2.7

Response Action Contract
Contract No. 68-W-98-228

EPA United States Environmental Protection Agency
REGION 10

Final (Revision 2)

REMEDIAL INVESTIGATION REPORT

Coeur d'Alene Basin
Remedial Investigation/Feasibility Study

VOLUME 3

Part 2 (Continued)

September 2001

URS Greiner
in association with
CH2M HILL
White Shield, Inc.

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White Shield, Inc.

Ninemile Creek

CSM Unit 1, Upper Watersheds

Ninemile Creek

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ABBREVIATIONS AND ACRONYMS

AWQC	Ambient Water Quality Criteria
BLM	Bureau of Land Management
cfs	cubic foot per second
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
East Fork	East Fork of Ninemile Creek
Eco RA	Ecological Risk Assessment
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HHRA	human health risk assessment
IDEQ	Idaho Division of Environmental Quality
MFG	McCulley, Frick & Gilman, Inc.
µg/L	microgram per liter
NMSeg	Ninemile segment
PDF	probability density function
PRG	preliminary remediation goal
RI	remedial investigation
SL	screening level
South Fork	South Fork Coeur d'Alene River
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Ninemile Creek Watershed is located within the Coeur d'Alene River basin and is a southwest-flowing tributary of the South Fork Coeur d'Alene River (South Fork). The Bureau of Land Management (BLM) has identified 70 source areas (e.g., mining waste rock dumps, adits, and jig tailings piles) within the watershed (BLM 1999). The watershed has been affected by mining activities and hazardous substances have been and continue to be released into the environment.

In the Ninemile Creek watershed, previous cleanup actions have been implemented at the Interstate Callahan mine and mill, and the Success mine sites, and a portion of the impacted channel and riparian zone for the east fork and main stem of the channel. In addition, several actions have also been implemented to address human health concerns. In the 1992 and 1993 field seasons, the Mine Operator graded the mine waste rock pile and tailings at the Interstate-Callahan site to remove it from the floodplain (CDARPT, 1994). This action was followed in 1998 by a non-time critical removal of 66,000 cubic yards of tailings and placement in an unlined repository onsite. This repository had a rock pad to allow groundwater through-flow, and a multi-layered cap with a bentonite-augmented soil barrier layer. The cap was revegetated and armored on the sides for erosion control (USEPA, 1998, Golder, 1998 and Calibretta, 1998).

In 1993, EPA implemented time-critical removal actions at the Success mine and mill site. This action included re-locating about 1,600 feet of the EFNMC channel, regrading the waste rock pile away from the channel, placement of grade control and energy dissipation structures into the channel, and capping the tailings with a one-foot thick layer of rock (USEPA, 1993). Concurrent with the actions by EPA, IDEQ installed upgradient surface water drainage and ground water interceptor drains to collect groundwater and drainage from the Alameda and Success adits. This drainage was directed to infiltration galleries along the edges of the waste rock pile (Harvey, 2000). In 1998, a bench-scale pilot project was undertaken by IDEQ to evaluate in-situ passive treatment processes to treat groundwater at the Success mine site (Terragraphics, 1998). As a result of the bench scale testing, in late 2000, IDEQ began implementing a pilot project to test the effectiveness of a permeable reactive barrier using apatite as the treatment media to address groundwater from the Success site (Golder, 2000).

During the 1994 field season, the Silver Valley Natural Resource Trustees along with the IDEQ and Hecla, performed time-critical removals in the lower 0.5-mile segment of the east fork of Ninemile Creek, and a 0.75 mile stretch of the main stem of Ninemile Creek near Black Cloud.

These actions included removal of contaminated tailings and sediment based upon visual identification, followed by riparian stabilization and revegetation. Approximately 150,000 cubic yards of material were placed on top of the existing Day Rock Repository and were capped with native soils and growth media (CDARPT, 1994). In 1998, the fish pond located near the confluence of the east and west forks of Ninemile Creek was re-constructed as off-channel habitat (Calibretta, 1998).

During the 1998 and 1999 field seasons, the USACE on behalf of the USEPA performed a residential soil cleanup and placed one home on an end-of-tap water purification system determined to be necessary to protect human health for these residents (USEPA 1999, and 2000).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself has been divided into four segments to focus this investigation (Figure 1.1-1). Brief descriptions of each segment are presented in this section.

1.1 SEGMENT DESCRIPTIONS

Segment 1 contains the headwaters of the East Fork of Ninemile Creek (East Fork) downstream to just above the Interstate mill site (Figure 1.1-1). The BLM identified eight source areas in this segment. Sampling of surface water collected near the downstream boundary of the segment indicates that metals concentrations are greater than ambient water quality criteria (AWQC); however, samples collected a short distance upstream do not exceed AWQC. Most of this segment of the watershed is relatively undisturbed by mining-related activities, with intact, well-vegetated, and stable stream banks.

Segment 2 begins on the East Fork above the Interstate mill site and ends at the confluence of the East Fork with the main stem of Ninemile Creek (Figure 1.1-1). The BLM identified 29 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC. Aquatic life in this part of the watershed is nearly absent.

Segment 3 contains the headwaters of Ninemile Creek down to its confluence with the East Fork (Figure 1.1-1). The BLM identified six sources in this segment. Sampling of surface water indicates few exceedances of AWQC. This segment of the watershed is relatively undisturbed by mining-related activities, with intact, well-vegetated, and stable stream banks; however, extensive timber harvesting has been conducted recently in the upland areas of this segment.

Segment 4 begins at the confluence of the main stem of Ninemile Creek with the East Fork and ends at the confluence of Ninemile Creek with the South Fork (Figure 1.1-1). The BLM identified 27 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC. Aquatic life is nearly absent from this segment.

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Ninemile Creek Watershed is one of eight reports contained within Part 2 presenting the remedial investigation (RI) results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on the U.S. Environmental Protection Agency's (EPA) *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (USEPA 1988). This report contains the following sections:

- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology
- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination, includes a summary of chemical results and estimates of mass loading from source areas
- Section 5–Fate and Transport, includes chemical and physical transport processes for metals
- Section 6–References

Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment (HHRA), the ecological risk assessment (Eco RA), and the feasibility study (FS) (all under separate cover).

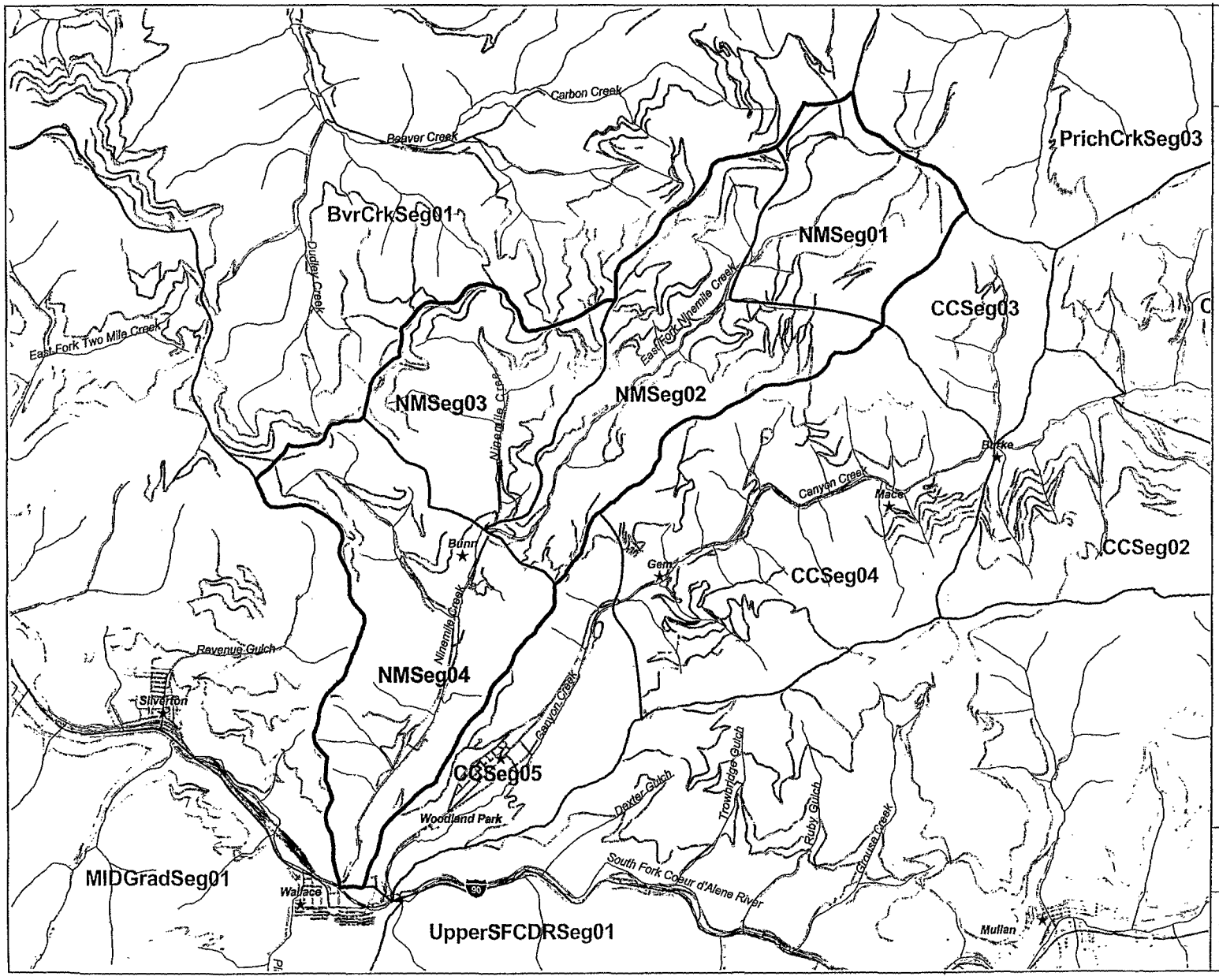

Figure 1.1-1
Ninemile Watershed

LEGEND

- Stream
- Road
- Interstate 90
- City
- Ninemile Watershed
- Ninemile Creek Segment
- River Segment
- Lake/River

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:48,000

0.5 0 0.5 Miles

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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 16 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Ninemile Creek Watershed are presented in this section.

2.1.1 Geomorphic Setting

The principal drainages of the Ninemile Creek Watershed are Ninemile Creek, East Fork Ninemile Creek, and Blackcloud Creek. The headwaters of East Fork Ninemile Creek are located southeast of Sunset Peak at an elevation of approximately 6,000 feet (Figure 1.1-1). Ninemile Creek begins southwest of Dobson Pass at an elevation of approximately 4,700 feet. Ninemile Creek and West Fork Ninemile Creek flow in a southerly direction and coalesce to form the main stem of Ninemile Creek, near the town of Bunn. Blackcloud Creek also begins at an elevation of approximately 4,700 feet, flows in a southeasterly direction, and joins Ninemile Creek between Bunn and the South Fork. Throughout its course, Ninemile Creek and its tributaries occupies a steepwalled, V-shaped canyon, characterized by steep gradients. Ninemile Creek is a perennial stream with flow that is considerably reduced in late summer.

2.1.2 Bedrock Geology

Weakly metamorphosed sedimentary rock formations grouped within the Precambrian Belt Supergroup are the dominant rocks within the Ninemile Creek Watershed (Part 1, Figure 3.2-2). Surface exposures of bedrock typically consist of one of five formations (presented from oldest to youngest) within the Belt Supergroup: the Pritchard formation (argillite and quartzite), the Burke Formation (predominantly a quartzite), the Revett Formation (also a quartzite), the St. Regis Formation (more variable and consisting of either argillite, quartzite, or lesser amounts of limestone), and the Wallace Formation (consisting of argillite and lesser quartzite). Unlike the other Belt Supergroup formations, which have a minor or rare carbonate component, the Wallace Formation consists of abundant carbonate-bearing argillite and quartzite, dolomitic quartzite, and dolomite (Hobbs et al. 1965).

The Wallace and Pritchard Formations are most prevalent in the upper reaches of the watershed. In the lower reaches of Ninemile Creek, the Burke and Revett formations are more prevalent. The St. Regis and Revett Formations are the most prevalent rock types in the central portion of the watershed, along with a relatively small amount of Burke Formation. The Cretaceous-age

Gem stocks outcrop on the east side of the upper reaches of the watershed (Part 1, Figure 3.2-2). The Gem stocks consist of igneous monzonite that intrudes the older Belt Supergroup rocks.

Alluvial deposits have been mapped in the bed of Ninemile Creek from the mouth to the headwaters and along most of West Fork Ninemile Creek. Alluvial deposits are also present in the creek bed of Blackcloud Creek from its confluence with Ninemile Creek to a point approximately 0.5 mile upstream. From that point to its headwaters, Blackcloud Creek flows directly atop bedrock.

2.1.3 Structural Geology

The bedrock is structurally complex in the Ninemile Creek area. The rocks have been intensely deformed resulting in steep folds and numerous faults (Hobbs et al. 1965). The predominant structural features in the area are the Osburn Fault, the Dobson Pass Fault, and the Blackcloud/Ruth Fault system. Strike-slip movement up to 16 miles is observed in the east-west trending Osburn Fault, the largest structural feature in the district. The most prominent north-trending fault is the Dobson Pass Fault, a low angle normal fault that offsets the Dago Peak stocks westward from their location of formation adjacent to the Gem stocks. North-trending faults are also associated with the Dayrock and Interstate-Callahan Mines (Part 1, Figure 3.2-3).

The Blackcloud Fault is the most prominent northwest-trending structure in the watershed. The Blackcloud Fault is a reverse fault, and is part of a zone of closely spaced northwest-trending structures that occur across an area roughly 1 mile wide (Part 1, Figure 3.2-2). The veins of the California and Monarch Mines occur within this fault zone. Northwest-trending structures also control mineralization at the Rex and Interstate-Callahan Mines in the high country above East Fork Ninemile Creek. As shown on Figure 3.2-2 (in Part 1), there are numerous faults and folds (not shown) that control and offset mineralization in the watershed.

2.1.4 Soils

Like most of the soils throughout the district, the soils of the Ninemile Creek Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay. Hillside soils are generally less than 2 feet thick. Valley soils are found within and along the flanks of the major drainages of the Ninemile Creek Watershed.

Valley soils are most extensive in the floodplain located along Blackcloud Creek at its confluence with Ninemile Creek and along Ninemile Creek above the confluence of Blackcloud Creek and Ninemile Creek to the confluence of West Fork Ninemile Creek and East Fork Ninemile Creek. Floodplain soils at the confluence of Blackcloud Creek and Ninemile Creek consist of alluvial fan gravels and sands deposited by a shifting channel. This type of floodplain soil typically forms at the mouth of tributary streams such as Blackcloud Creek (Box et al. 1999).

Valley soils along the floodplain of Ninemile Creek above the mouth of Blackcloud Creek consist of terrace gravels, which are characterized by well-developed sandy soil overlying cobbly to bouldery gravels (Box et al. 1999). The various types of valley soils along the floodplains of the Ninemile Creek Watershed have been grouped together as Quaternary alluvium (see Part 1, Figure 3.2-2, symbol Qal).

Included with the Quaternary alluvium are tailings and related materials produced by mining activities. Tailings are discussed further in Section 4, Nature and Extent of Contamination.

The location of a representative geologic cross section is shown in Part 1, Figure 3.2-2, and the cross section is provided in Part 2, Canyon Creek Watershed, Figure 2.1-1. The steep topography of the Ninemile Creek Watershed and the presence of Quaternary alluvium overlying sedimentary bedrock is shown in this cross section.

2.1.5 Ore Deposits

The Ninemile Creek Watershed drains the Rex-Snowstorm and Sunset mineral belts and the Dayrock and Success subbelts (Part 1, Figure 3.2-4). As indicated by the production figures, lead and zinc were the most abundant metals produced. The ore deposits in the Ninemile Creek Watershed occur in either (1) steeply dipping veins (associated with quartz) that cut across either argillite or quartzite beds (e.g., Interstate-Callahan, Dayrock, Tamarack-Custer, Monarch, and California Mines) or (2) replacement deposits (e.g., Success, Sunset, and Rex Mines), where ore-bearing fluids altered the host quartzites and argillites by replacing the quartz and clay minerals with sphalerite and galena (Umpleby and Jones 1923).

Most of the deposits in this watershed are relatively close to the Gem stocks (typically within tens or hundreds of feet) and occur in argillite assigned to the Prichard Formation. Specifically, the Interstate-Callahan, Dayrock, Success, Rex, and Monarch Mines recovered ore from the Prichard. The vein at the Sunset Mine occurs at the transition between the Prichard and overlying Burke Formation quartzite, with most of the ore enclosed in the Prichard argillite. The

Tamarack-Custer Mine is hosted solely by Burke Formation quartzite. The California Mine is also hosted by quartzite; yet this quartzite strata is assigned to the Revett Formation.

The principal non-ore minerals of the vein deposits are quartz and pyrite. The non-ore minerals in the replacement deposits contain, in varying proportions, pyrite, pyrrhotite, magnetite, quartz, and silicates such as garnet and pyroxene. For both the vein deposits and the replacement deposits in the Ninemile Creek Watershed, total sulfide content is typically low (perhaps on the order of 3 to 5 percent or less, based on reviews of deposit descriptions (Umpleby and Jones 1923; Ransome and Calkins 1908), and the carbonate mineral content is low to absent.

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

Between 1891 and 1977, at least nine mines and mining complexes operated in the Ninemile Creek watershed. These mines produced an estimated 5 million tons of ore (Mitchell and Bennett 1983). From this ore, an estimated 340,000 tons of lead, 300,000 tons of zinc, 1,800 tons of copper, 600 tons of silver, and 4 million tons of tailings were produced (Mitchell and Bennett 1983; SAIC 1993). Some of the ore mined in the Ninemile Creek drainage was extracted and milled in either the Beaver Creek drainage or the Canyon Creek drainage (Ridolfi 1998).

