PREASSESSMENT SCREEN AND DETERMINATION
Viburnum Trend Lead Mining Sites,
Reynolds, Iron, Crawford, and Washington Counties, Missouri
by
U.S. Fish and Wildlife Service
Missouri Department of Natural Resources

This is the Preassessment Screen (PAS) and determination for the Viburnum Trend Lead Mining Sites (VTLMS), and surrounding areas located in Crawford, Iron, Reynolds, and Washington, Counties, Missouri. This document has been prepared by the Missouri Department of Natural Resources (MDNR) and the U.S. Department of the Interior (DOI) who are Trustees for natural resources at the VTLMS (collectively referred to hereinafter as "Trustees") in accordance with Natural Resource Damage Assessment (NRDA) procedures. 43 C.F.R. Part 11.

I. AUTHORITY

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, 42 U.S.C. § 9601 *et seq*., the Oil Pollution Act of 1990 (OPA), 33 U.S.C. § 2701 *et seq*., and the Federal Water Pollution Control Act (FWPCA), as amended, 33 U.S.C. § 1251 *et seq.*, authorize the United States, States and Indian tribes to recover damages for injuries to natural resources and their supporting ecosystems, belonging to, managed by, appertaining to, or otherwise controlled by them.

In accordance with 42 U.S.C. § 9607(f)(2)(B) and the National Contingency Plan, 40 C.F.R. § 300.600 (NCP), the Director of the MDNR has been designated the natural resource trustee by the Governor of Missouri. The MDNR acts on behalf of the public as Trustee for natural resources, including their supporting ecosystems, within the boundary of Missouri or belonging to, managed by, appertaining to, or otherwise controlled by Missouri.

The U.S. Fish and Wildlife Service (Service) is acting on behalf of the Secretary of the Interior as trustee for natural resources. The President has designated the Secretary of the Department of the Interior to act on behalf of the public as trustee for natural resources and their supporting ecosystems, managed or otherwise controlled by the DOI. Executive Order 12580, Section 1(c), January 23, 1987; 40 C.F.R. § 300.600. The official authorized to act on behalf of the Secretary at the Viburnum Trend Lead Mining Sites and surrounding area is the Regional Director for Region 3 of the U.S. Fish and Wildlife Service.

PURPOSE

The purpose of this PAS is to provide a review of readily available information on discharges or releases of hazardous substances and the potential resulting impacts on natural resources at the Viburnum Trend Lead Mining Sites and surrounding area for which the DOI and/or MDNR may assert trusteeship under section 107(f) of CERCLA.

Federal regulations at 43 C.F.R. § 11.23(a) provide for the Trustees to complete a PAS and make a determination as to whether there is a reasonable probability of making a successful claim for natural resource damages before additional assessment efforts are undertaken. This document fulfills that requirement and follows the structure of Federal

Regulations at 43 C.F.R. Part 11. These regulations provide a method for the assessment of natural resource damages resulting from releases of hazardous substances under CERCLA. Adherence to the methods set forth in these regulations is not mandatory and does not preclude the Trustees' use of alternate methods of assessing damages or arriving at a negotiated settlement with potentially responsible parties.

II. SITE INFORMATION

The VTLMS are located within the New Lead Belt of Southeast Missouri on the western edge of the Ozark Dome in Missouri and are part of the Southeast Missouri Lead Mining District (SEMOLMD). Topography in the New Lead Belt is characterized by rolling hills dissected by narrow floodplain, creek, and river valleys. Hills and ridges are generally steep sided with flat tops consisting of thin mantles of clayey soils. The major physical features of the area are the St. Francois Mountains in the east, and the dissected topography of the Salem Plateau in the northern and central portions. The principal drainage systems for the VTLMS are the north flowing Courtois and Huzzah Creeks and their tributaries and the east and south flowing Black River and its tributaries. Due to local geology, the associated tributaries frequently gain or lose flow through bedrock and can be intermittent or perennial (Duchrow, 1983).

This PAS addresses nine of the major mine, mill, and/or smelter sites in the Viburnum Trend including Fletcher Mine/Mill, Brushy Creek Mine/Mill, Buick Mine/Mill, Buick Smelter, Magmont Mine/Mill, Viburnum Mines #27, 28, and 29 (and associated mills and tailings impoundments), and the Casteel Mine. It also addresses the streams draining these sites including Bills Creek, West Fork of the Black River, Strother Creek, Neals Creek, Middle Fork of the Black River, Crooked Creek, Bee Fork, Indian Creek, Mill Rock Creek, and Courtois Creek. The Trustees believe that there may be potential injuries to natural resources outside of Reynolds and Iron Counties, Missouri resulting from releases from these Sites. This PAS will also address potential injuries outside of the Reynolds and Iron Counties in downstream locations in Washington and Crawford Counties. For purposes of the PAS, this entire geographic area is referred to as "VTLMS." The West Fork Mine/Mill Complex, Sweetwater Mine/Mill Complex and Glover Smelter site are also located within the Viburnum Trend in SEMOLMD and were included in a separate PAS released by the Trustees on June 30, 2008. (See http://www.dnr.mo.gov/env/hwp/sfund/nrda.htm or http://www.fws.gov/midwest/semonrda).

