviews referenced in the Record of Decision. TDEC remains committed to the Copper Basin Mining District and desires to participate in implementation of the various components of the selected remedy.

If you have any questions, please feel free to contact me at (615) 532-0911 or Andy.Binford@tn.gov .

Sincerely,

Robert A Binford

Robert A. Binford
Director
Division of Remediation

cc: DOR/NCO
DOR/CHEFO
WPC/CHEFO