Mills were constructed along Ninemile Creek to concentrate the ore before its shipment to smelters. The concentration process required large volumes of water and resulted in the generation of fine dust and tailings. Locating mills along the creek provided the water needed to operate the mills and a convenient disposal method for the tailings produced by the concentration process. When the creek flow was insufficient to transport all of the tailings downstream, the mills sometimes had railroad cars carry the coarse tailings as much as 100 miles away to be used for ballast under railroad tracks and ties; sometimes the tailings were used as fill material (Quivik 1999). Prior to 1965, all of the mills along Ninemile Creek discharged most, if not all, of their tailings to the stream. By 1968, all the mills impounded their tailings (Stratus 1999). Figures in Section 4 show the location of some of the mines and mills that historically operated in the Ninemile Creek watershed.

2.1.6.1 Mines

The mines that operated in the Ninemile Creek watershed for which ore production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity, and the segment in which the mine is (or was) located. Additionally, some mining operations were carried out at more than one location, occasionally in more than one segment or even more than one watershed. The ore production listed in Table 2.1-1 is the total production for all mining operation.

2.1.6.2 Mills

Table 2.1-2 lists the mills that operated in the Ninemile Creek watershed for which there are records. This table includes the operating years of the mill and a summary of mill ownership, and the segment in which the mill is located. Not all mills are listed because records were not available for all mills.

2.1.7 Mine Workings

The primary permeability of the bedrock in the Ninemile Creek Watershed is low. Secondary permeability features such as fractures, faults, and mine workings control groundwater flow in the bedrock aquifer. This section describes these secondary features that affect the hydrogeology of the bedrock aquifer. Faults may also influence groundwater movement by offsetting the different soil and bedrock types and by affecting the bedrock configuration.

Underground workings in many mines are very extensive and act as collection and distribution systems for groundwater. Many adits and tunnels in the watershed act as discharge points for groundwater. The adit drainage discharges directly to surface water or infiltrates waste rock piles before discharging to surface water from seeps (SAIC 1993). The mine workings and any noted mine drainage in each segment of the Ninemile Creek Watershed are described in the following subsections.

2.1.7.1 Segment NMSeg01

There are six mines within segment NMSeg01. The mine workings are located in the headwaters of the East Fork Ninemile Creek. Seeps, springs, and other discharges associated with these mines drain to the East Fork Ninemile Creek. Three adits are known to discharge mine waters to the surface water: Sunset Tunnel, Little Sunset Mine, and an unnamed adit near the Guelph

Shaft (Ridolfi Engineers 1998). No other information about drainage from specific mines within NMSeg01 was found in the literature on Ninemile Creek.

2.1.7.2 Segment NMSeg02

There are 18 mines within segment NMSeg02. The mine workings are located along Lower East Fork Ninemile Creek. Seeps, springs, and other discharges associated with these mines drain to East Fork Ninemile Creek.

In November 1997 and May 1998, mine drainage was observed flowing from the Interstate No. 4 adit and measured by URS at rates of 19 and 15 gpm, respectively. Mine drainage and surface water from two side draws infiltrate a portion of the waste rock pile at the Interstate-Callahan location and subsequently discharge into East Fork Ninemile Creek (SAIC 1993).

Groundwater seeps were noted at the Rex Mine and Mill site (Rex No. 2). The seeps are thought to be caused by mine drainage and surface water infiltrating a waste rock pile and tailings pond. The seeps emerge from the toe of the tailings pond (SAIC 1993).

Drainage to the tailings pile from the main adit at the Success No. 3 Mine was measured at approximately 3 to 5 gpm in 1993 (SAIC 1993) and 16 gpm in June 1997 (Balistrieri et al. 1998). Drainage to the tailings pile from a second adit (Alameda adit) located south of Success No. 3 Mine was measured at approximately 2 to 4 gpm (SAIC 1993).

No other information about drainage from specific mines within NMSeg02 was found in the literature on Ninemile Creek.

2.1.7.3 Segment NMSeg03

There are six mines within segment NMSeg03. The mine workings are located in the headwaters of Ninemile Creek. Seeps, springs, and other discharges associated with these mines drain to West Fork Ninemile Creek. No information on specific discharge locations within NMSeg03 was found in the literature on Ninemile Creek.

2.1.7.4 Segment NMSeg04

There are 15 mines within segment NMSeg04. The mine workings for five of these mines are located in the Blackcloud Creek drainage. Seeps, springs, and other discharges associated with these mines drain to Blackcloud Creek. The other 10 mines drain to Ninemile Creek.

Adit drainage was specifically noted from three of the mines in NMSeg04: Dayrock Main Level, Duluth Mine, and Silver Star Mine. No other information on specific discharge locations within NMSeg04 was found in the literature on Ninemile Creek.

2.2 HYDROGEOLOGY

The hydrogeology of the Ninemile Creek Watershed can be divided into two main aquifer systems: the bedrock aquifer and the shallow alluvial aquifer. The hydrogeologic conceptual model for the Ninemile Creek drainage is an alluvial valley with a single, discontinuous, unconfined alluvial aquifer underlain by the nearly impermeable bedrock aquifer.

The bedrock aquifer within the Ninemile Creek Watershed consists primarily of the sedimentary formations of the Precambrian Belt Supergroup. The rocks are predominantly quartzites, dolomites, and argillites (Hobbs et al. 1965). In general, the bedrock has very low primary permeability. Secondary features such as fractures, faults, or mine workings increase the permeability and likely control groundwater movement through the bedrock aquifer. Section 2.1.7 lists the mine workings that may have some influence on groundwater.

The alluvial aquifer is composed of naturally occurring sediments, waste rock, and tailings from mining operations. Past erosion of upstream tailings sources has resulted in transport and redeposition of tailings throughout the floodplain of the Lower East Fork and the main stem of Ninemile Creek (Ridolfi Engineers 1997). In general, alluvium thickness increases from the headwaters of Ninemile Creek toward its confluence with the South Fork (Box 1999).

2.2.1 Aquifer Parameters

Aquifer parameters such as hydraulic conductivity are generally obtained by performing multi-well aquifer tests or single-well slug tests. In December 1999, as part of the RI, slug tests were performed in three monitoring wells (locations NM441, NM442, and NM459) to estimate aquifer characteristics of the shallow alluvial aquifer(s). Although slug tests are a valuable tool for estimating aquifer parameters, it is important to note that they provide estimates for only a small volume of aquifer material around the well and the section of aquifer where the wells are located. In addition, because the monitoring wells were screened over their entire length, the estimated hydraulic conductivities should be considered as estimates of the average conductivity of all the materials encountered over the screened interval.

The hydraulic conductivity values were derived using the solution developed by Bouwer and Rice (1976). The hydraulic conductivities ranged from 90 to 120 feet/day (Table 2.2-1) and are typical of silty sand and sand materials (Freeze and Cherry 1979). The locations of the monitoring wells are shown in Figure 2.2-1. It should be noted that these three wells are all located in, and are representative of conditions in segment NMSeg04.

2.2.2 Flow Rates and Gradient

Based on the findings at similar watersheds, it can be assumed that the overall groundwater flow direction in the Ninemile Creek Watershed is downstream paralleling Ninemile Creek. There is no specific information regarding groundwater flow rate or direction for three of the four segments of Ninemile Creek. However, at least one groundwater study was performed in segment NMSeg03.

In October of 1997, four monitoring wells were installed in the tailings pile in the southwest corner of the Interstate Mill site (Golder and Associates 1998) (Figure 2.2-1). Water level elevations were recorded in all monitoring wells at the Interstate Mill site on October 24 and November 25, 1997. Approximate groundwater contours indicate that groundwater flows from the hill slope toward East Fork Ninemile Creek (Golder and Associates 1998). Because remediation work performed at this site has likely altered the shallow groundwater flow system, these groundwater investigation data are not presented. However, the current groundwater flow direction is probably still from the hill slope toward the creek.

2.2.3 Surface Water/Groundwater Interaction

2.2.3.1 Segment NMSeg01

There is little interaction between the groundwater and surface water in segment NMSeg01 because the creek (East Fork Ninemile Creek) is cut into the bedrock in a narrow valley with a few small, discontinuous areas of alluvium along the stream channel. The shallow alluvial deposits along Ninemile Creek serve as very localized aquifers and if they are hydraulically connected to the creek, are capable of taking from or adding to the flow in the creek. The interaction between the surface water in East Fork Ninemile Creek and the groundwater in the shallow alluvial aquifers creates some gaining or losing reaches that are not well-defined in any of the reports for the Ninemile Creek Watershed. Due to the limited number and extent of the alluvial deposits in this segment, the extent of groundwater/surface water interaction in terms of volume is thought to be limited.

One study identified a specific instance of surface water/groundwater interaction within this segment. Adit drainage from the Interstate No. 4 adit infiltrates a waste rock pile and subsequently discharges into East Fork Ninemile Creek (Ridolfi 1997).

2.2.3.2 Segment NMSeg02

Segment NMSeg02 is different from segment NMSeg01 in that it contains areas of floodplains and tailings deposits along the bank of the creek (which constitute the alluvial aquifer in this segment) that are hydraulically connected and interact with the surface water. In addition, several mine adits drain either directly to the creek or first through tailings or waste rock piles and then to the creek. The results of stream gauging Ninemile Creek at the Interstate Mill site indicate that the creek is losing water to the alluvial aquifer near the millsite (Golder and Associates 1998).

Direct historical evidence of surface water/groundwater interaction includes the seepage observed in the fall of 1996 from the base of the Interstate-Callahan tailings accumulation at its downstream end. As described in Section 1.1, the Interstate tailings were placed in an onsite repository in 1998, and post-closure monitoring suggests significant decreases in zinc and lead loading (Harvey 2001). Additionally, mine drainage from at least two of the Tamarack adits and the Rex tailings dam is known to enter East Fork Ninemile Creek (Gearheart et al. 1999).

Farther downstream, in segment NMSeg02, mine drainage from Success No. 3 and the Alameda adits are directed to infiltration galleries to prevent leaching through a nearby tailings pile. However, seeps from the tailings pile are still evident (USGS 1997).

2.2.3.3 Segment NMSeg03

Segment NMSeg03 encompasses West Fork Ninemile Creek, which accounts for only about 8 percent of the flow of Ninemile Creek (Ridolfi 1998). As in segment NMSeg01, there is little interaction between the groundwater and surface water in segment NMSeg03. West Fork Ninemile Creek is cut into the bedrock in a narrow valley with a few small, discontinuous areas of alluvium. No major floodplains, tailings deposits, or waste rock dumps are noted along this segment of the creek. Recent mapping of the floodplain in the lower part of the West Fork drainage indicate no accumulations of tailings or other mine wastes (Ridolfi 1998).

2.2.3.4 Segment NMSeg04

Segment NMSeg04 encompasses the main stem of Ninemile Creek from the confluence of West Fork Ninemile Creek and East Fork Ninemile Creek to the confluence with the South Fork. Blackcloud Creek is also located within NMSeg04, approximately 2.5 miles upstream from the confluence of Ninemile Creek and the South Fork. The main stem of Ninemile Creek contains tailings and floodplain deposits that serve as aquifers and interact with the surface water (Ninemile Creek). The largest floodplain deposits in this segment are located at the Dayrock Mine and Mill site and also downstream of the Northside Mine.

Where these areas of alluvial deposits along Ninemile Creek are hydraulically connected to the creek, they are capable of taking from or adding to flow in the creek. There are no data available to indicate what specific interactions are occurring in this section of Ninemile Creek.

2.2.4 Water Quality and Water Chemistry

Eight monitoring wells were installed in the Ninemile Creek Watershed in 1998; the objective of the investigation was to conduct a detailed investigation of the Rex and Success Mine and Mill complexes to help characterize the upper part of Ninemile Creek (USEPA 1999). Water quality parameters (temperature, pH, specific conductance, salinity, turbidity, and oxidation-reduction [redox] potential) were measured to evaluate changes in water quality in the alluvial aquifer as groundwater moves hydraulically downgradient through the Ninemile Creek Watershed. Water quality data from the 1998 wells in the Rex Reach, Success Reach, and Lower Ninemile Creek Reach areas are presented in Table 2.2-2. Water chemistry data (chloride, sulfates, and sulfides) from the same wells are presented in Table 2.2-3. The 1998 groundwater sampling locations are shown in Figure 2.2-1.

Two of the eight 1998 wells (locations NM421 and NM423) were dry; therefore, no water quality samples were collected. At most of the wells, groundwater samples were collected at different depths in the water column. Unless otherwise noted, the following statements apply to the groundwater conditions throughout Ninemile Creek based on groundwater sampling at widely spaced locations:

- Salinity and specific conductance values are typical of freshwater conditions (Table 2.2-2 and 2.2-3).

- The hydrogen ion concentrations (i.e., pH) within the watershed are commonly between 5 and 8. In the headwaters area of the watershed along the Rex Reach

(NM422), the pH is 6.3. Groundwater samples collected at location NM441 on December 3, 1998, have similar pH values, ranging from 6.14 to 6.16. However, a pH of 5.43 was detected in an additional sample collected on December 9, 1998, at location NM441. At the Day Rock location (NM442), pH values are more acidic, ranging from 5.05 to 5.24. Near the Lower Ninemile Creek Reach (locations NM459 and NM460), the pH values range from near neutral (i.e., a pH of 7.0) to 7.52 (Table 2.2-2).

- The redox potential, the ability of a specific groundwater environment to bring about any oxidation or reduction process, indicates an oxidizing environment at all groundwater sampling locations (Table 2.2-2).

- Groundwater typically displays low turbidity in samples collected from appropriately constructed monitoring wells (Table 2.2-2).

- Sulfides are generally not present at detectable concentrations. Chloride ranges from less than 250 to 13,600 µg/L and sulfates range from approximately 19,000 to 488,000 µg/L (Table 2.2-3).

2.2.5 Groundwater Use

Surface water in creeks and groundwater in shallow unconfined alluvial aquifers are potential domestic water sources in the watershed. Water-rights records indicate that four groundwater/spring sources in the Ninemile Creek Watershed are used for domestic purposes only. The records also indicate that 10 surface water sources and 5 groundwater/spring sources in the watershed are used for domestic purposes or irrigation (IDWR 1996).

2.3 SURFACE WATER HYDROLOGY

Surface water hydrology of Ninemile Creek, a tributary to the South Fork Coeur d'Alene River, is described in this section. The Ninemile Creek Watershed has a drainage area of approximately 11.6 square miles with approximately 9.5 miles of mapped channel length and a drainage density of 0.8 miles per square mile.

2.3.1 Available Information

The available hydrologic information for Ninemile Creek includes U.S. Geological Survey (USGS) stream flow data for Ninemile Creek for water year 1999, climatological data for Wallace, ID, and instantaneous discharge data from a variety of consultants from 1991 to 1999. In addition, historical USGS discharge data is available for Placer Creek, of similar size and near Ninemile Creek.

The USGS began reporting stream flow discharge data from USGS station number 12413130, Ninemile Creek, above mouth at Wallace, ID, on October 1, 1998 (USGS 2000a). This station is located at the downstream end of NMSeg04. This station records water stage at 15-minute intervals. Discharge is calculated from the stage data based on a rating curve developed for the specific gage. The rating curve is developed through time by measuring discharge at known stages to relate stage to discharge. Once a rating curve is developed, a discharge can be calculated by comparing a known stage to the rating curve. One complete year of discharge data, water year 1999, is available for Ninemile Creek at Wallace at this time. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Woodland Park were collected for the same period (WRCC 2000). This precipitation gage is the nearest gage to Ninemile Creek. The hydrograph and precipitation data are presented in Figure 2.3.1-1. The maximum discharge recorded during water year 1999 was 133 cubic feet per second (cfs) on May 25, 1999. The minimum discharge for this period of record was 3 cfs on both December 20 and 21, 1998.

In addition to the USGS gage on Ninemile Creek, the USGS has several gages in the area with historical streamflow data, most notably USGS station number 12413140, Placer Creek at Wallace, ID. The Placer Creek gage has a drainage area of 14.9 square miles and a period of record from November 1967 to September 1995, October 1996 to September 1997, and water year 1999. This data can be used to estimate historical hydrographs and discharges for floods of specific recurrence intervals within Ninemile Creek.

The USGS also has developed a synthetic hydrograph for the East Fork Ninemile Creek, above mouth near Blackcloud, ID, Station 12413127 (USGS 2000b), for water year 1999 (Figure 2.3.1-2). This station is located at the downstream end of NMSeg02. To develop this hydrograph, the USGS measured streamflow at the flow gaging location over a range of water stages. Twelve measurements were made during water year 1999. These measurements were correlated to measurements taken at approximately the same time at Station 12413130, Ninemile Creek at Wallace. This correlation provided a relationship between discharge at Ninemile Creek at Wallace and East Fork Ninemile Creek near Blackcloud. The relationship was used with the

continuous streamflow data from the gage at Ninemile Creek at Wallace to develop the synthetic hydrograph presented as Figure 2.3.1-2 for water year 1999. This method appears to give adequate results, as indicated by the reported r^2 value of 0.77 for the correlation analysis. The residuals of the correlation analysis are greatest for large discharges (e.g., greater than 50 cubic feet per second), indicating there may be some uncertainty in the predicted discharge for higher flows.

Stream discharge measurements were taken in association with water quality sampling events completed by McCulley, Frick & Gilman, Inc. (MFG), URS, Idaho Division of Environmental Quality (IDEQ), and USGS. These measurements have occurred since 1991. These data can be used to evaluate the adequacy of the historical hydrographs developed from the Placer Creek data. These data are summarized in Table 2.3.1-1.

2.3.2 Hydrologic Description

The hydrology of Ninemile Creek based on, water year 1999 stream discharge and precipitation data, and estimates of historical discharge data are presented in this section. Base flow discharge is estimated at 3 to 5 cfs, maximum discharge is estimated at 970 cfs, and the minimum discharge is estimated at less than 0.3 cfs. These estimates are based on discharge data from water year 1999 for Ninemile Creek and historical data from Placer Creek dating from 1967.