1) Time, quantity, duration and frequency of the discharge or release

The Trustees reviewed relevant information which indicates that hazardous substances have been discharged, allowed to escape, disposed or otherwise released into VTLMS environment and surrounding areas.

Based on a review of topographical maps and aerial photos, the Trustees estimate that at least 2,400 acres of tailings[1] and transition zone soils around the nine (9) major facilities addressed in this PAS are disturbed by lead and zinc mining and/or milling. (See Table 1) Extrapolating from data from other similar lead and zinc mining and milling sites in SEMOLMD, the Trustees

[1] Tailings are the waste product of a chemical floatation process that produces particles 0.004 to 0.06 mm in diameter (USEPA, 2006).

assume for the purposes of this PAS that this land may also be potentially contaminated primarily with lead and associated heavy metals. Soils contaminated by runoff and windblown deposition from tailings represent a transition area around the piles.

Table 1. Estimated Surface Area of Potentially Impacted Environs in the VTLMS

MINE	Surface Area of Mine/Mill (Ac)	Surface Area of Tailings (Ac)	Surface Area of Impounded Water* (Ac)	Total Impacted Acres
Viburnum #27 Mine	12	NA	NA	12
Viburnum #29 Mine	17	NA	NA	17
Viburnum Central Mill and Mine #28	30	863	115	1008
Casteel Mine	20	NA	NA	20
Magmont Mine/Mill	55	455	35	545
Buick Smelter	192	NA	NA	192
Buick Mine/Mill	80	840	95	1015
Brushy Creek Mine/Mill	18	224	NA	242
Fletcher Mine/Mill	17	406	42	465
TOTAL	441	2788	287	3516

* = Surface Water over area inside the tailings impoundment. Does not include mine water ponds or process water ponds.

Source: U.S. Fish and Wildlife Service, 2008 and MDNR's Land Reclamation Program http://www.dnr.mo.gov/env/lrp/homemm.htm