2.3.2.1 Historical Description

Continuous data prior to 1999 is not available for Ninemile Creek; therefore, an estimate of mean daily discharge at the mouth of Ninemile Creek was developed from historical data from Placer Creek. Mean daily discharge for Placer Creek, water year 1999, was scaled by the ratio of drainage area of Ninemile Creek to Placer Creek to produce an estimate of mean daily discharge for Ninemile Creek. The difference between the estimated discharge and measured discharge was calculated. The hydrographs and difference are shown in Figure 2.3.2-1. The relationships developed correlates well with base flow and timing of high flow events but does not correlate well for the magnitude of the high flow events. This method overestimates the peak daily mean discharge by 133 percent. In order to improve the estimated magnitude of high flow events, the estimated discharge was adjusted by a multiple of Placer Creek discharge. As indicated in Figure 2.3.2-1, the difference between the estimated and measured discharge increases with increasing discharge. When plotted as the difference in discharge verses the discharge in Placer Creek, a general linear relationship is apparent, Figure 2.3.2-2. This relationship was applied to the estimated discharge for discharge greater than 6 cubic feet per second to result in Figure 2.3.2-3. This relationship may be shown as:

$$Q_{ninemile}=(Q_{placer}*DA_{ninemile}/DA_{placer})-0.3994*Q_{placer}$$

Or

$$Q_{ninemile}=0.439Q_{placer}$$

This relationship overestimates the peak mean daily discharge for 1999 by approximately 45 percent, a significant improvement over drainage area ratios alone. To obtain additional insight into the estimated discharge magnitudes, instantaneous discharge measurements from the project database for sample site location NM305, near the mouth of Ninemile Creek, were plotted with the estimated mean daily discharge, Figure 2.3.2-4. Although the discharge estimates are mean daily and the measurements shown in Figure 2.3.2-4 are instantaneous, this indicates that the relationship developed to estimate mean daily discharge is reasonable.

This relationship was applied to the entire historical data set from Placer Creek to estimate historical discharge in Ninemile Creek, Figure 2.3.2-5. The maximum discharge recorded at the Placer Creek gage is outside the period of record; however, the USGS has estimated this discharge at 2,200 cfs on February 9, 1996. Applying the above relationship results in an estimate of maximum discharge for Ninemile Creek of 970 cfs. Maximum mean daily discharge based on this analysis is approximately 540 cfs and summer base flow is 3 to 5 cfs. Minimum discharge for the period of record is less than 0.3 cfs.

2.3.2.2 Flood Frequency

Because historical discharge data are not available for Ninemile Creek prior to 1999, Placer Creek historical data were used to estimate flood frequency for Ninemile Creek. A flood frequency analysis was completed for Placer Creek and the relationship developed to estimate mean daily discharge from Placer Creek discharge was applied to estimate discharges with specific recurrence intervals.

Peak annual discharge for Placer Creek for the period of record were used with the USGS computer program PEAKFQ2.4 (USGS 1998) to calculate the discharge and 95 percent confidence intervals at various recurrence intervals. PEAKFQ2.4 performs the flood frequency calculations based on Bulletin 17B, from the Interagency Advisory Committee on Water Data (USGS 1982). These values were scaled with the relationship developed for mean daily discharge to obtain an estimate of discharges of specific recurrence intervals for Ninemile Creek, Table 2.3.2-1. The bankful discharge, the approximately 1.5 year event, is estimated to be approximately 110 cfs.

2.3.2.3 Water Year 1999

Total annual average precipitation at the WRCC Wallace at Woodland Park Station for the 51 year period of record is 37.7 inches while for water year 1999 the total precipitation was 39.8 inches. Total annual average snowfall for the WRCC station is 85.1 inches while for water year 1999 the total snowfall was 82.2 (WRCC 2000). While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was typical.

The mean monthly flows for Ninemile Creek at Wallace, mean monthly precipitation (rain and snow water content), and total snowfall at the WRCC station at Wallace, Woodland Park are summarized in Table 2.3.2-2. Table 2.3.2-2 and Figure 2.3.1-1 indicate the majority of precipitation, 83 percent, occurred from October to March. Much of this precipitation was in the form of snow and did not run off into the channel immediately.

As indicated in Table 2.3.2-2, stream discharges remained relatively low through February 1999. Small increases in discharge are noticeable in response to precipitation events in Figure 2.3.1-1 through the middle of March, 1999. However, daily mean discharges did not exceed 20 cubic feet per second.

The majority of discharge in Ninemile Creek during water year 1999 was produced during spring. The increase in discharge during the spring is attributed to increased runoff caused by snowmelt. Maximum daily temperature and mean daily discharge for water year 1999 are presented in Figure 2.3.2-6. This figure indicates that three periods of increased runoff occurred in mid to late March, mid to late April, and late May to late June, of water year 1999. Increased temperatures over these periods melted much of the snow in the upper watershed. Rain on snow also contributed to these increased discharges as indicated in Figure 2.3.2-6.

In summary, water year 1999 was typical from a total snowfall and total water budget perspective in the Ninemile Creek Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the peak discharges.

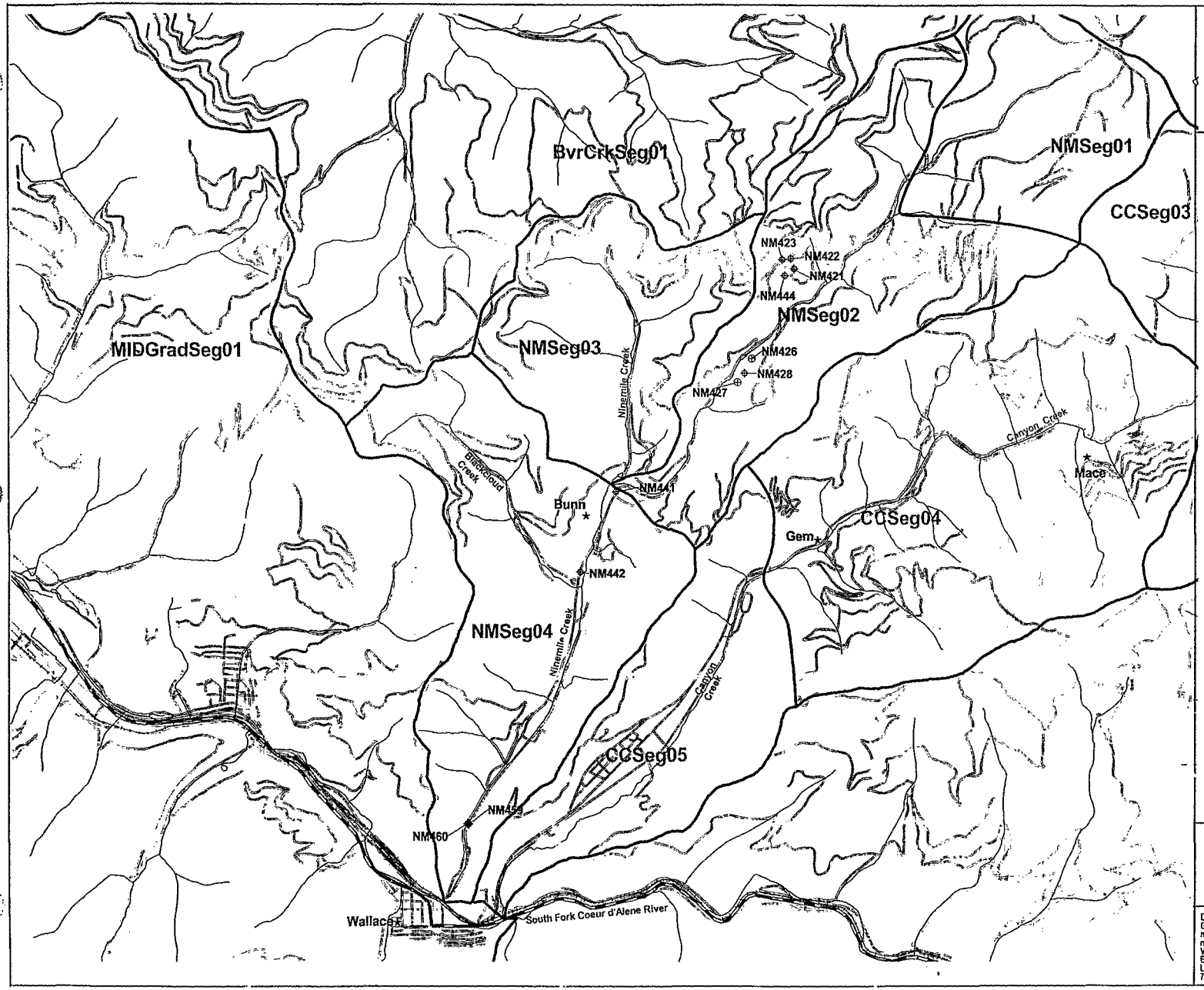

Figure 2.2-1
Locations of Wells in Ninemile Creek Watershed

Legend

- ⊕NM427 Piezometer
- ⊕NM423 Monitoring Well
- ★ City
- Stream
- Interstate 90
- Roads
- Railroad
- Segment Boundary

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2MHill, and the Bureau of Land Management.

SCALE: 1: 40,000

0 0.5 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

EPA REGION 10

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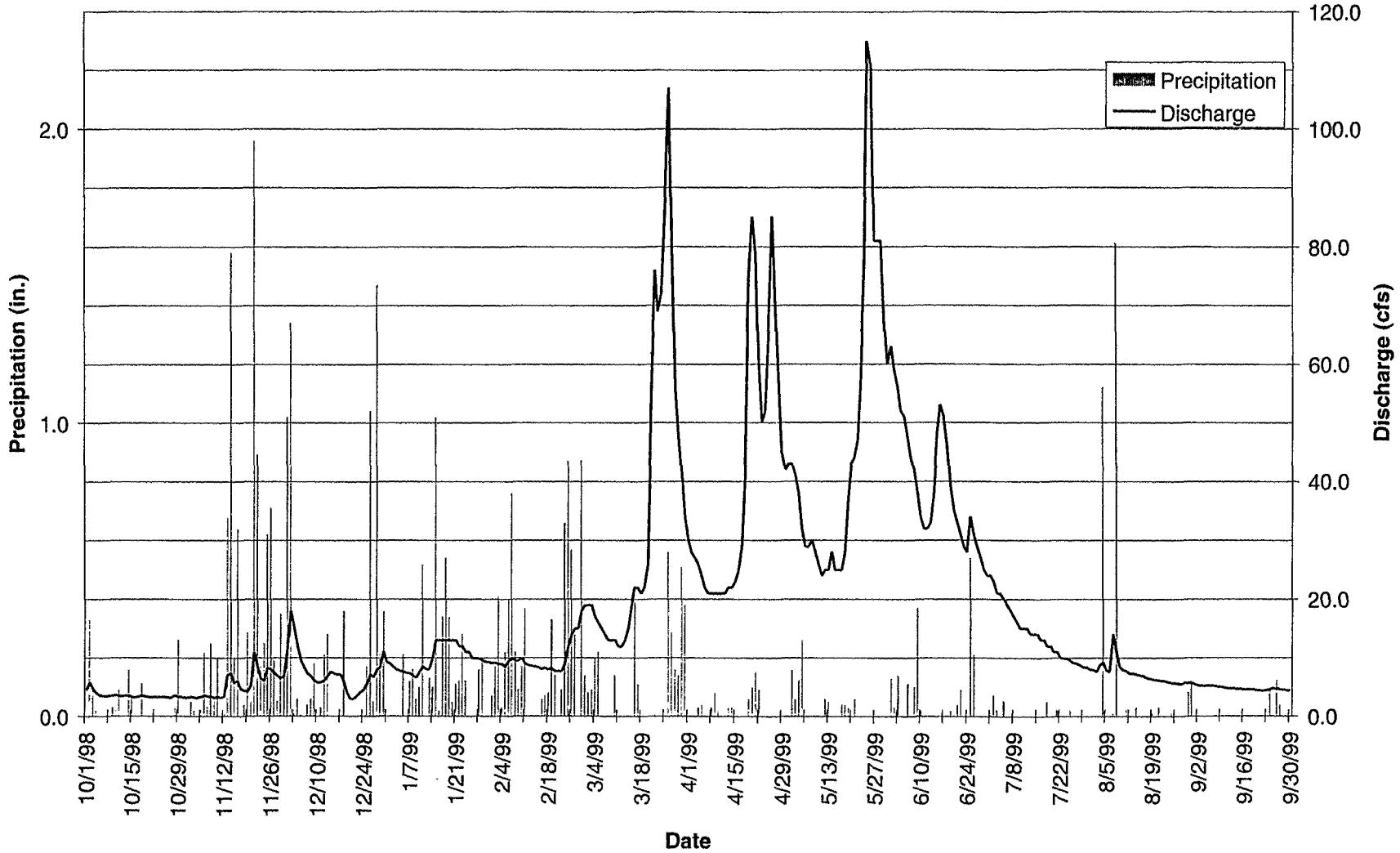
nm_wells.apr
View: nm_wells
Extent: Ninemile
Layout: Final RI nm_wells (11x17)
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

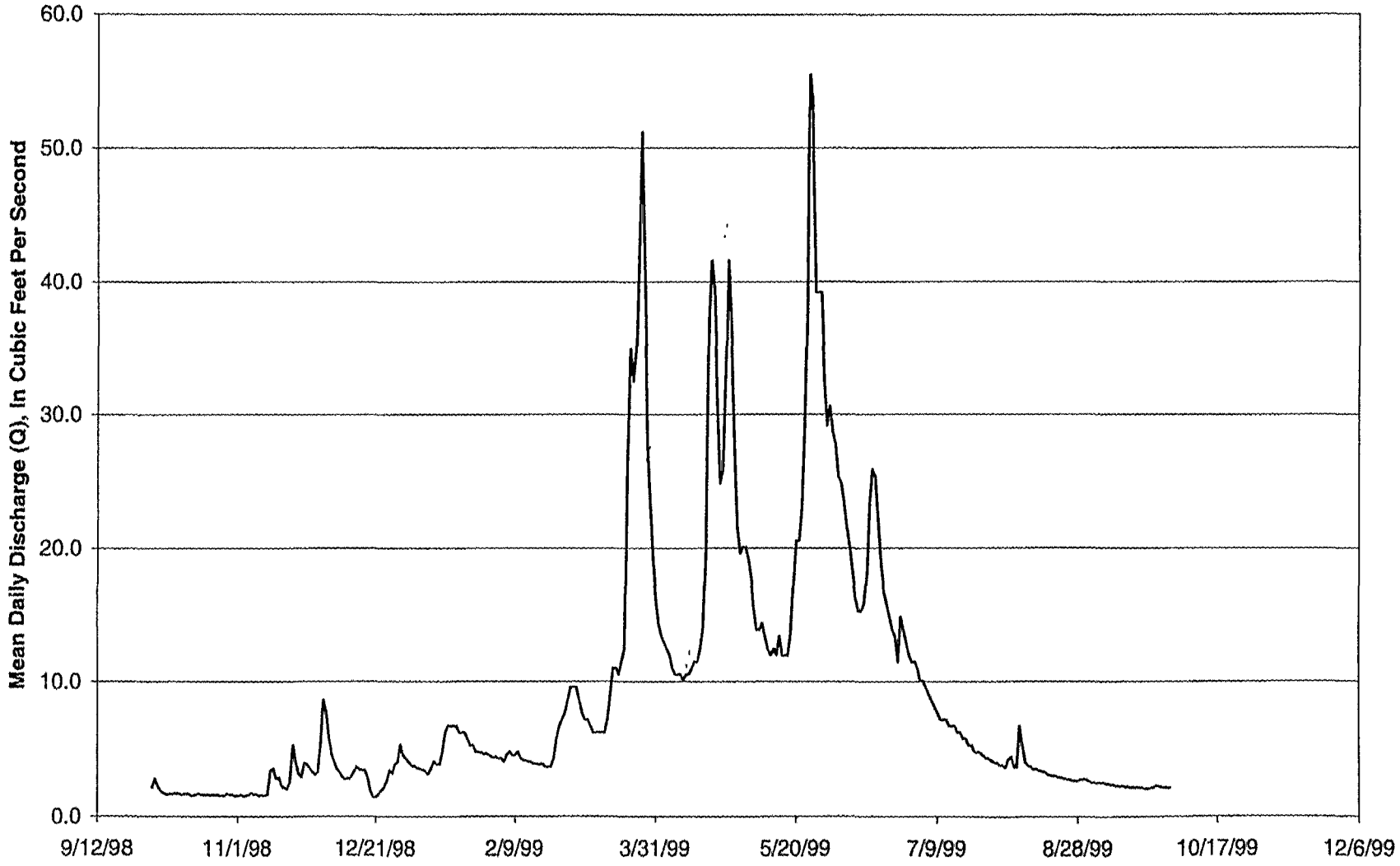
Date of Plot: July 16, 2001

Daily Total Precipitation at Woodland Park and Daily Average Discharge for Ninemile Creek Near Wallace, USGS Station 12413130 Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 2.3.1-1

USGS Synthetic Hydrograph, East Fork Ninemile Creek Near Blackcloud, Station 12413127, Water Year 1999



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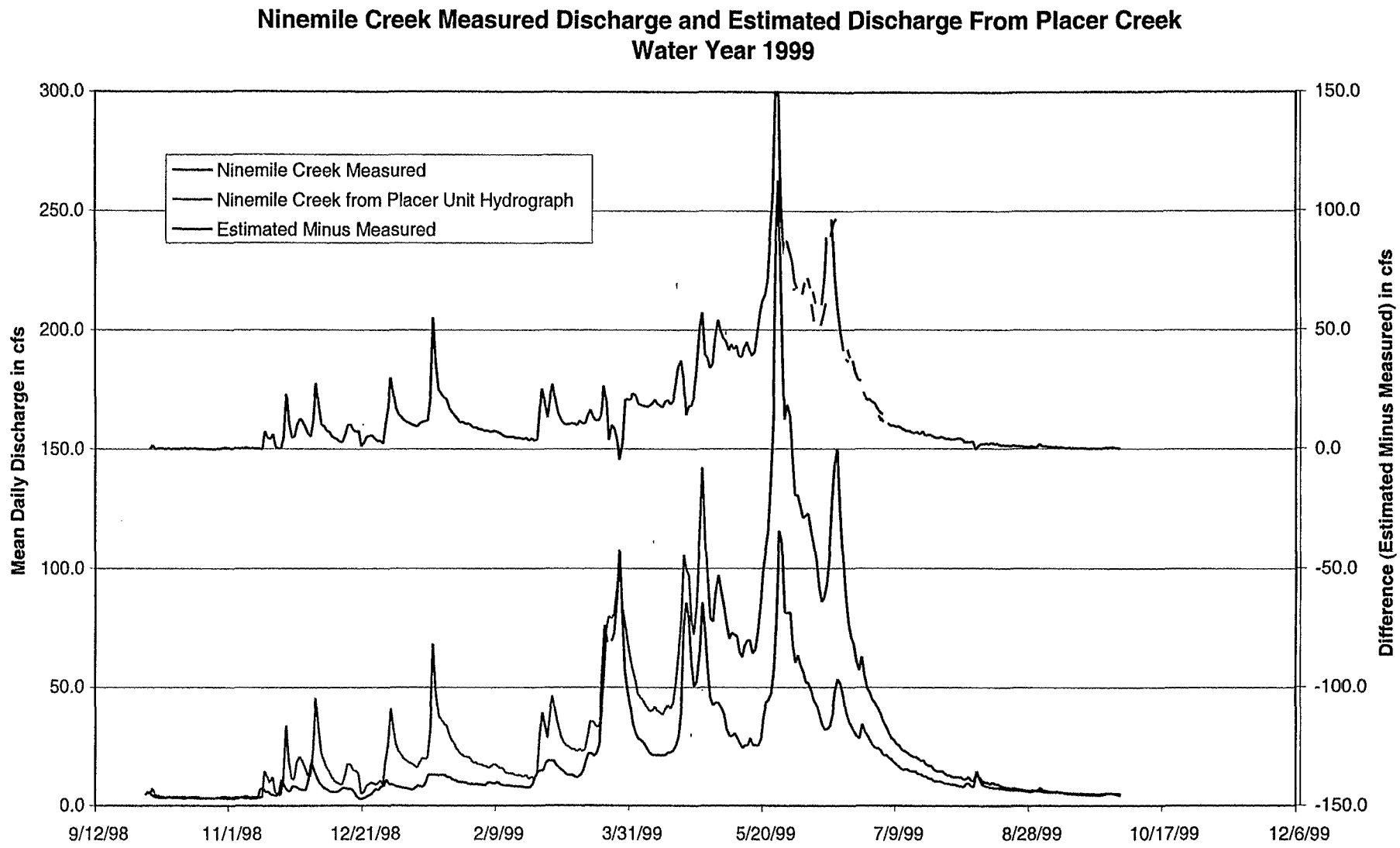
Ninemile Creek Series
07/13/01

Figure 2.3.1-2



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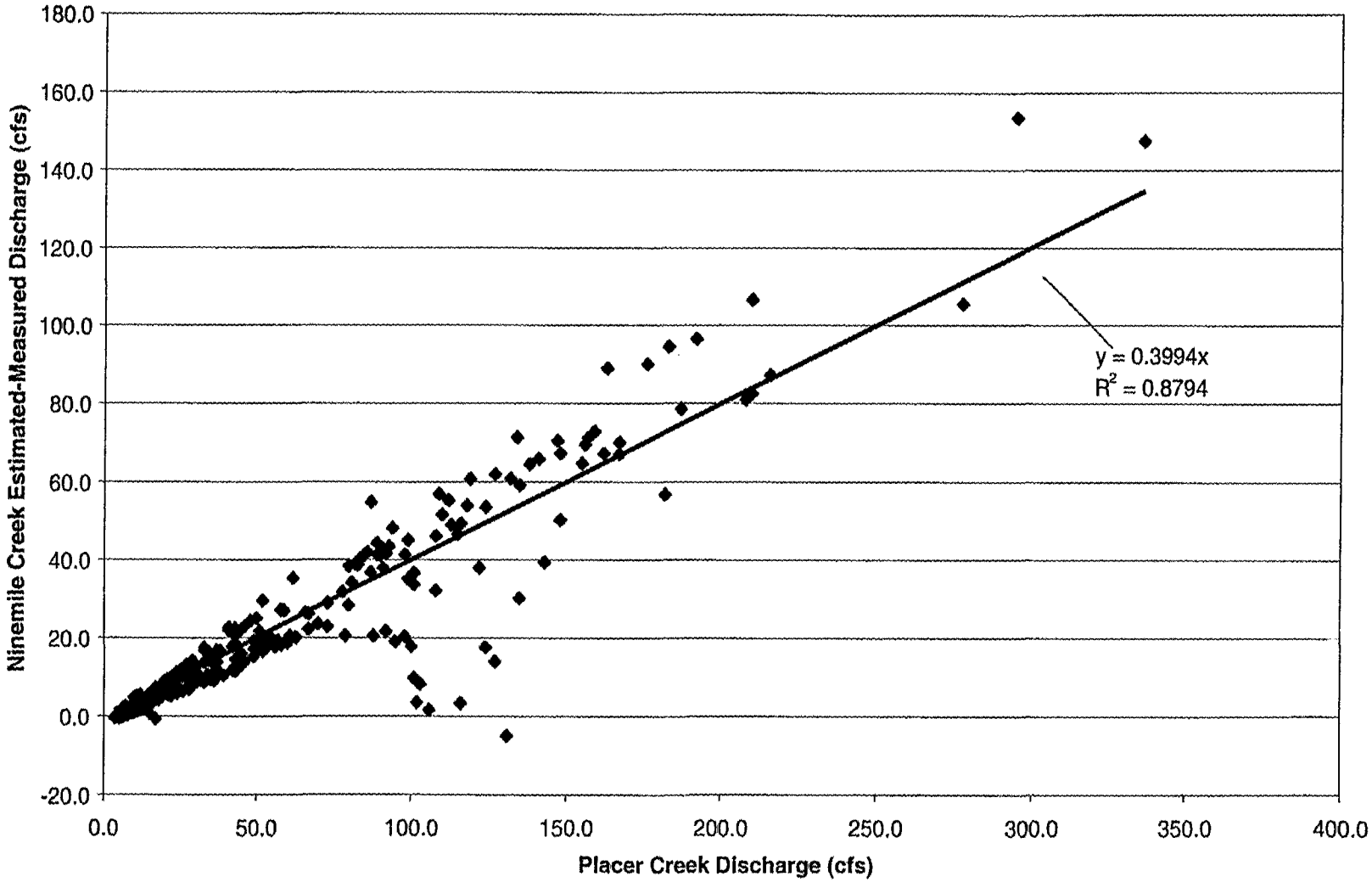
07/13/01

Figure 2.3.2-1

Placer Creek Discharge Versus Difference of Estimated and Measured in Ninemile Creek, Water Year 1999



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RI REPORT

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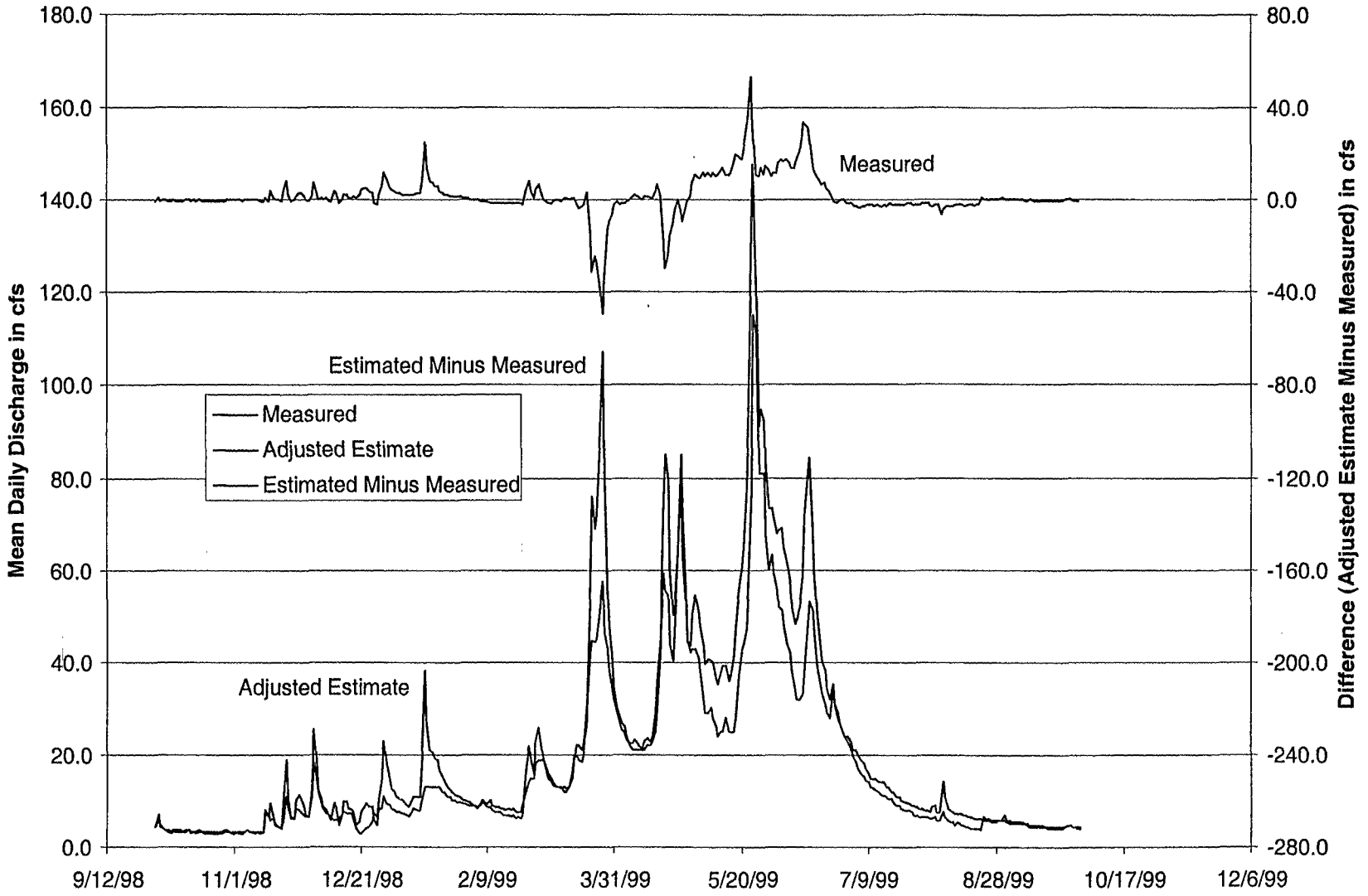
Generation: 1

Ninemile Creek Series
07/13/01

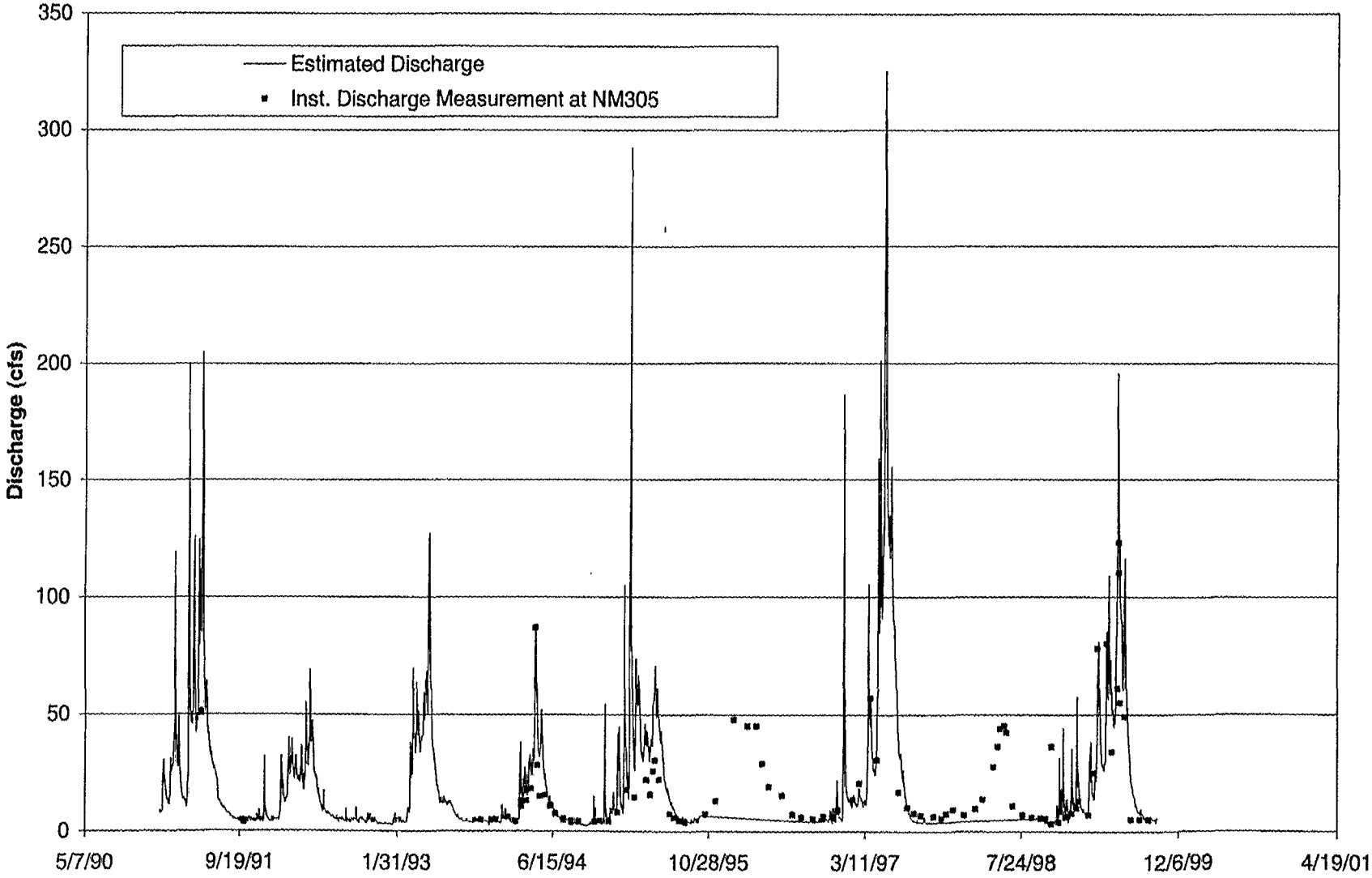
Figure 2.3.2-2

Ninemile Creek Measured Discharge and Adjusted Estimated Discharge From Placer Creek, Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 2.3.2-3

Estimated Mean Daily Discharge and Instantaneous Discharge Measurements, Ninemile Creek



EPA REGION 10

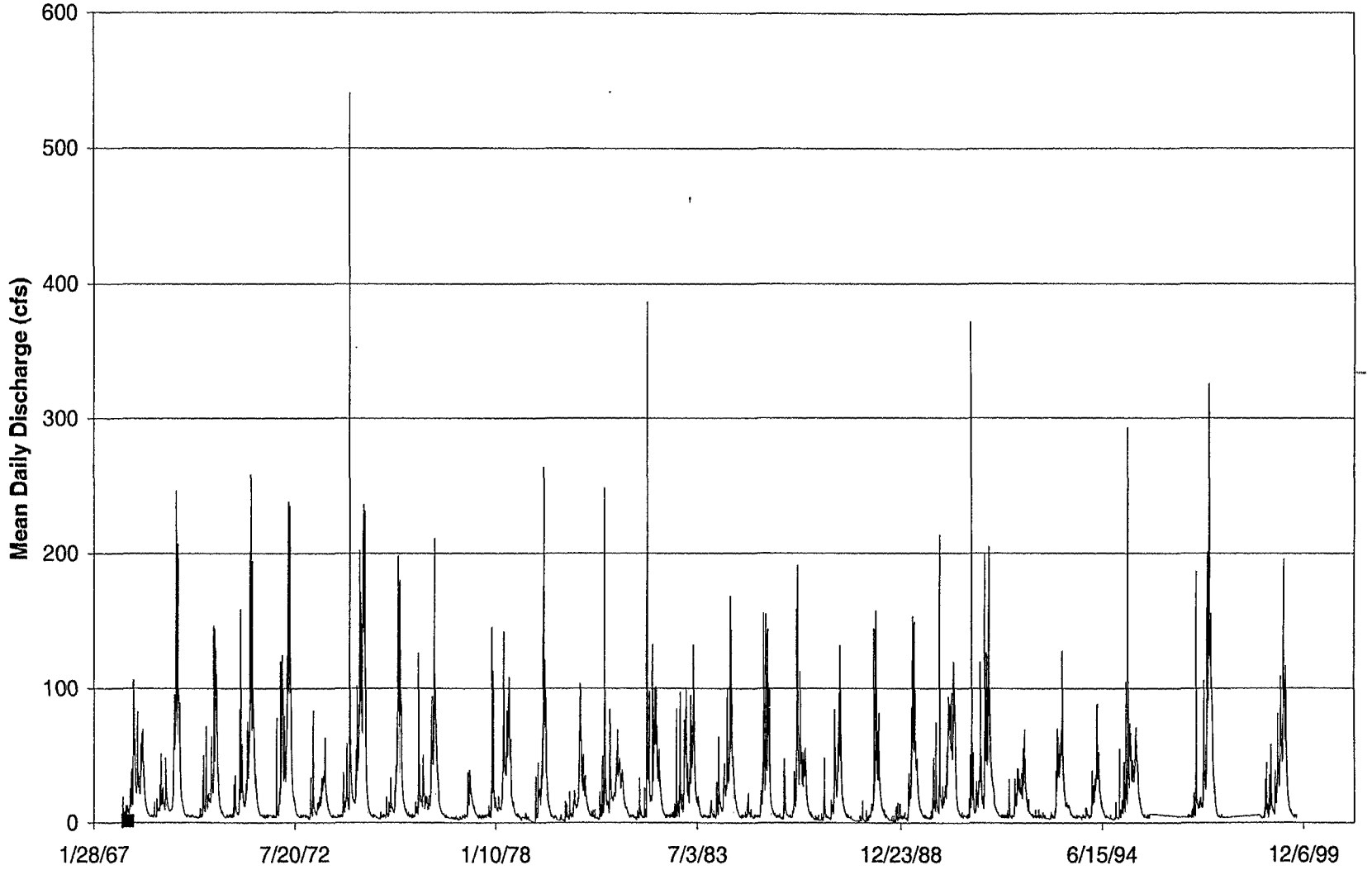
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