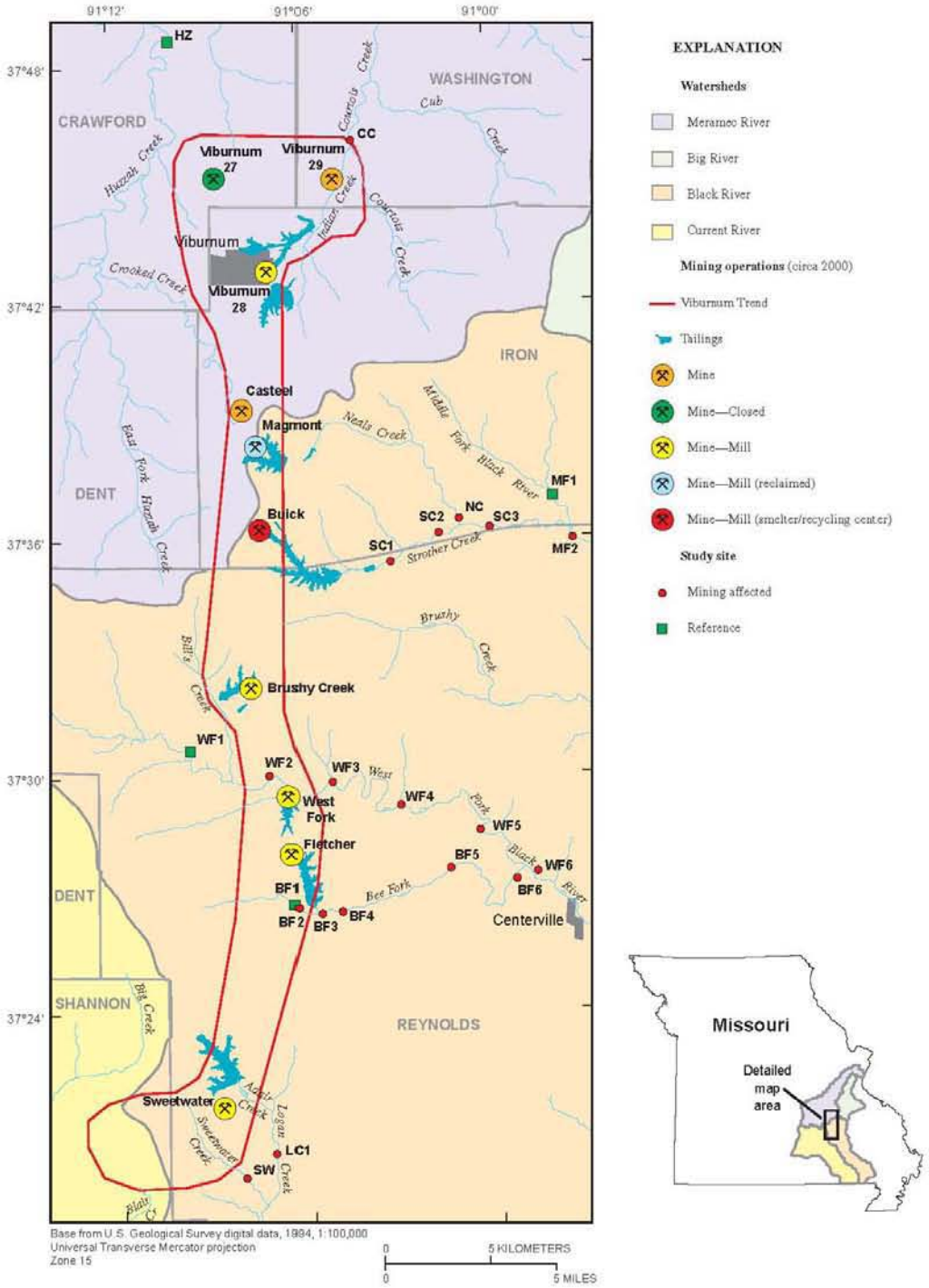
Numerous sources (Dieffenbach 1968, Ryck 1974, Ryck and Whitley 1974, Ryck 1977, Trial 1982, Trial 1983, Duchrow 1983) have documented discharges of mine and mill wastes to the streams of the VTLMS. Ryck (1974 and 1977) and Trial (1982 and 1983) demonstrated significant differences in benthic macroinvertebrate abundance and diversity above and below the effluent outfalls at the Viburnum Mines, Fletcher Mine, and Buick Mine. In 1974, Ryck and Whitley noted that:

> Mine and mill effluents from the AMAX Buick Project near Boss, Missouri seriously polluted Strother Creek from the start of operations in 1969 to late 1972. Heavy growths of filamentous algae that covered 75-95% of the stream bottom were common.
>
> * * * * *
>
> Bee Fork was polluted by effluents from the St. Joe Minerals Corporation Fletcher Mine and Mill from the start of operations in the spring of 1967 until the autumn of 1972. Prior to 1970, pollution was related to heavy siltation and turbidity…Subsequent decreases in diversity and the number of pollution sensitive mayfly and stonefly taxa in November 1970 and October 1971 were accompanied by thick bacterial-algal mats and some siltation.

Ryck and Whitley (1974) also discussed improvements to benthic macroinvertebrate diversity in receiving streams of the VTLMS after technological improvements were implemented and operational at the abovementioned mining sites.

Incremental releases continue to occur to terrestrial and aquatic environs on a regular basis due to the forces of water and wind erosion as well as human disturbance of the tailings disposal areas (Besser 2007). Permitted and unpermitted off-road vehicle use on the piles and impoundments has destroyed the minimal existing vegetation, aggravating erosion at some sites.

Figure 1. Map of the VTLMS (Source Brumbaugh *et al.*, 2007)



2) The hazardous substances released

The hazardous substances released at the VTLMS, include cadmium (CAS # 7440439), lead (CAS # 7439921), nickel (CAS # 7440-02-0), and zinc (CAS # 7440666). These compounds or mixtures have been identified under CERCLA §l01 (14) as hazardous substances (40 CFR §302, Table 302.4). Lead (Pb) is by far the most common contaminant of concern at the VTLMS.

3) History of the current and past use of the Site

Until the 1960's, the majority of lead mining in SEMOLMD occurred in the Old Lead Belt in St. Francois County. As ore bodies in the Old Lead Belt were depleted, mining activities began to decrease in the 1950s. However, higher grade ores were discovered in the Viburnum Trend counties of Reynolds, Iron, and Crawford and lead and zinc mining began in the Viburnum Trend in 1955. The VTLMS currently covers approximately 200 square miles.