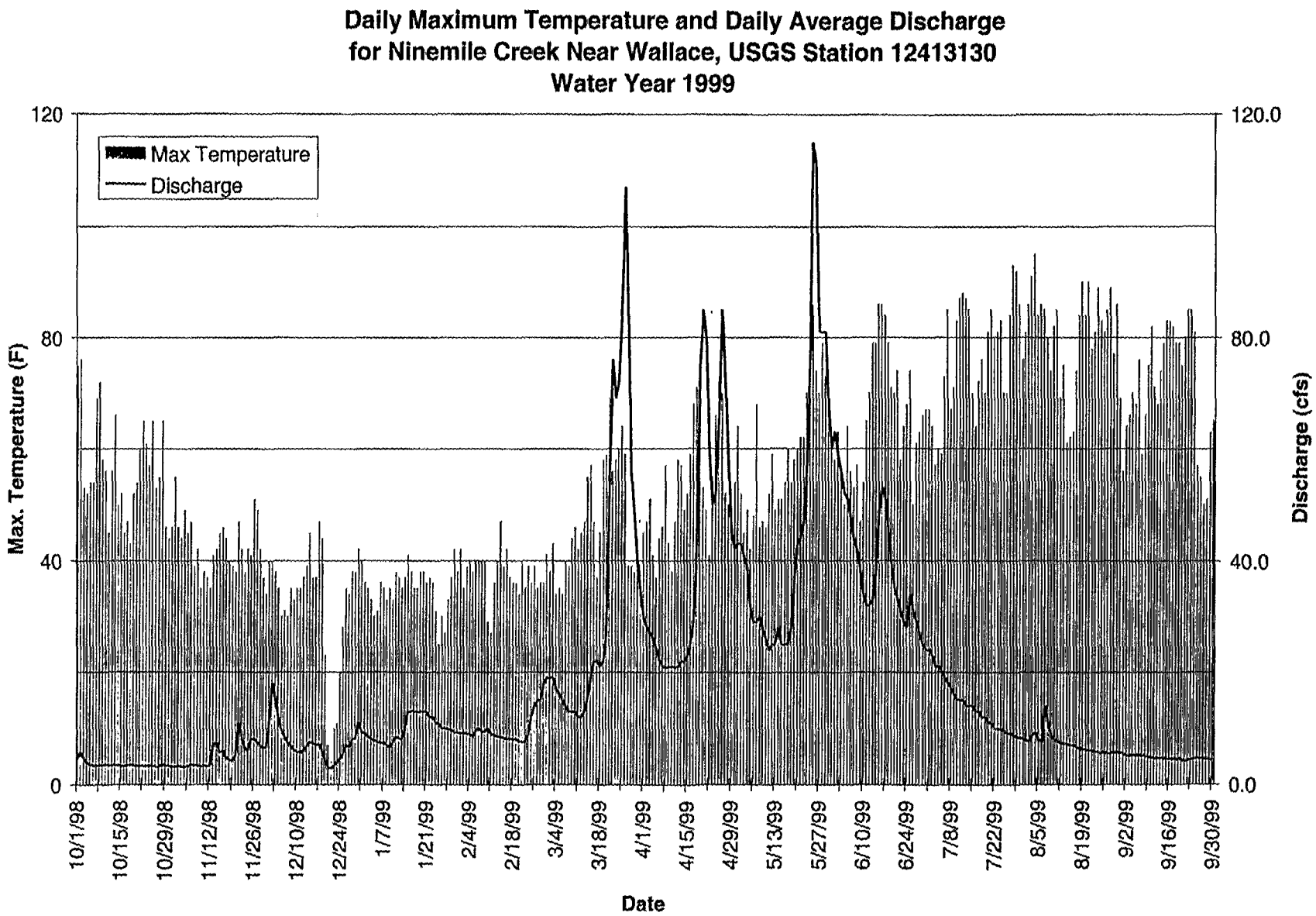
Ninemile Creek Series
07/13/01

Figure 2.3.2-4

Synthetic Hydrograph, Mean Daily Discharge, Ninemile Creek at Mouth, Calculated from Placer Creek Gage Data, Water Years 1968 to 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 2.3.2-5



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Ninemile Creek Series
07/13/01

Figure 2.3.2-6

Table 2.1-1
Mines in the Ninemile Creek Watershed

CSM Segment	Mine	Production Years[a]	Ore (tons)	Mill	Estimated Tailings Produced[b] (tons)	Comments
NMSeg04	California	1902-1925	49,079	Blackcloud/Marsh	41,945	Records indicate that production began at the California Mine by 1902. Little information is available about the mine's operation during the early part of the century. By 1930, the mine had been incorporated with the Dayrock property. Ore from the California mine was shipped to a custom mill owned by the Marsh Mining Company (Ridolfi 1998).
NMSeg04	Dayrock	1924-1974	1,276,488	Dayrock, Hercules (Wallace)	1,121,575	The Stratton Mines Company was incorporated in 1924, in response to an important lead-silver discovery that was made along Ninemile Creek during the latter part of 1923. The Day interests soon acquired control of the new company (Quivik 1999). The mine shipped its first car of ore in 1924 and railroad facilities were installed in 1927 (Ridolfi 1998). In 1928, the Dayrock Mining Company succeeded Stratton Mine Company in title to the Stratton's mines (Quivik 1999). By 1930, the California and Monarch mines were incorporated with the Dayrock. Ore from the mine was shipped to the Hercules Mill near Wallace, until 1941 when the Dayrock Mill was constructed. In 1949, the mine began using the sand fraction of its tailings as backfill within the mine. Fine tailings were discharged to Ninemile Creek until a tailings impoundment was constructed in 1968. The mine continued to operate until 1977 (Bull 1999).

Table 2.1-1 (Continued)
Mines in the Ninemile Creek Watershed

CSM Segment	Mine	Production Years[a]	Ore (tons)	Mill	Estimated Tailings Produced[b] (tons)	Comments
NMSeg02	Interstate-Callahan	1906-1977	1,432,619	Interstate-Callahan, Galena	1,039,087	The Interstate-Callahan Mine was the largest producer in the Ninemile Creek drainage, accounting for 30 to 40 percent of overall production. The mine began shipping ore in 1906. The mine was primarily a zinc producer, which was known to have the highest-grade zinc in the drainage. In 1915, the Interstate-Callahan was the largest producer of zinc in Idaho. The mine was operated sporadically through the 1920s, mostly by lessees. After 1945, operation of the mine was conducted through the Carlisle Mine located on Beaver Creek. The Interstate-Callahan and several other mines were later consolidated to form the Monitor Mine. Operations at the Monitor were discontinued in 1977 (Ridolfi 1998).
NMSeg04	Monarch	1904-1942	58,840	Blackcloud/Marsh	52,053	Records indicate that production began at the Monarch Mine by 1904. Little information is available about the mine's operation during the early part of the century. By 1930, the mine had been incorporated with the Dayrock property. Ore from the Monarch Mine was shipped to a custom mill owned by the Marsh Mining Company (Ridolfi 1998).

Table 2.1-1 (Continued)
Mines in the Ninemile Creek Watershed

CSM Segment	Mine	Production Years[a]	Ore (tons)	Mill	Estimated Tailings Produced[b] (tons)	Comments
NMSeg02	Rex	1905-1949	154,441	Rex, Old Rex (16 to 1)	134,813	In October 1904, the Rex Mining Company was incorporated. The company took over control of the Sixteen-to-One Mine and Mill (formerly the Custer Mill). Improvements were made to the mine and mill, and operations began 1905. About 1916, the mine and mill were transferred to the Rex Consolidated Mining Company. During the same year the company purchased six claims adjoining the Rex property. The mine was closed in 1917 due to a fire. The property was operated intermittently by lessees during the 1920s and by 1927 the property was under control of the Delaware Mines Corporation. During this time, some of the ore removed from the Rex was treated at the custom Hercules flotation mill. In 1930, the Associated Mine Company took over the property and in 1938 ownership was transferred again, to the Callahan Mining Company (Quivik 1999). In the late 1930s, the Rex workings were connected to the Red Monarch Mine on Beaver Creek. Mine operations ceased by about 1955, except for some activity by lessees (Ridolfi 1998).

Table 2.1-1 (Continued)
Mines in the Ninemile Creek Watershed

CSM Segment	Mine	Production Years[a]	Ore (tons)	Mill	Estimated Tailings Produced[b] (tons)	Comments
NMSeg02	Success (Granite)	1905-1952	789,704	Success, Granite	665,798	Operations began at the Granite Mine in 1885. Production records for the mine have been traced back to 1905, when the mine was renamed the Success. However, the Granite Mill was in operation by 1889, so it is likely that the mine was a producer prior to the time indicated by available records (Ridolfi 1998). Prior to 1905, the ore removed from the Granite was difficult to treat profitably. After experimenting with the ore, H. F. Samuels found that he could profitably treat the ores with a new process. Soon after, Samuels and several others formed the Success Mining Company and production began on a new mill. In October of 1905, the Success shipped the first load of zinc concentrates from the Coeur d'Alene. The mine was operated sporadically until July 1926, when all underground equipment was removed (Quivik 1999). It continued to be operated by lessees until its final shutdown in 1956 (Ridolfi 1998).
NMSeg01	Sunset	1913-1976	355,032	Golconda	302,863	Workings associated with the Sunset Mine are located near the headwaters of the East Fork Ninemile Creek and within the Beaver Creek drainage to the north. A 1941 report by Gage reports that production from the mine during the early 1940s was being removed through the Beaver Creek workings (Ridolfi 1998).

Table 2.1-1 (Continued)
Mines in the Ninemile Creek Watershed

CSM Segment	Mine	Production Years[a]	Ore (tons)	Mill	Estimated Tailings Produced[b] (tons)	Comments
NMSeg02	Tamarack-Custer	1912-1922	845,842	Old Rex (16 to 1), Frisco	703,065	Records indicate that the original Tamarack and Chesapeake Mine began production in 1905. In 1912, the property was combined with the nearby Custer property (production at the Custer Mine is reported as early as 1888 [Quivik 1999]), and the Tamarack and Custer Consolidated Mining Company was formed. During the same year, the mine was connected via an aerial tramway to the old Rex Mill at Sunset, which allowed production at the mine to expand. Later an additional tramway was constructed to carry ore to the Frisco Mill on Canyon Creek for flotation treatment. In 1922, use of the tramways was discontinued when the mine was connected via underground workings to Canyon Creek. The mine continued to be operated from Canyon Creek until its closure in 1949. It is estimated that approximately 30 percent of the mine's total production was removed from Ninemile Creek workings. The remainder of the mine's production was removed through and processed within Canyon Creek (Ridolfi 1998).

[a]Represents years for which production was estimated. Mine may have operated over a longer time period.
[b]Estimated tailings produced by each mine were not necessarily disposed of within the reach where the ores were mined.

Table 2.1-2
Mills With Documented Operations in the Ninemile Creek Watershed

Mill	CSM Segment	Operation Years	Ownership	Comments
Custer/Sixteen-to-One Rex	NMSeg02	1891-1918, 1943-1963	J.M. Porter, C.D. Porter, Peter Porter, W.H. Claggert, W.H. Taylor; John Finch, Amasa Campbell; Rex Mining Company, Theodore Anderson; Silver-Lead Company; Tamarack and Custer Consolidated Mining Company; Rex Consolidated Mine Company; N.C. Sheridan; Delaware Mines Corporation; Associated Mines Company; Callahan Mining Company; Callahan Consolidated Mines Company; Bill Kennedy, Herb Zanetti	Ore conveyed via tramway 2 miles from mine to mill. The mill operated intermittently between 1891 and 1918. By 1927, all equipment had been removed. In 1943, the Callahan Consolidated Mines Company built a flotation mill closer to the mine (approximately 450 feet from the opening); this new mill was also called the Rex Mill.
Black Cloud/ Pittsburg/Marsh	NMSeg04	1898-1918	Wallace Mining Company; James Viles, Jr.; California Consolidated Mining Company; Heinz Lead & Silver Mining Company/Pittsburg Lead Mining Company; Marsh Mining Company; Consolidated Marsh Mines Company; Hecla Mining Company; Dayrock Mining Company	Ore conveyed via aerial tramway ½ mile from mine to mill. The mill operated sporadically between 1898 and 1918. It was purchased by the Dayrock Mining Company in 1930 but was never reactivated. By 1949, the mill buildings were no longer standing.
Success	NMSeg02	1905-1927	Success Mining Company; Duluth	The mill operated only intermittently from 1919-1927. Disassembly of the mill began in 1927 and was completed in 1930.
Interstate-Callahan	NMSeg02	1913-1923, 1940-1949	Consolidated Interstate-Callahan Mining Company; Callahan Zinc-Lead Company, Galena Mining Company; Zanetti Brothers	Ore conveyed via aerial tramway ½ mile below the mine opening. In 1919, two sorting plants were built, one at the mine site to remove waste and one at the mill to separate first-class ore for direct shipment. The mill was permanently closed in 1923 and destroyed by 1940 when a coarse jigging plant was constructed at the millsite by the Zanetti Brothers. By 1949, all buildings were removed from the millsite and the entire property was demolished by 1961.
Spokane Metals Recovery Company	NMSeg02	1918	Spokane Metals Recovery Company	The mill was constructed to treat tailings and was located 3½ miles from Wallace, just below the large tailings dump generated by the Rex Mill. The mill burned late in 1918 and was never re-built.
Dayrock	NMSeg04	1941-1965	Dayrock Mining Company	The mill operated at reduced capacity from 1958-1965 due to low metal prices.

*Quivik 1999

Table 2.2-1
Slug Test Results for Ninemile Creek Watershed

Location ID	Test ID	Apparent Hydraulic Conductivity[a] (feet/day)
NM441	R2	[90]
NM442	R1	110
	R2	120
NM459	R1	100
	R2	110

[a]Hydraulic conductivity value represents average over the interval—saturated thickness above bedrock.

Notes:
Hydraulic conductivity estimated by Bouwer and Rice method using AQTESOLV 2.5 (Bouwer and Rice 1976).
Values in brackets represent poor quality. Water level measurements taken just after the slug had been removed.

Table 2.2-2
Water Quality Parameters in 1998 Wells in Ninemile Creek Watershed

Location ID	Sampling Date	Depth (feet below top of casing)	Temperature (°C)	pH	Specific Conductance (µS/cm)	Salinity (pph)	Turbidity (NTUs)	Oxidation-Reduction Potential (millivolts)
NM422	12/01/98	20	5.8	6.3	0.087	0	3	273
NM441	12/03/98	11.55	8.7	6.14	0.222	0	7	559.1
NM441	12/03/98	17.35	8.4	6.16	0.251	0	12	255.2
NM441	12/03/98	51.47	8.1	6.14	0.258	0.01	44	255.4
NM441	12/09/98	17.8	8.6	5.43	0.095	0	242	258.1
NM442	12/03/98	9.03	8.7	5.05	0.677	0.02	0	257.7
NM442	12/03/98	15.03	8.2	5.1	0.688	0.02	0	265
NM442	12/03/98	38.92	8.9	5.02	0.727	0.03	0	268
NM442	12/09/98	16	8.9	5.24	0.0485	0.01	0	267
NM459	12/02/98	6.4	6.7	7.09	0.248	0	-4	284
NM459	12/02/98	12.4	6.8	7.09	0.247	0	-5	263
NM459	12/02/98	27.8	7.4	7.2	0.293	0.01	2	263
NM459	12/09/98	NR	6.5	7.27	0.29	0.01	0	347
NM460	12/02/98	2	6.6	7.48	0.385	0.01	1	149
NM460	12/02/98	8	6.3	7.49	0.38	0.01	0	161.3
NM460	12/02/98	31	6.5	7.52	0.381	0.01	1	227.6

Notes:
Water quality parameters could not be measured at location NM444 because of insufficient sample volume.
µS/cm - microsiemen per centimeter
NR - not recorded
NTU - nephelometric turbidity unit
pph - part per hundred

Table 2.2-3
Water Chemistry Parameters in 1998 Wells in Ninemile Creek Watershed

Location ID	Sampling Date	Depth (feet below top of casing)	Chloride (µg/L)	Sulfates (µg/L)	Sulfides (µg/L)
NM422	12/01/98	16	238	19,500	200 U
NM441	12/03/98	12	4,000	57,000	1,000 U
NM441	12/03/98	18	3,000	58,000	1,000 U
NM441	12/09/98	18	3,500	25,500	200 U
NM441	12/03/98	43	4,000	74,000	1,000 U
NM442	12/03/98	9	10,000	260,000	1,000 U
NM442	12/03/98	15	9,000	290,000	1,000 U
NM442	12/09/98	16	5,810	180,000	200 U
NM442	12/03/98	32	9,000	310,000	1,000 U
NM444	12/01/98	78	662	488,000	200 U
NM459	12/02/98	6.4	670	23,500	698
NM459	12/02/98	12.4	677	25,000	200 U
NM459	12/09/98	13	619	21,800	200 U
NM460	12/02/98	2	8,550	18,800	200 U
NM460	12/02/98	8	10,000	19,100	200 U
NM460	12/02/98	31	13,600	20,200	200 U

Note:
U - not detected

Table 2.3.1-1
Summary of Discharge Data From Project Database

Segment Name	Site Location		Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
NmSeg01	NM	289	MFG, URS	4	05/16/91	05/14/98	0.2	18.1	cfs
NmSeg01	NM	290	URS	2	11/13/97	05/14/98	0	0.38	cfs
NmSeg02	NM	8	MFG	2	05/16/91	10/04/91	2.2	33.5	cfs
NmSeg02	NM	100	USGS	1	05/23/99	05/23/99	38	38	cfs
NmSeg02	NM	291	IDEQ, MFG, URS, USGS	44	05/16/91	11/15/98	0.0422	69.3519	cfs
NmSeg02	NM	292	URS	3	11/13/97	11/15/98	0.095	4.22	cfs
NmSeg02	NM	293	IDEQ, MFG, URS, USGS	33	05/16/91	11/15/98	1.24	70.78	cfs
NmSeg02	NM	294	URS	3	11/13/97	11/15/98	0.027	0.137	cfs
NmSeg02	NM	295	IDEQ, MFG, URS, USGS	27	05/16/91	11/15/98	1.93	87.9794	cfs
NmSeg02	NM	296	IDEQ, MFG, URS, USGS	61	05/16/91	12/06/98	1.48	67.657	cfs
NmSeg02	NM	297	MFG, URS	4	10/04/91	12/06/98	2.2	31.8	cfs
NmSeg02	NM	298	IDEQ, URS, USGS	54	10/27/93	09/01/99	1.9	55.6	cfs
NmSeg02	NM	412	URS	1	11/15/98	11/15/98	2.51	2.51	cfs
NmSeg02	NM	435	URS	2	11/15/98	11/16/98	1.886	2.42	cfs
NmSeg02	NM	440	URS	1	12/06/98	12/06/98	2.93	2.93	cfs
NmSeg03	NM	299	MFG, URS	4	05/16/91	05/14/98	0.43	3.8	cfs
NmSeg04	NM	13	MFG	1	10/04/91	10/04/91	3.37	3.37	cfs
NmSeg04	NM	300	URS, USGS	3	11/11/97	05/23/99	0.906	5.6	cfs
NmSeg04	NM	301	MFG, URS	4	05/16/91	05/15/98	2.32	39.2	cfs
NmSeg04	NM	302	URS	3	11/11/97	12/06/98	0.53	2.19	cfs
NmSeg04	NM	303	IDEQ, MFG, URS, USGS	47	05/16/91	05/14/98	2.24	62.71	cfs
NmSeg04	NM	304	URS	2	11/11/97	05/15/98	6.97	32.3	cfs
NmSeg04	NM	305	IDEQ, MFG, URS, USGS	103	05/15/91	09/01/99	3.2	123	cfs
NmSeg04	NM	443	URS	1	12/06/98	12/06/98	6.34	6.34	cfs
NmSeg04	NM	448	URS	1	12/06/98	12/06/98	6.46	6.46	cfs
NmSeg04	NM	458	URS	1	12/06/98	12/06/98	10.21	10.21	cfs

Notes:
IDEQ - Idaho Division of Environmental Quality
MFG - McCulley, Frick & Gilman, Inc.