The current and past land uses at the VTLMS are un-impacted natural land, mining-related, urban, logging, minimal arable agriculture (soybeans, corn, and hay) as well as cattle grazing. The ongoing lead mining still produces contaminated mine waste which remains on the surface and is deposited in tailings impoundments (USEPA, 2007).

4) Relevant operations occurring at or near the Site

From 1955 through the 1970's, 10 mines were opened along the north-south trending ore body of the Viburnum Trend. Generally, the older mines were established in the northern part of the trend, progressing approximately 40 miles southward to near Corridon, Missouri. The mines and other facilities used in processing ore from the Viburnum Trend are as follows:

Inactive Facilities

1. Viburnum Mine 27 (closed in 1983)
2. Viburnum Mine 28 (closed in 2004)
3. Viburnum Mine 29 (closed in 2004)
4. Viburnum Central Mill (closed in 2004)
5. Magmont Mine/Mill (closed in 1994)
6. Glover Smelter (inactive)†

Active Facilities

1. Buick Smelter
2. Buick Mine/Mill
3. Brushy Creek Mine/Mill
4. West Fork Mine/Mill Complex†
5. Fletcher Mine/Mill
6. Sweetwater Mine/Mill Complex†
7. Herculaneum Smelter (located approximately 55 miles northeast of the Viburnum Trend)‡

† Not included this PAS for VTLMS but in separate PAS
‡Not included in this PAS.
Source (USEPA, 2007.)

According to the U.S. Environmental Protection Agency (EPA), 2007:

> Ore from the mines was/is crushed, milled, and processed in order to form a lead concentrate. Lead concentrate commonly contains lead at concentrations greater than 70 percent (700,000 parts per million). This concentrate was/is shipped by rail and/or truck to various smelters where it is/was further processed into a purer form of lead. Historically, the majority of concentrate from the Viburnum Trend was shipped to three smelters in Herculaneum, Glover, and near Bixby, Missouri. Currently, lead concentrate from the Viburnum Trend is shipped by truck to the Herculaneum Smelter and to Cape Girardeau, Missouri. The lead concentrate that is shipped to Cape Girardeau is loaded onto barges and is eventually shipped overseas for further processing. The Herculaneum smelter is the only primary lead smelter currently operating in the United States.

5) Additional hazardous substances potentially released from the VTLMS site

Other hazardous substances potentially released from the VTLMS include copper (CAS # 7440-50-8), barium (CAS # 7440-39-3), and cobalt (CAS#7440-48-4).

6) Potentially Responsible Parties

The Potentially Responsible Parties at the VTLMS include, but are not limited to, The Doe Run Resources Corporation d/b/a The Doe Run Company, Teck Cominco American Incorporated, Phelps Dodge Corporation (formerly Cyprus Amax Minerals Company), Homestake Lead Company of Missouri, and DII Industries, LLC.

III. NO STATUTORY EXCLUSIONS FROM LIABILITY UNDER CERCLA APPLY AT THIS SITE

In accordance with 43 C.F.R. § 11.24(b), the Trustees determined that no statutory exclusions from liability under CERCLA apply at any of the VTLMS.

Injuries to natural resources and damages resulting from the discharge or release of hazardous substances from the VTLMS were not identified in any environmental impact statement, pursuant to the National Environmental Policy Act (NEPA), as amended (42 U.S.C. 4321 et seq.), or any similar review or document.

The release or discharge of the hazardous substances at the VTLMS are ongoing and did not occur wholly before enactment of CERCLA, nor the 1977 amendments to the FWPCA. Injuries to natural resources and damages to the public from the release or discharge of the hazardous substances are ongoing and did not occur wholly before enactment of CERCLA, nor the 1977 amendments to the FWPCA.

The hazardous substances at the VTLMS are not pesticide products registered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended (7 U.S.C. 135-135k). Injuries to natural resources and damages resulting from the discharge or release of the hazardous substances at the VTLMS did not result from the application of a FlFRA registered pesticide product.

Injuries to natural resources and damages resulting from the discharge or release of the hazardous substances from the VTLMS did not result from any federally permitted release as defined in CERCLA §l01 (10).

The hazardous substances are not recycled oil products as described in CERCLA §107(a)(3) or (4). Injuries to natural resources and damages resulting from the discharge or release of the hazardous substances at the VTLMS did not result from release of a recycled oil product.

No exclusion from damages is applicable to this site, pursuant to the CERCLA and FWPCA.

IV. PRELIMINARY IDENTIFICATION OF RESOURCES POTENTIALLY AT RISK

1) Preliminary identification of pathways

Surficial mine and mill wastes, soils, and surface water all act as sources of hazardous substances (including cadmium (Cd), lead (Pb), nickel (Ni) and zinc (Zn)) to the environment at the VTLMS. Hazardous substances can be released directly from these sources into the air, surface water, groundwater, and soils. Additionally, air can entrain and transport metals as it flows over fugitive dust sources, *i.e.* tailings impoundments.

Surface water can receive hazardous substances directly from erosion of various types of mine waste during runoff. Direct exposure to suspended and dissolved metals can occur to aquatic organisms dwelling in the water column. Stream sediment is habitat for a wide-variety of benthic invertebrates and fish. Contaminated sediment provides exposure through incidental ingestion and by increasing metal concentrations in the pore water of the sediment. Contaminated pore-water is a direct exposure pathway through the gills of aquatic organisms.

Rain water percolating through the tailings impoundments can leach hazardous substances into the soil beneath the waste pile. Groundwater can also be affected as it flows through underground mine workings and comes into contact with exposed ore bodies. Groundwater contamination may be of limited scope at the VTLMS due to the high pH of the ore's dolomitic host rock. Additionally, groundwater can be injured from contaminated losing streams within the watershed.

Air, surface water, groundwater, and soils may receive hazardous substances not only directly from the sources, but also from each other. Air can transport hazardous substances and deposit them directly into surface water or onto soils. Hazardous substances can also move back and forth between ground and surface water through discharge and recharge.

Terrestrial and aquatic biota may be exposed to contaminants in environmental media either directly (for example, plants exposed directly to hazardous substances in soils) or indirectly through food chain transfer. For example, contaminated soils may provide an exposure pathway to heavy metals contamination for migratory birds. Depending upon the species, migratory birds will feed on terrestrial seeds and berries, soil invertebrates, fish, aquatic invertebrates, or aquatic plants (Levey and Stiles, 1992).

Biological studies have documented that exposure to contaminated sediments is a likely pathway of hazardous substances to benthic organisms in streams that drain the VTLMS (Besser et al. 2009, Allert et al. 2008a). Allert et al. (2008b) and Besser et al. (2009) showed a negative correlation with elevated sediment pore water concentrations and reduced crayfish and sculpin abundance as measured by catch per unit effort in streams within the VTLMS. Besser et al. (2009), showed significantly greater metal concentrations in aquatic vegetation, macroinvertebrates (including macrobenthos, snails, and crayfish), and small riffle-dwelling fish below some VTLMS compared to metal concentrations in the same vegetation and species at control sites not impacted by mining activities.

2) Exposed Areas

Areas exposed to the released hazardous substances include the waters, wetlands, stream banks, sediments, soil and biota of the VTLMS. The Trustees estimate that over 2,900 acres of contaminated mill waste and soil provides an exposure pathway for wildlife. In addition, areas downstream of the VTLMS are likely impacted from releases of hazardous substances attributable to the VTLMS mining operations.

3) Exposed Water Estimates

The principal drainage systems for the VTLMS are tributaries to the Black and Meramec Rivers. Based on readily available information, sampling conducted by the U.S. Geological Survey (USGS), the VTLMS tributaries contain at least 12 miles of contaminated sediment which exceed relevant Probable Effect Concentrations. An additional 3 miles of sediment in these tributaries exceed the relevant Threshold Effect Concentrations, as well as portions of sediment in Clearwater Lake. Besser (2009) also found sediment pore water concentrations of metals above the applicable 2005 water quality criterion established by U.S. Environmental Protection Agency (USEPA) in Strother Creek, Bee Fork, and Courtois Creek.

4) Estimates of Concentrations

a. Chat, Tailings, and Soil

Little data is readily available on concentrations of source material (chat and tailings) from the VTLMS. The Trustees relied on data from the neighboring and contemporary Viburnum Trend sites, the Sweetwater and West Fork Mine/Mill Complexes, to anticipate likely estimates of metal concentrations in tailings and soil throughout the rest of the VTLMS. Lead concentrations determined by MDNR (2004) for the Sweetwater Mine/Mill Complex are as high as 4260 mg/kg on the tailings pile. Maximum lead concentrations were 108,657 mg/kg from the Sweetwater mill. MDNR collected three samples from the West Fork tailings impoundment in 2007. Tailings concentrations of cadmium, lead, and zinc averaged 76 mg/kg, 673 mg/kg, and 2229 mg/kg, respectively (Medine, 2007).

The Ecological Screening values (ESVs) for soils are USEPA's Ecological Soil Screening Levels (Eco SSLs) summarized in Table 2 below. All samples exceed the screening levels except that minimum concentrations reported at the sampling sites do not exceed the Eco SSLs established for soil invertebrates.