Table 2.3.2-1
Estimated Recurrence Intervals, Ninemile Creek
Based on Placer Creek Annual Peak Discharge

Recurrence Interval (Years)	Estimate of Discharge Annual Peak Flow (cfs) 30 Year Period of Record	Lower 95 Percent Confidence Interval (cfs)	Upper 95 Percent Confidence Interval (cfs)
2	162	132	202
5	285	233	378
10	391	303	540
25	536	404	799
50	663	487	1036
100	799	571	1313

Table 2.3.2-2
Precipitation Summary and Discharge Comparison for Ninemile Creek Water Year 1999
Wallace Woodland Park, Idaho
NOAA Cooperative Station 109498

Climate Indicators	Monthly Totals												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Total Precipitation (in.)	1.2	9.7	6.9	4.7	6.9	3.5	0.7	0.9	1.8	0.2	3.0	0.3	39.8
Total Snowfall (in.)	0.0	6.3	8.7	18.9	26.4	21.3	0.6	0.0	0.0	0.0	0.0	0.0	82.2
Average Precipitation for Period of Record (in)	2.9	4.9	5.2	5.0	3.9	3.4	2.8	2.7	2.6	1.3	1.4	1.9	37.7
Average Snowfall for Period of Record (in)	0.5	8.3	22.6	24.0	15.0	10.5	2.5	0.3	0.0	0.0	0.0	0.0	83.7
Mean Monthly Discharge (cfs)	3.6	5.3	7.5	10.1	9.9	35.0	41.7	46.9	39.6	13.8	7.2	3.6	18.7

3.0 SEDIMENT TRANSPORT PROCESSES

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movements incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the size and quantity of sediment, stream energy, and discharge.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing provides exposed soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increase runoff rates and provide additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. For purposes of this report, sediment yield will be referred to in units of tons per square mile per year. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling, sliding, or bouncing on the channel bed (Dunne and Leopold 1978).

All sediment motion downstream is dictated by the shear and gravitational forces acting at a given time and place within the channel. For sediment transport purposes, gravitational forces are essentially constant. Shear forces, however, are dynamic through space and time and are dependent upon the location, depth of water, and slope of the water surface. Sediment transport occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et al. 1992).

Sediment derived in Ninemile Creek is transported through the system and into the South Fork. Sediment sources in Ninemile Creek are rock debris situated adjacent to channels, channel bed sediment, bank erosion, and road drainage. Based on U.S. Geological Survey (USGS) sediment transport and stream discharge data, approximately 500 tons of sediment were transported out of Ninemile Creek in water year 1999. Based on estimates of historical stream and sediment discharge, this was below average for the period 1990 to 1999. This reduction may have resulted from the removal of material from the channel and over banks by the EPA, SVNRT, IDEQ, and Hecla. In this discussion, the available information, analyses, and likely sediment sources are identified.

3.1 AVAILABLE INFORMATION

One year of sediment transport gaging data is available for Ninemile Creek. The USGS installed a stream gaging station (Ninemile Creek above Mouth at Wallace, ID number 12413130) which began reporting hydrologic data for water year 1999 (October 1, 1998 through September 30, 1999) (USGS 2000a). Associated with this gage, the USGS established suspended load and bedload sampling locations (USGS 2000b). To date, data from seven suspended load and six bedload sampling events were available from three storm events. The suspended load data were further divided into sand and silt fractions. The suspended load and bedload sampling events were completed over a range of stream discharges to establish a rating curve relating sediment discharge to stream discharge. In addition, sampling was completed on both the rising and falling limbs of high water events to examine the transport during these differing conditions. Instantaneous stream discharge was recorded at the time of sampling for use in rating curve development.

Mean daily discharge estimates prior to 1999 have been calculated as outlined in Section 2.3. These estimates were developed based on relationships between the discharge patterns in Ninemile Creek as compared to Placer Creek for which discharge data prior to 1999 has also been collected.

In addition to the gaging data, historical and current aerial photographs are available. For Ninemile Creek, 1998 photographs by URS Greiner, Inc. (URSG and CH2M HILL 1999), 1991 photographs by U.S. Department of Agriculture (USDA) (USDA 1991), and 1984 photographs by USDA (USDA 1984) were reviewed.

3.2 ANALYSES

3.2.1 USGS Sediment Gaging Data

The USGS sediment transport data were analyzed in general accordance with the U.S. Army Corps of Engineers (USACE) guidance manual for sedimentation investigations (USACE 1989). Sediment rating curves were developed by relating measured stream discharge to measured sediment discharge. These curves integrated with the stream discharge for water year 1999, and estimates of historical stream discharge, produced estimates of annual sediment yield for Ninemile Creek. These sediment transport data were further examined to delineate threshold discharges where different particle size classes become mobile.

The USGS sediment discharge station on Ninemile Creek is located near the confluence with the South Fork Coeur d'Alene River, near the downstream end of NMSeg04. As such, these data represent the sediment yield for the entire Ninemile Creek Watershed. Along Ninemile Creek, small sediment traps were observed. These could act to modify sediment transport in the creek.

The suspended sediment data are presented in Figure 3.2-1 with rating curves established for the sand and fine fractions. The stream discharge presented is the instantaneous discharge noted at the time of sampling. The regression used to establish the curves is a power function that calculates the least squares fit through the points. The total curve is simply the sum of the fines and sand fractions. The grain size break between sand and fines is 63 microns.

The relationships indicated on Figure 3.2-1 were integrated with the mean daily discharge data from USGS station 12413130, Ninemile Creek at Wallace, to obtain mean daily suspended sediment discharge for water year 1999. Like the original data, sand, fines, and total fractions were calculated separately. Cumulative sediment discharge for water year 1999 year was calculated by summing the mean daily discharges. The results are presented in Figures 3.2-2 through 3.2-4. With a drainage area of approximately 11.6 square miles, the total suspended sediment yield for Ninemile Creek for water year 1999 was approximately 25 tons per year per square mile. Of that, approximately 11 tons per year per square mile were sand and 14 tons per year per square mile were fines.

A similar analysis was completed for the bedload sediment data. The USGS provisional report, titled "Sediment Transport in the Coeur d'Alene River Basin of Northern Idaho" (USGS 2000c), presents the rating curves and regression relationship for bedload transport in Ninemile Creek. As with the suspended sediment data, the regression relationship for bedload was integrated with the mean daily discharge hydrograph to obtain daily and cumulative bedload discharge for water year 1999. These results are presented in Figure 3.2-5. Annual bedload sediment yield was approximately 9 tons per year per square mile for Ninemile Creek in water year 1999.

Summing the total suspended load and bedload sediment gives a total sediment yield for Ninemile Creek for water year 1999 of approximately 34 tons per square mile, for a total of approximately 400 tons. Water year 1999 appears to be typical, from a water and snow budget perspective, as discussed in Section 2.3; however, sediment yields can vary significantly from year to year based on hydrologic conditions, sediment inputs, changing land use, and other conditions.

As indicated by the USGS data, the majority of sediment transport occurs during high flow events. Much larger events are likely in Ninemile Creek than were observed during water year 1999. During these larger events, increased sediment load should be expected.

Review of Figures 3.2-2 through 3.2-5 indicates the majority of sediment transport occurred during three distinct periods with approximate dates March 21 to 30, April 18 to May 3, and May 20 to June 26, 1999. High temperatures, rainfall, and snowmelt caused large stream discharge during these periods, which is discussed in Section 2.3. These high stream discharges mobilized and transported the vast majority of the sediment yield for water year 1999. Similar high sediment transport rates would be expected on an annual basis as snowmelt in the upper watershed mobilizes and transports sediment through the system.

To estimate sediment transport in years before water year 1999, the estimates of discharge based on Placer Creek, described in Section 2.3, were integrated with the sediment transport relationships developed for Ninemile Creek in 1999. The results are presented in Table 3.2-1. These estimates are probably high because the discharge estimates for Ninemile Creek from Placer Creek provided in Section 2.3 overestimate discharge by 45 percent for the peak discharge measured in water year 1999. In addition, extrapolation of the rating curves to stream discharges greater than discharges that were used to develop the rating curve needed to be employed. Nevertheless, a wide range of sediment transport quantities is indicated. In this type of analysis the quantities of sediment transported is directly correlated to the magnitude and duration of stream discharge. Years with high peak discharge and long duration will produce more sediment than years with low discharge and short duration. This information is presented in Figures 3.2-6 through 3.2-8. These figures present estimates of cumulative sediment transport (for fines, sand and bedload, respectively) through time for water years from 1980 to 1999. A wide range of magnitudes of sediment transport are estimated and in general most of the transport occurs between February and June during large stream discharges.

During the 1993 and 1994 construction seasons, approximately 150,000 cubic yards of sediment were removed from the channel and overbank areas adjacent to Ninemile Creek. In addition, rock groynes and other roughness elements have been constructed to provide energy dissipation and sediment trapping functions. These activities have likely reduced the quantity of sediment transport. Roughness in channels reduces the available energy of a stream to move sediment, and sediment traps can reduce the available material from transport. Sediment transport during construction may have been temporarily increased because of equipment in the water. It is expected that this presumed increase was small because construction activities would be limited to periods of the year when low water discharge occurs, and the time which equipment would be used in the water was relatively short.

To identify stream discharge rates at which different size fractions of sediments are mobilized, USGS data for calculated daily sediment discharge for bedload (gravel sized particles based on USGS grain size curves), sand and fines were further examined. For each sediment size class and estimate of daily sediment discharge, the percent of the mass of total annual sediment for that size class that was transported by a specific stream discharge (or greater) was calculated. This percentage verses stream discharge for each sediment size class is presented in Figure 3.2-9.

As indicated from Figure 3.2-9, a stream discharge rate at which 10 percent of the total annual sediment discharge occurs for sand and fines occurs between approximately 35 and 40 cubic feet per second (cfs). A stream discharge rate at which 10 percent of the total annual bedload discharge is approximately 70 cfs. Although this analysis is based on few measurements of sediment concentration, it provides guidance to discrete discharges when increased sediment discharge might be expected.

3.2.2 Channel Classification

Channel classifications may provide a level of understanding and description of a channel behavior. Some channel classification systems require fieldwork and in depth study while others only require topographic map and aerial photograph interpretation. The level of information provided by a classification based solely on topographic map and aerial photograph interpretation is limited but does provide a basic framework for channel processes and conditions.

Rosgen (Rosgen and Silvey 1996) proposed a classification that delineates channel types based on plan-view morphology, cross-section morphology, channel sinuosity, channel slope, and bed features to provide a broad level delineation. Aerial photograph and topographic map interpretation can be used for this type of classification, Level 1. The Rosgen methodology builds from this broad classification when combined with more detailed information. The Rosgen Level 1 classification was used for this study to identify broad reach-level channel morphologies.

Electronic USGS 7 ½ minute quadrangle maps containing three dimensional topographic data were analyzed using AutoCAD Land development software. Topographic information and channel classifications are shown in Figures 3.2-10 through 3.2-13. Plots of channel profile and slope were produced for each segment of Ninemile Creek, Figures 3.2-14 to 3.2-17. In general, the divisions between segments were established based on changes in channel type or other morphologic feature, as such, each segment contains one or two channel types. The channel type was determined based on channel slope and review of aerial photographs from 1998. Further description of the aerial photographs, current and historical, is contained in a separate section.

Channel stationing was established from the confluence of Ninemile Creek with the South Fork as 100 foot stations upstream from mouth for ease of locating specific features. This stationing is indicated on Figures 3.2-10 through 3.2-17. This stationing is approximate and is intended for general locating of discussed areas, more detailed stationing and survey should be used for precise locating and project construction.

In the Ninemile Creek watershed, three Rosgen stream types occur, Aa+, A, and B. The following paragraphs briefly summarize these three types of channels and the mapping effort of channel classification.

Aa+ streams are very steep gradient, greater than 10 percent, well entrenched, and laterally confined. Sediment supply is often high due to the high energy, steep channel slopes and narrow channel cross sections. Bedforms associated with this channel type include waterfalls, cascades, and step-pools. Debris flows often initiate in Aa+ type channels. In Ninemile Creek, structural control from joints, faults, or bedding may influence the locations of "Aa+" type channels.

"A" stream types are similar to "Aa+" in that similar bedforms and channel characteristics are common to both types; however, "A" stream types have slopes which range from 4 to 10 percent. Generally, "A" stream types have high sediment transport potential with little in-channel sediment storage capacity due to the channel slope. Large woody debris can play a major role in the bedform and channel stability in "A" type streams.

"B" stream types are moderately steep to gently sloped channels, gradients from 2 to 4 percent. Faults, joints, and contacts often influence "B" type channels by restricting the development of wide floodplains. Stream erosion rates, aggregation and degradation rates are generally low. Lateral movement of "B" type channels is typically low. Rapids and scour pools are typical bedforms in type "B" channels.

The channel types within Ninemile Creek are identified on the topographic maps, Figures 3.2-10 through 3.2-13. The steep upper channels in NMSeg01 and NMSeg03 contain Aa+ channel types. The lower portion of NMSeg01 and all of NMSeg02 contain A channels. NMSeg04 contains type Aa+, A and B channels. Based on this classification and the generalizations stated above, areas which have the highest potential for sediment (and metals) entrainment into the surface water are the A and Aa+ stream types in NMSeg01, NMSeg02, and NMSeg03. The B type channel in NMSeg04 is likely to respond as a transport reach and not contribute as much sediment to the system as the A and Aa+ channels. Of course, all of the channels have the potential to contribute sediment and this level of review is intended to a provide broad overview of potential sediment sources.

IDEQ developed Rosgen classifications for three reaches in the Ninemile Creek watershed, all approximately 100 meters in length, under the BURP project (see Figures 3.2-10, 3.2-11, 3.2-13 to 3.2-15). These reaches were selected to be representative of general conditions in that area of the watershed. All three reaches were classified as Rosgen type A in the BURP studies, which agrees with the classifications presented here (IDEQ 1998, 1999). Both classifications are preliminary in nature and are presented here for baseline characterization purposes only. They are not intended for use in the design phase of remediation planning. Detailed, site specific hydrologic studies may be needed to guide actual remedial design development.

3.2.3 Channel Descriptions

The 1998 set of aerial photographs by URS Greiner, Inc., and CH2M HILL, the 1991 and 1984 set by USDA, and the topographic maps and profiles presented in Figures 3.2-10 through 3.2-17 were reviewed to further describe Ninemile Creek. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system. The following paragraphs provide further description.

3.2.3.1 NMSeg01 (Interstate Mine to Headwaters)

NMSeg01 has approximately 5,700 linear feet (1.1 miles) of mapped channel as indicated on Figure 3.2-10. The slope of the channel ranges from 10 to 19 percent and the profile appears relatively uniform, Figure 3.2-14. The photographic coverage of NMSeg01 was limited, the 1998 photographic set covered to station 360+00. The valley bottom is vegetated with conifers that obscure view of the channel. Little disturbance was observed in the limited review, except from approximate station 340+50 to 344+00 where unstructured piles of rocky debris has been placed. The high slope of this reach provides very efficient transport of sediment supplied to the stream. Likely sources of sediment other than the rocky debris are mobilization of channel bed sediment, minor bank erosion and sediment from road drainage.

3.2.3.2 NMSeg02 (East Fork Ninemile Creek from Confluence to Interstate Mine)

NMSeg02 has approximately 17,500 linear feet (3.3 miles) of mapped channel as indicated on Figure 3.2-11. The slope of the east fork in this segment range from about 5.5 to 13.5 percent and the profile appears to be relatively uniform, Figure 3.2-15. The channel form in NMSeg02 varies from a meandering braided channel to confined and channelized. Rockfalls, rock debris piles, mobilization of the channel bed material, lateral migration, and road drainage are all

sediment sources in NMSeg02. Of the four segments in the Ninemile Creek watershed, NMSeg02 appears to contain the majority of sediment sources.

From the confluence with the mainstem, station 165+00, to approximate station 179+00 the channel has approximate slope of 5 to 7.5 percent and flows through fluvial sediments from the east fork. The photographs indicate that the channel has migrated laterally in a braided pattern through time. Essentially no vegetation is visible growing on the fluvial deposits in the three years of photographs reviewed. This reach appears to be depositional overall; however, mobilization of sediment likely occurs when the channel migrates. Likely sediment sources in this reach are the mobilization of fluvial deposits.