Table 2: USEPA's Ecological Soil Screening Levels (mg/kg)

Cadmium			
Plants	**Soil Invertebrates**	**Wildlife**	
		Avian	**Mammalian**
32	140	0.77	0.36
Lead			
Plants	**Soil Invertebrates**	**Wildlife**	
		Avian	**Mammalian**
110	1,700	11	56
Zinc			
Plants	**Soil Invertebrates**	**Wildlife**	
		Avian	**Mammalian**
50	100	46	79

Source: USEPA, 2006.

In 2005, MDNR's Hazardous Waste Program conducted a survey of potentially smelter contaminated residential soils near the Buick Smelter. The survey was conducted as part of the Resource Conservation and Recovery Act (RCRA) corrective actions efforts. The study documented average concentrations of Pb in surface soils up to 1600 mg/kg attributable to emissions fallout from the smelter operations. The study also demonstrated average Pb concentrations in surface soils attributable to emissions fallout above USEPA's residential soils criteria (400 mg/kg) at distances of up to 2.5 miles away from the smelter (MDNR, 2005)

b. Sediment

MacDonald et al. (2000) identified consensus-based freshwater sediment quality guidelines: the Probable Effect Concentrations (PECs) and Threshold Effect Concentrations (TECs). PECs represent concentrations of contaminants above which adverse effects on sediment-dwelling organisms are expected to occur frequently. TECs represent concentrations of contaminants in sediment below which adverse effects on sediment-dwelling organisms are expected to occur infrequently. The TEC and PEC values for cadmium, lead, zinc and nickel appear below, in Table 3.

Table 3: TEC and PEC Values for Cd, Pb and Zn

Contaminant	**TEC Value mg/kg**	**PEC Value mg/kg**
Cadmium	0.99	4.98
Lead	35.8	128
Zinc	121	459
Nickel	22.7	48.6

Sediment samples collected in tributaries to the VTLMS exceeded the PECs for Pb, Cd, Ni, and/or Zn in approximately 12 miles of stream, including Courtois Creek, Strother Creek, and Middle and West Forks of the Black River. Brumbaugh et al. (2007) found maximum concentrations of Pb (272 mg/kg) and Cd (3.26 mg/kg) in sediment in Courtois Creek just below the confluence of Indian Creek; maximum concentrations of Zn (633 mg/kg) in West Fork; and

maximum concentrations of Ni (124 mg/kg) in Strother Creek. In addition, the TEC for Pb was exceeded in Bee Fork. Brumbaugh et al. (2007) also found Pb, Zn, Ni, and Cu exceeded the TEC in Clearwater Lake.

In 1993, sediment samples were collected by Barr Engineering in the East and West Fork of Crooked Creek, which drain the Buick Smelter. Concentrations of Pb in the sediments were found to be as high as 4,330 mg/kg in the East Fork and as high as 10,500 mg/kg in the West fork (Barr, 1994). In May 2007, the MDNR collected sediment samples in Crooked Creek, which drains the Casteel Mine and the Buick Smelter, and found PEC exceedances for Pb, Zn, Cd, Ni, and Cu. These concentration levels were higher than USGS samples collected from other Viburnum Trend streams. Maximum Pb, Zn, Cd, Ni, and Cu concentrations collected by MDNR were 1,670, 725, 51.7, 128, and 183 mg/kg, respectively.

c. Surface Water

Several of the streams draining the Viburnum Trend have been added to the 2006 303(d) list because of exceedances of toxicological benchmarks for sediment or state water quality criteria for metals, and/or show evidence of toxicity. Streams added to the 2006 303(d) list draining the Viburnum Trend include Bee Fork, Courtois Creek, Crooked Creek, Indian Creek, Strother Creek, and the West Fork of the Black River. The MDNR collected water samples every year from 2003 through 2007 in Crooked Creek, which exceeded the acute Missouri Aquatic Life Criteria (ALC) for Cd. Maximum concentrations of dissolved Cd in Crooked Creek were 55.7µg/l. The acute ALC for Cd at the upper 25th percentile hardness for the stream (267 mg/l) is 12.37µg/l. Indian Creek exceeded the chronic ALC for Pb and Zn at the upper 25th percentile hardness for the stream (210 mg/l). Bee Fork exceeded the ALC for Pb on two occasions; once in 2003 and once in 2006.

Sampling conducted by Barr Engineering in 1993 in the East and West Fork of Crooked Creek revealed concentrations of Pb in surface water as high as 20,800 µg/l in the East Fork and 2,820 µg/l in the West Fork. These samples exceeded the Missouri ALC for Pb by a factor 100 and 10, respectively. The same sampling event detailed Cd levels in the East Fork of Crooked Creek as high as 244 µg/l and 104 µg/l in the West Fork. These samples exceeded the Acute ALC for Cd by a factor of 20 and 10, respectively (Barr, 1994).