From station 179+00 to 210+00 the channel has approximate slope of 5 to 11 percent and the valley is about 100 feet wide. Little or no vegetation is visible in the valley bottom in any of the photographs reviewed. The channel has migrated laterally and is braided in the 1984 and 1991 photographs. The 1998 photographs indicate that remedial actions such as bed controls, and settling pools have been installed and the braided pattern is not as evident as in the other photographs. A rockfall on the hillslope west of the channel is apparent in all three sets of photographs reviewed. Although remedial actions have been taken, this reach has historically shown indications of lateral migration. As such, the likely sources of sediment from this reach are mobilization of the channel bed, lateral migration, and sediment derived from rockfalls.

From station 210+00 to 215+00 the channel has an approximate slope of 5 to 7 percent and is constrained against the west hillslope by structured undifferentiated rock debris apparently from the Alameda Prospect. The channel through this reach shows a braided pattern in the 1998 photographs. Likely sediment sources in this reach are mobilization of the channel bed, lateral migration, and rock debris piles.

The channel from station 215+00 to 250+00 has slope of 6 to 13 percent. The 1991 and 1984 photographs indicate a braided channel through this reach, while in the 1999 photographs the channel appears uniform and confined to a single channel. Presumably there have been actions taken to straighten and channelize this reach. From approximately station 234+00 to 246+00, a large pile of structured undifferentiated rock debris has been placed adjacent to the channel. Striations on the slip face in the 1998 photographs may indicate the pushing of loose debris over the face. A small rockfall at approximate station 247+00, northwest of the channel is shown on the 1998 photographs. The 1991 and 1984 photographs indicate a rockfall at about station 250+00 southeast of the channel, apparently beginning at an adit or shaft of the Granite Mine. Sources of sediment in this reach are likely mobilization of channel bed material, lateral channel migration, structured rock debris piles, and rockfall.

From station 250+00 to 303+00, the channel slope is approximately 4.5 to 6.5 percent and the channel is constrained in a narrow valley by a road and bedrock hillslopes. The valley bottom has become increasingly vegetated since 1984, as indicated by review of the photographs. A large mining operation, is sited on the hillslope above the channel at approximately station 270+00 to 280+00 to the northwest of the channel. Large areas of exposed soil and rock, including structured debris piles, surround the mill and workings. Water runoff from this site drains to Ninemile Creek. This drainage presumably is a sediment source to Ninemile Creek. Logging, exploration, and other dirt roads dissect the hillslope to the north of the channel through this reach. Sediment sources likely in this reach include mobilization of channel bed material, minor bank erosion, road drainage, and sediment from areas of exposed soil and rock.

From station 303+00 to 323+00, the channel slope is approximately 6 to 12 percent and the valley bottom is 100 to 200 feet wide. The 1998 photographs show a braided channel through this reach. Piles of undifferentiated rock and soil have been placed adjacent to the channel along the southeast bank. A small tributary entering the east fork at approximate station 304+00 has piles of rock and debris lining the ravine from the mouth to the mine workings on the hillslope. Although the piles of rock debris may not be in direct contact with Ninemile Creek, water runoff from these areas flow into the Creek. As such, these areas represent a potential sediment source for Ninemile Creek. Likely sediment sources in this reach are mobilization of channel bed material, lateral channel migration, rock debris piles, and road drainage.

From station 343+00 to the upstream end of NMSeg02 (approximate station 340+50) the channel has a slope of approximately 5.5 to 13 percent. The channel is constrained by bedrock hillslopes and a road. At approximately station 332+00 a tributary enters from the northwest. An unstructured pile of bare rock has been placed in the valley bottom of the tributary. At the upstream end of NMSeg02, another tributary enters from the northwest; a similar pile of rocky debris has been placed in this valley. Likely sediment sources in this reach include channel bed mobilization, minor bank erosion, road drainage, and sediment from the piles of debris from the two tributaries.

3.2.3.3 NMSeg03 (Confluence with East Fork to Headwaters)

NMSeg03 has approximately 9,500 linear feet (1.8 miles) of mapped channel, as indicated on Figure 3.2-12. The channel slope varies from about 2 percent in the lower reaches to 22 percent at the headwaters as shown on Figure 3.2-16. Man-made disruption of the stream channel appears to be minor as compared to other segments within the watershed. Likely sources of sediment include mobilization of channel bed material, minor bank erosion, and road drainage.

Sediment transport is likely very efficient in the upper reaches of the channel where the channel slope is very high.

From the confluence with the East Fork, station 165+00, to approximate station 174+00, Ninemile Creek has an approximate slope of 4.5 to 6 percent. The channel flows through fluvial deposits from the East Fork. The increased slope of this reach as compared to the channel slope upstream is probably due to the deposition of sediment at the confluence. These deposits are characteristic of an aggrading streambed within this reach. Past remedial actions taken in this reach include construction of several small pools and steps, apparently for bed control, settlement of sediment, and as a fish pond. Remobilization of the fluvial deposits is the likely source of sediment from this reach but is probably small as it appear that overall this is a depositional reach.

From station 174+00 to 225+00 the channel slope is approximately 2 to 3 percent with distinctly higher slopes at station 180+00 and 192+50, shown on Figure 3.2-16. Review of the photographs does not indicate local cascades in these areas. These locally increased slopes are likely the result of the mapping software or errors in the base map. The valley floor is approximately 100 to 150 feet wide and is moderately vegetated with conifers. Obvious signs of channel migration are not observed on the photographs with the moderate vegetation obscuring view. The Mayflower Mine is situated on the hillslope east of Ninemile Creek at approximate station 205+00. This tailings pile has become progressively more vegetated since 1984. This vegetation likely provides additional stability to the deposit. However, the deposit is located on a steep hillslope in a shallow ravine. Over time, surface water runoff through the ravine and weathering of the materials in the deposit could lessen the strength of the deposit and landsliding could occur. Current sediment sources in this reach are likely mobilization of channel bed sediment, minor bank erosion, and sediment from roads drainage.

From station 225+00 to the headwaters at station 261+50, the channel slope is 14.5 to 22 percent and is constrained by bedrock hillslopes. The 1998 photographs do not cover this area; however, the 1991 photographs show no obvious indication of channel migration or instability. Exploration drill roads criss-cross the southern hillslopes adjacent to this reach. The high slope of this reach provides very efficient transport of sediment supplied to the stream. Likely sources of sediment are mobilization of channel bed sediment, minor bank erosion and sediment from road drainage.

3.2.3.4 NMSeg04 (Mouth to East Fork Ninemile Creek)

NMSeg04 has approximately 26,000 linear feet (4.9 miles) of mapped channel as indicated on Figure 3.2-13, including one major tributary, Blackcloud Creek. The slope of the mainstem of Ninemile Creek through NMSeg04 varies from less than 1 percent to about 7 percent, as shown on Figure 3.2-17. Most of the channel length is constrained in the current position by old railroad grades, roads, bedrock hillslopes and recent channel remedial projects; however, there are reaches that show indications of lateral movement. Blackcloud Creek is a high gradient stream with slopes ranging from 4 to 29 percent. Primary sources of sediment in NMSeg04 include mobilization of channel bed material, local scour, small scale bank erosion, lateral migration, and drainage from roads.

The channel, from station 0+00 to 34+00, has a slope ranging from 2 to 7 percent. At approximately Station 34+50, the slope of the channel drops to less than 1 percent and continues with this shallow slope to approximately station 54+00. The shallow slope of the channel could be due to a channel bed control such as a bedrock outcrop in the channel bottom at approximately station 34+50 with channel aggregation upstream of the bed control or may be shown overly shallow due to errors in the map. Throughout the reach from station 0+00 to 54+00 the channel appears to be constrained in its location by bedrock valley walls, an abandoned railroad grade, and the Ninemile Creek Road. The valley floor through this reach is relatively narrow, approximately 50 to 150 feet wide. Indications of large-scale channel movements or erosion are not observed in the three sets of photographs reviewed; however localized bank erosion may occur throughout this reach. Sources of sediment in this reach are most likely from local areas of scour, small-scale bank erosion, and remobilization of channel bed sediment during high water events.

From station 54+00 to 85+00, the channel flows through a broad valley typically 200 to 350 feet wide with slope ranging from about 1.5 to 3 percent. Currently, lateral migration of the channel is constrained by a railroad grade and Ninemile Creek Road over this reach. The channel may have incised into terrace gravel as mapped by Box et al. (2000), which may also constrain the channel to the current position. Indications of large scale lateral channel movements are not observed in the photographs reviewed; however, localized bank erosion may occur throughout this reach. Sources of sediment in this reach are probably from remobilization of channel bed material and small-scale bank erosion.

From approximate station 85+00 to 141+00, the channel gradient varies from 1 to 5 percent and the valley bottom is 150 to 200 feet wide. Ninemile Creek Road crosses the creek at approximate station 141+00. Remedial measures in the 1998 photographs are particularly

apparent from approximate station 90+00 to 112+00. These measures appear to include bed control structures and high flow channel dikes and sills (narrow bands of intrusive rock). These remedial measures are not apparent in the earlier photographs. All three sets of photographs reviewed indicate the channel is braided, and shows lateral migration within the floodplain from station 112+00 to 141+00. Little vegetation exists in the floodplain throughout this reach. With wider and more active channel bed from station 112+00 to 141+00, more sediment production is likely from this reach. Bank erosion is also likely higher because the channel is not constrained. Other sources of sediment include mobilization of channel bed material and minor bank erosion.

Upstream of the Ninemile Road crossing to the upstream end of NMSeg04, station 141+00 to 165+00, the channel is constrained by a railroad grade and mine and mill workings of the Dayrock Mine. The channel slope varies from about 3 to 4 percent. All three sets of photographs indicate that the channel has been in this approximate location since 1984. Review of the three sets of photographs indicate that the exposed soil surrounding the Day Rock Mine working have become progressively more vegetated through time. Although present downstream of the Day Rock Mine, logging and other dirt roads become more abundant at the Day Rock Mine and upstream. Indeed, the hillslope above the Day Rock Mine mill site is scattered with dirt roads. Some of the roads visible in the 1984 photographs above the Day Rock Mine apparently have been abandoned as indicated by vegetation growing on the roads shown in the 1998 photographs. Nevertheless, the roads above the Day Rock Mine likely constitute a sediment source to Ninemile Creek. Other sources of sediment include channel bed material and minor bank erosion. Runoff from the exposed soils surrounding the mill site is also a probable sediment source to Ninemile Creek. The increased vegetation since, 1984, at the mill site likely has reduced the amount of sediment from this source.

At approximate station 126+00, Blackcloud Creek enters the mainstem of Ninemile Creek. Review of the photographs does not show a clear channel in the Blackcloud Valley indicating the stream may be contained in a constrained channel and culvert. Blackcloud valley is very tightly constrained by bedrock valley walls that generally follow the Blackcloud Fault. Based on Figure 3.2-17, from the mouth to station 148+00 the channel slope ranges from 4 to 10 percent. This reach of channel is vegetated with conifers that obscure the view of the channel. From approximate station 148+00 to the headwaters (station 219+10), the channel slope ranges from 6 to 29 percent and is constrained by bedrock valley walls. This reach is also heavily vegetated and the channel is obscured from view in the photographs. Numerous logging and drill exploration roads criss-cross the hillslopes adjacent to the channel. Likely sediment sources in Blackcloud Creek are mobilization of sediment from the channel bed, bank erosion and drainage from roads.

3.3 SUMMARY

Based on the information discussed above, approximately 400 tons, or 34 tons per square mile, of sediment was transported from Ninemile Creek to the South Fork Coeur d'Alene River in water year 1999. Sediment sources (including mining wastes) occur in all four segments. Based on interpretation of aerial photographs from 1984, 1991, and 1998, the majority of the sediment supplied to the creek appears to originate in NMSeg02. Large piles of rock debris and rockfall are positioned adjacent to the stream channel in this segment. The moderately steep slope and braided nature of the channel in this segment provides energy and material for effective movement of sediment. Channelization, bed controls, deposition pools, and structured debris piles have previously been used in this segment to reduce the sediment yield of the basin. These efforts have likely reduced the sediment load by some undetermined quantity. The sediment yield has also presumably been reduced through time, since the practice of discharging mining-related debris directly into the channel has been discontinued. The entire length of NMSeg02 appears to contain locations where additional stability measures could be implemented. Specifically from station 179+00 to 250+00 and 303+00 to 323+00, additional stabilization efforts and maintenance of existing stabilization measures could be completed. Surface stabilization of structured and unstructured debris piles along NMSeg02 also could be accomplished with vegetation or other techniques.

Additional areas where stabilization measures could be taken include areas where local scour, minor bank erosion, and mobilization of channel bed material occur. These areas are located throughout the watershed.

Throughout the basin a high density of logging and other dirt roads exist. Drainage from roads concentrates water and sediment discharge, particularly sand and silt. Detailed study of the road drainage and sediment discharge from these roads was not performed as part of the RI/FS.

Suspended Sediment Rating Curves, Ninemile Creek Near Wallace, Station 12413130, Total Suspended Sediment and Suspended Sediment by Sand Break, Water Year 1999

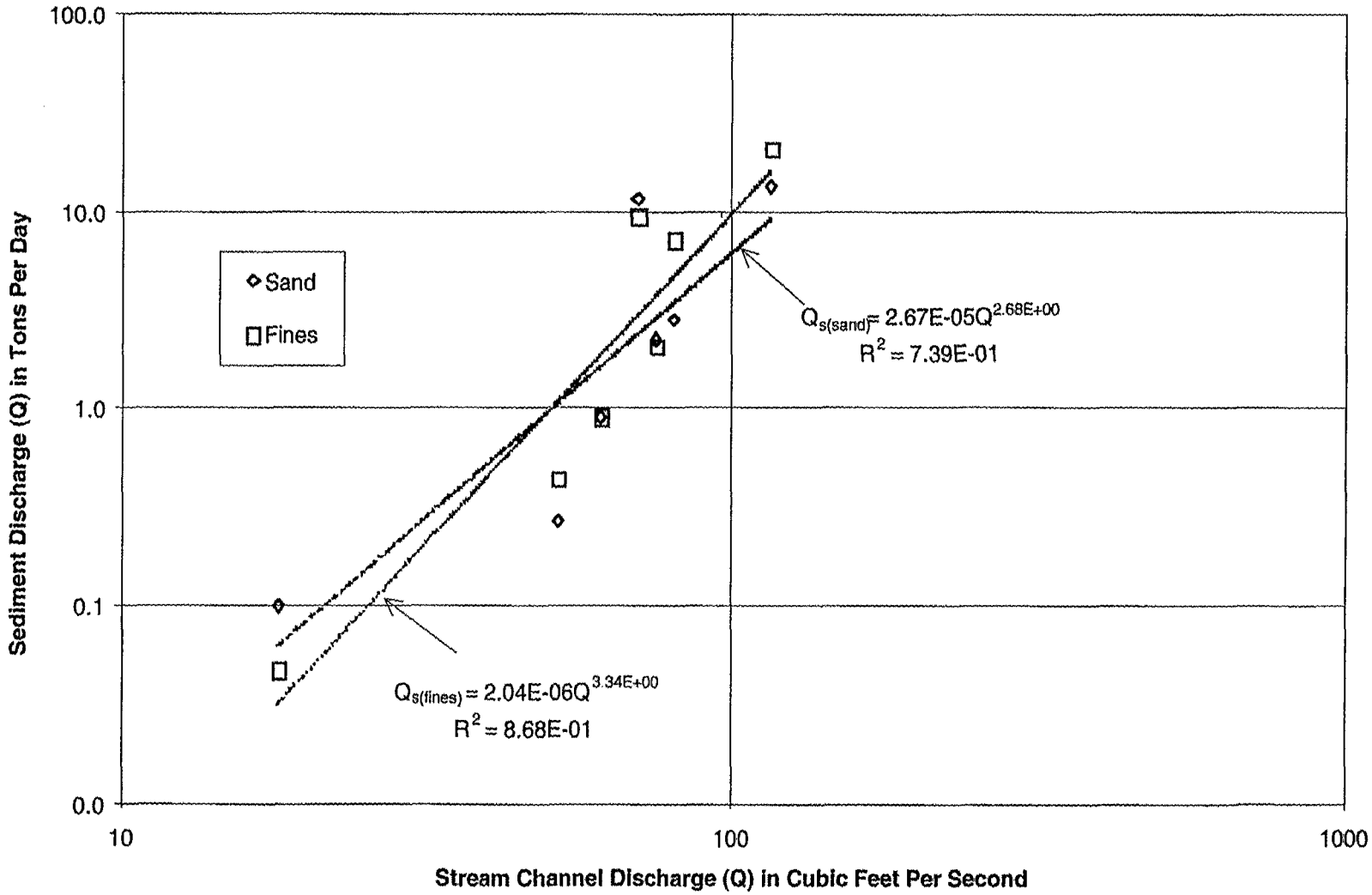


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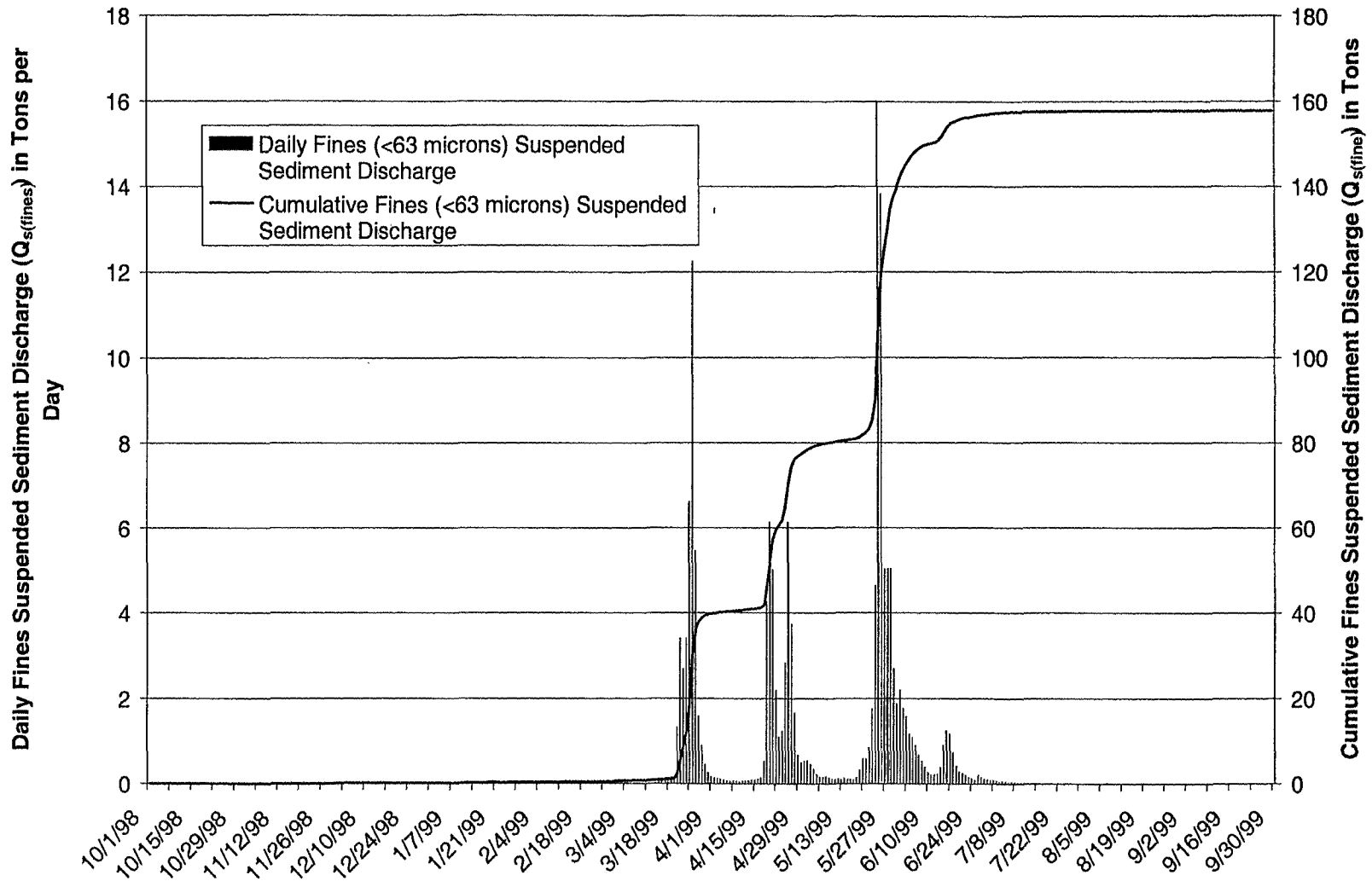
Figure 3.2-1