Table 4. The State of Missouri's Hardness Dependent Aquatic Life Criteria for Surface Water

Missouri Aquatic Life Criteria for Surface Water (µg/l)					
Hardness (mg/l)	*150-174*	*175-199*	*200-224*	*225-249*	*250+*
Cadmium (µg/l)					
Acute:	7.1	8.2	9.4	10.5	11.6
Chronic:	0.3	0.4	0.4	0.4	0.5
Copper (µg/l)					
Acute:	20	23	26	29	32
Chronic:	13	14	16	18	20
Lead (µg/l)					
Acute:	100	118	136	154	172

Chronic:	4	5	5	6	7
Nickel (µg/l)					
Acute:	660	752	842	930	1,017
Chronic:	73	84	94	103	113
Zinc (µg/l)					
Acute:	165	188	211	233	255
Chronic:	165	188	211	233	255

Brumbaugh et al. (2007) documented sediment pore-water metals above ALC in several Viburnum Trend streams, including Courtois Creek, West Fork of the Black River, Strother Creek, and Bee Fork. Injury to surface water is determined by exceedences of applicable water quality criteria, 43 C.F.R. 11.62 (b)(1)(iii). However, ALC are typically applied to ambient water in the water column and not sediment pore-water.

d. Potentially Affected Resources

Natural resources and their supporting ecosystems that have been or potentially have been affected by the release of hazardous substances, include but are not limited to, terrestrial environments; surface water, sediments, and biological resources including aquatic and terrestrial plants and microorganisms; aquatic and aquatic-dependent mammals; fish; aquatic invertebrates; terrestrial invertebrates; and migratory birds including waterfowl, shorebirds, raptors and songbirds.

The Federally endangered Hines' Emerald Dragonfly (HED) (*Somatochlora hineana*) is among the United States' most endangered dragonflies. The HED is restricted to wetland habitats characterized by thin soils over dolomite bedrock with marshes, seeps, and sedge meadows. The HED is known to occur in Illinois, Wisconsin, Michigan, and Missouri. In Missouri, HED has been documented at six sites downstream or adjacent to mining or milling facilities. The facilities potentially impacting HED include Fletcher, Magmont, and West Fork Mine/Mill Complex (McKenzie, 2009, personal communication). Due to the location of their habitat in floodplains below mining and milling sites, there exists a possibility that HED populations have been negatively impacted by the release of hazardous substances.

Potentially impacted terrestrial resources include plant communities at the VTLMS that have been highly modified to the extent that they now provide limited wildlife habitat. The phytotoxic effects of hazardous substances in mine wastes may be responsible for some or all of the observed negative impacts to the vegetative communities. At Sweetwater and West Fork Mill/Mine Complexes, Kaputska (2007) determined that Cd, Pb, and Zn occurred at concentrations that are toxic to plants. Kaputska developed a set of lower and upper threshold values for phytotoxic response to the three metals of concern, as detailed below.

Table 5. Phytotoxicity Threshold Values (mg/kg dry weight soil)

Element	**Lower Threshold**	**Upper Threshold**
Cadmium	3	100
Lead	100	1,000
Zinc	70	500

Source: Kaputska, 2007.

Kaputska indicated that the decreased fitness of plants exhibited at Sweetwater and West Fork Mine/Mill Complexes may partially be the result of decreased soil microbial function. He postulated that soil microbes, which are responsible for the production, maintenance and cycling of fertile soil, are most likely impaired by the concentrations of metals found at the two complexes. The Trustees will assess whether the same impairment is occurring throughout the VTLMS.

Surface water represents another trust natural resource. Surface water provides habitat for aquatic and semi-aquatic species such as invertebrates, fish, and amphibians; supports aquatic-dependent and non-aquatic organisms such as reptiles, birds, and mammals by providing habitat for prey species; vegetation used for food and nesting materials; and resting locations along migratory routes. Representative trust species potentially impacted by mining-related contaminated surface water at the VTLMS include woodland crayfish (*Orconectes hylas*), Ozark shiner (*Notropis ozarcanus*), American bullfrog (*Rana catesbeiana)*, northern water snake (*Nerodia sipedon*), green backed heron (*Butorides striatus)*, and muskrat (*Ondatra zibethicus*). Surface water habitats for these species may potentially be injured via contaminated sediments and dissolved discharges in the Viburnum Trend tributaries. Several researchers (see Section 4.b.) documented elevated sediment concentrations and associated biological effects.

In addition to high concentrations of metals contaminating the sediments in the Viburnum Trend streams, studies have shown that the metals are generally bioavailable. For example Besser et al. (2008) documented that periphyton, filamentous algae, benthic macroinvertebrate, crayfish, snail, and fish tissues collected from the watersheds have accumulated high levels of metals in their systems. Further, the watershed is not a carbon-rich ecosystem and the acid volatile sulfide (AVS) is low; both facts support the finding that the mining-related contaminants of concern are bioavailable (Schmitt, 1987, and 2007).

Freshwater fish communities may have been impacted by the release of contaminants from the VTLMS. As discussed previously, Ryck et al. (1975) documented that macroinvertebrate communities in the VTLMS and associated tributaries have been adversely impacted. Taxa diversity were reduced in mining affected streams. Pollution intolerant species of stoneflies and mayflies were also reduced in VTLMS impacted streams compared to references streams. Allert (2008) documented significantly reduced crayfish density correlated with elevated sediment pore-water metals concentrations. Similar to the crayfish findings, Allert (2007) found reduced sculpin (a riffle-dwelling fish) densities correlated with elevated sediment pore-water metals. Blood lead concentrations were significantly higher and the activity of the enzyme δ (delta)-aminolevulinic acid dehydratase (ALA-D), an enzyme involved in heme synthesis, was significantly lower in all species at sites nearest to active lead-zinc mines and in streams contaminated by mining than at reference or downstream sites. ALA-D activity was also negatively correlated with blood lead concentrations in all sculpin species. Additionally, Schmitt (2007) showed that ALA-D was significantly reduced and blood Pb concentrations increased in three species of fish (large-scale stonerollers, long-ear sunfish, and northern hog suckers) at multiple downstream sites at the VTLMS.

The Missouri Department of Health and Senior Services (DHSS) added the Middle Fork of the Black River to its 2008 Fish Consumption Advisory. The DHSS now advises all persons to

avoid the consumption of any smallmouth bass from the Middle Fork of the Black River in Reynolds County as a result of lead contamination emanating from the VTLMS (DHSS 2008).

V. PRE-ASSESSMENT SCREEN DETERMINATION

Based upon a review of readily available data and an evaluation of the preassessment determination criteria, summarized in this document, the Trustees have reached the following conclusions with regard to the VTLMS:

1. Discharges or releases of hazardous substances have occurred;
2. Natural resources for which the Trustees may assert trusteeship under CERCLA and FWPCA have been adversely affected by the discharge or release of hazardous substances;
3. The quantity and concentration of the released hazardous substances are sufficient to potentially cause injury to natural resources;
4. Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
5. Response actions planned will not sufficiently restore, replace, or provide compensation for injured natural resources without further action.

The Trustees hereby determine that further investigation and assessment is warranted and should be carried out at this site in accordance with Federal Regulations at 43 C.F.R. §11, Subparts C and E. The Trustees further determine that current information indicates that there is a reasonable probability of making a successful natural resources damage claim pursuant to section 107 of the CERCLA and section 311 of the FWPCA and that all criteria and requirements in 43 C.F.R. Part 11, generally, and 43 C.F.R. § 11.23(a)-(g), §11.24 and § 11.25, specifically, have been satisfied.

The information provided and conclusions made in this Preassessment Screen shall be used to direct further investigations and assessments and is not intended to preclude consideration of other resources later found to be affected or other parties found to be responsible for releases.

This Preassessment Screen may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the Preassessment Screen. The date of execution shall be the date of the final Trustee signature.

<SIGNATURE PAGES FOLLOW>

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MISSOURI DEPARTMENT OF NATURAL RESOURCES

Joseph P. Bindbeutel, Acting Director
Missouri Department of Natural Resources

2/25/09
Date

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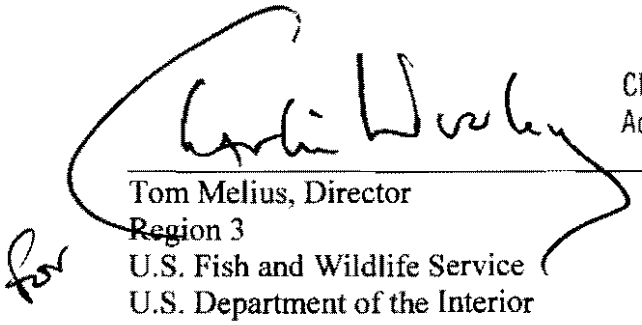

Charles M. Wooley
Acting Regional Director

3/12/09
Date

for Tom Melius, Director
Region 3
U.S. Fish and Wildlife Service
U.S. Department of the Interior