Fines Suspended Sediment Discharge, Ninemile Creek Near Wallace, Station 12413130, Daily and Cumulative Totals, Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 3.2-2

Sand Suspended Sediment Discharge, Ninemile Creek Near Wallace, Station 12413130

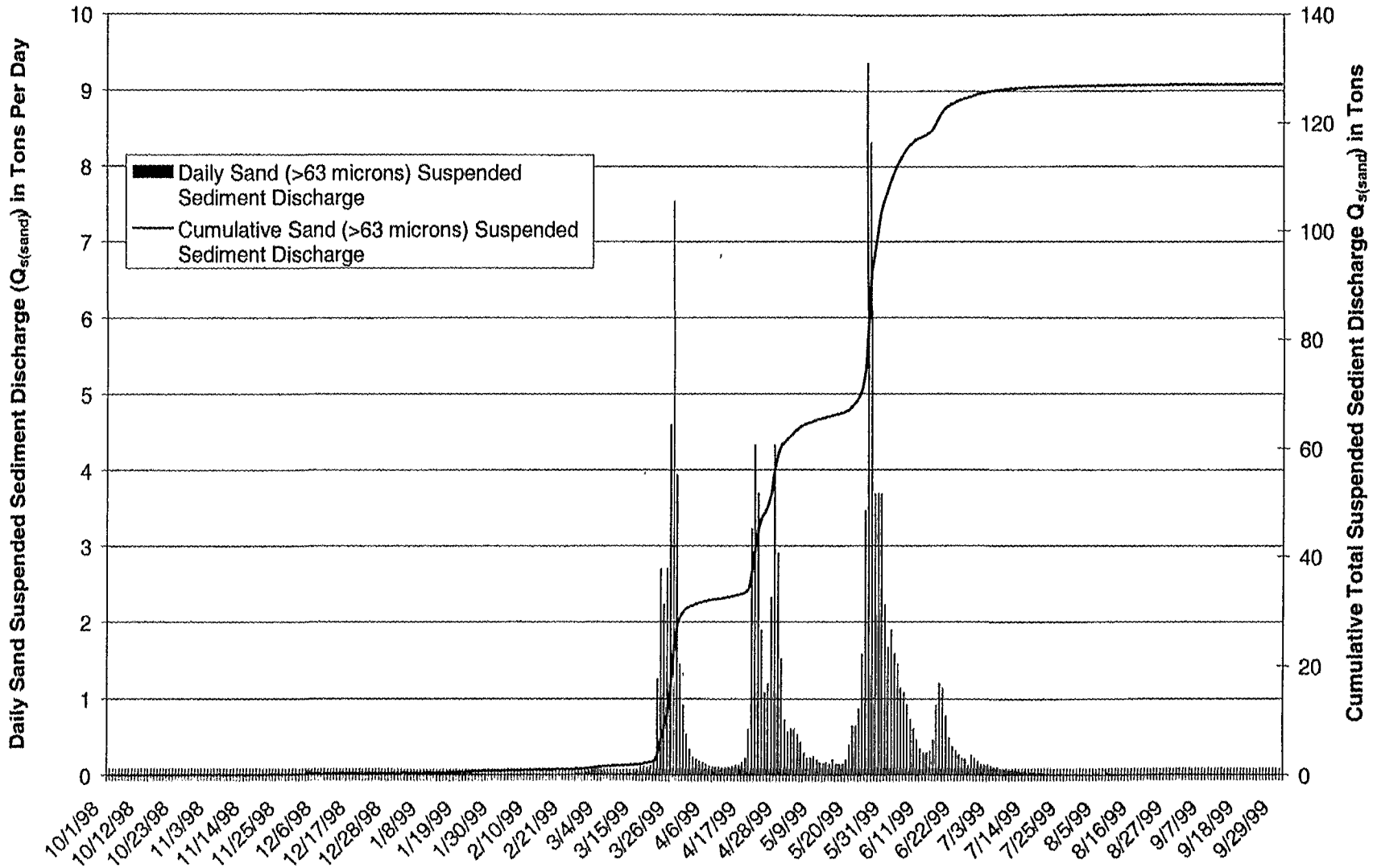


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Figure 3.2-3

Total Suspended Sediment Discharge, Ninemile Creek Near Wallace, Station 12413130, Daily and Cumulative Totals, Water Year 1999

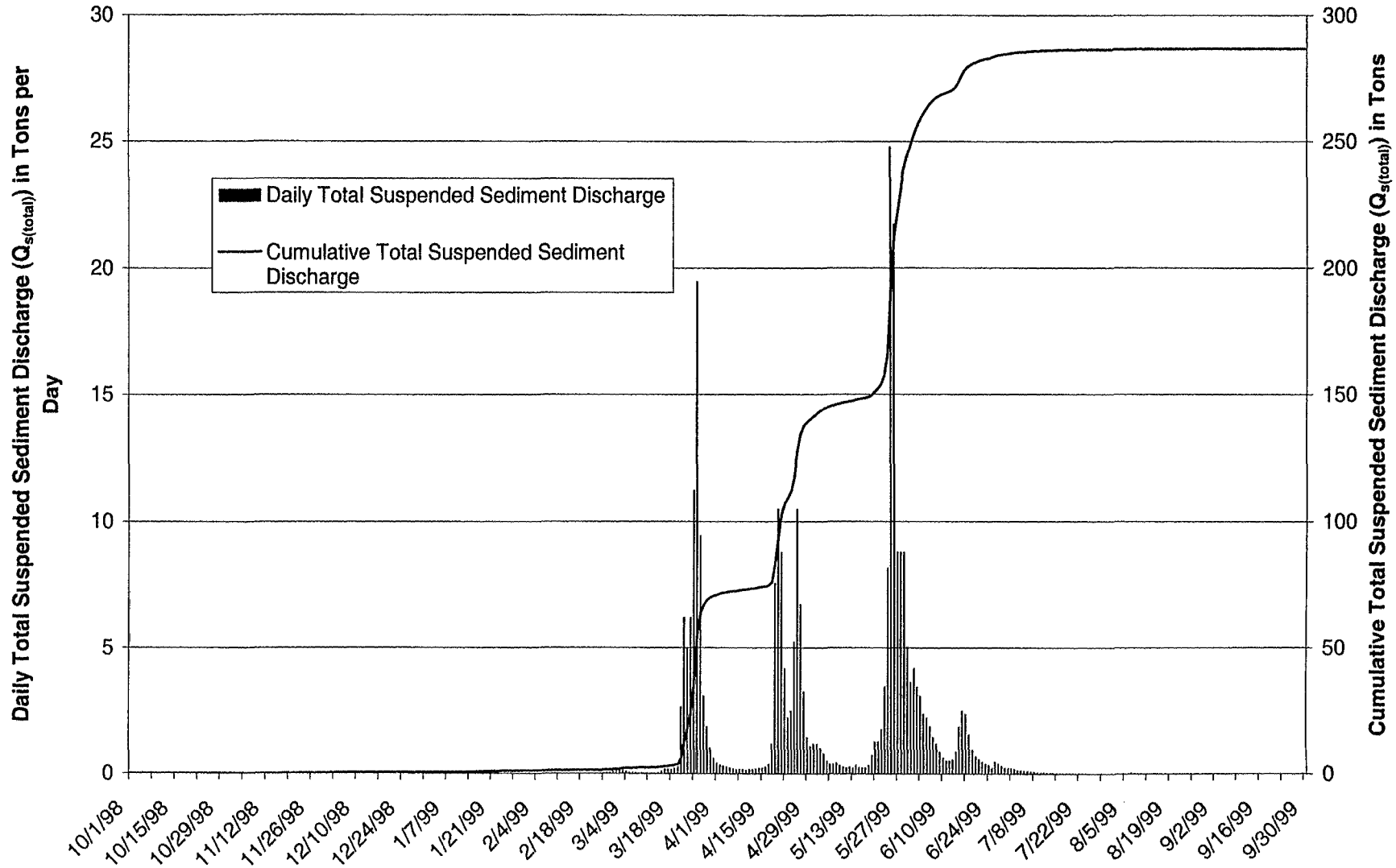

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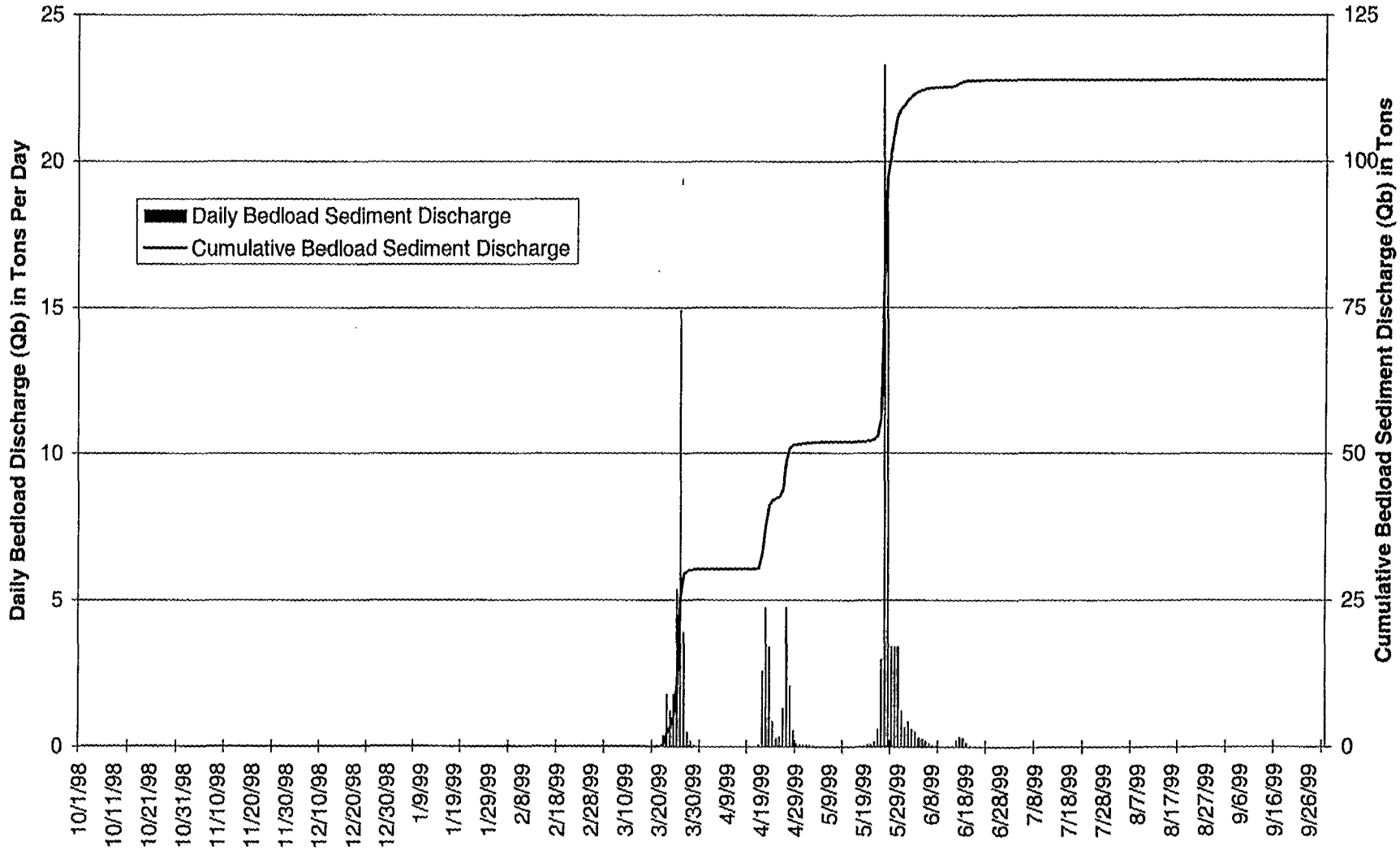
Figure 3.2-4

Bedload Sediment Discharge, Ninemile Creek Near Wallace, Station 12413130, Water Year 1999



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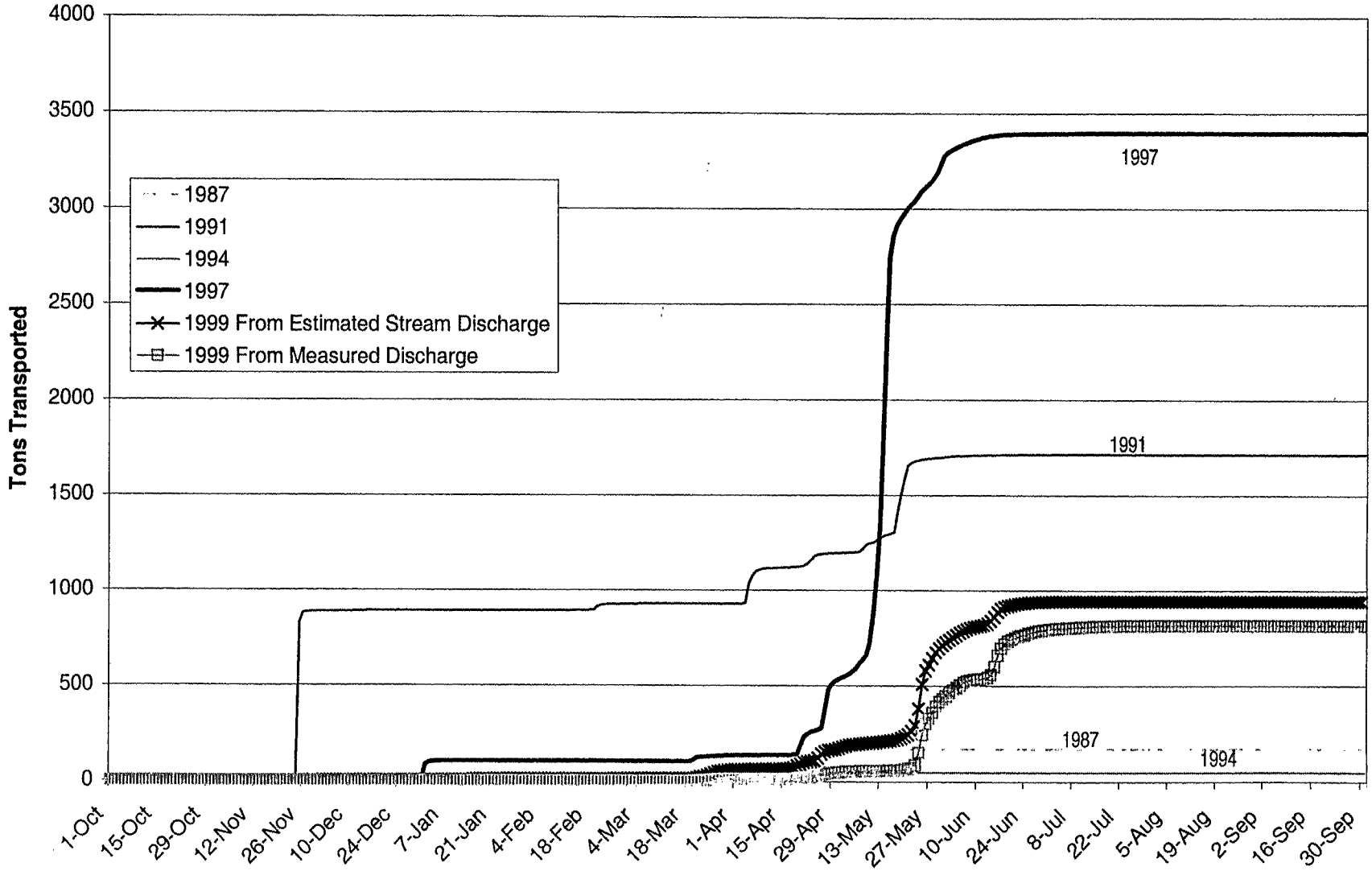
07/13/01

Figure 3.2-5

Estimated Cumulative Fines Sediment Transport Ninemile Creek



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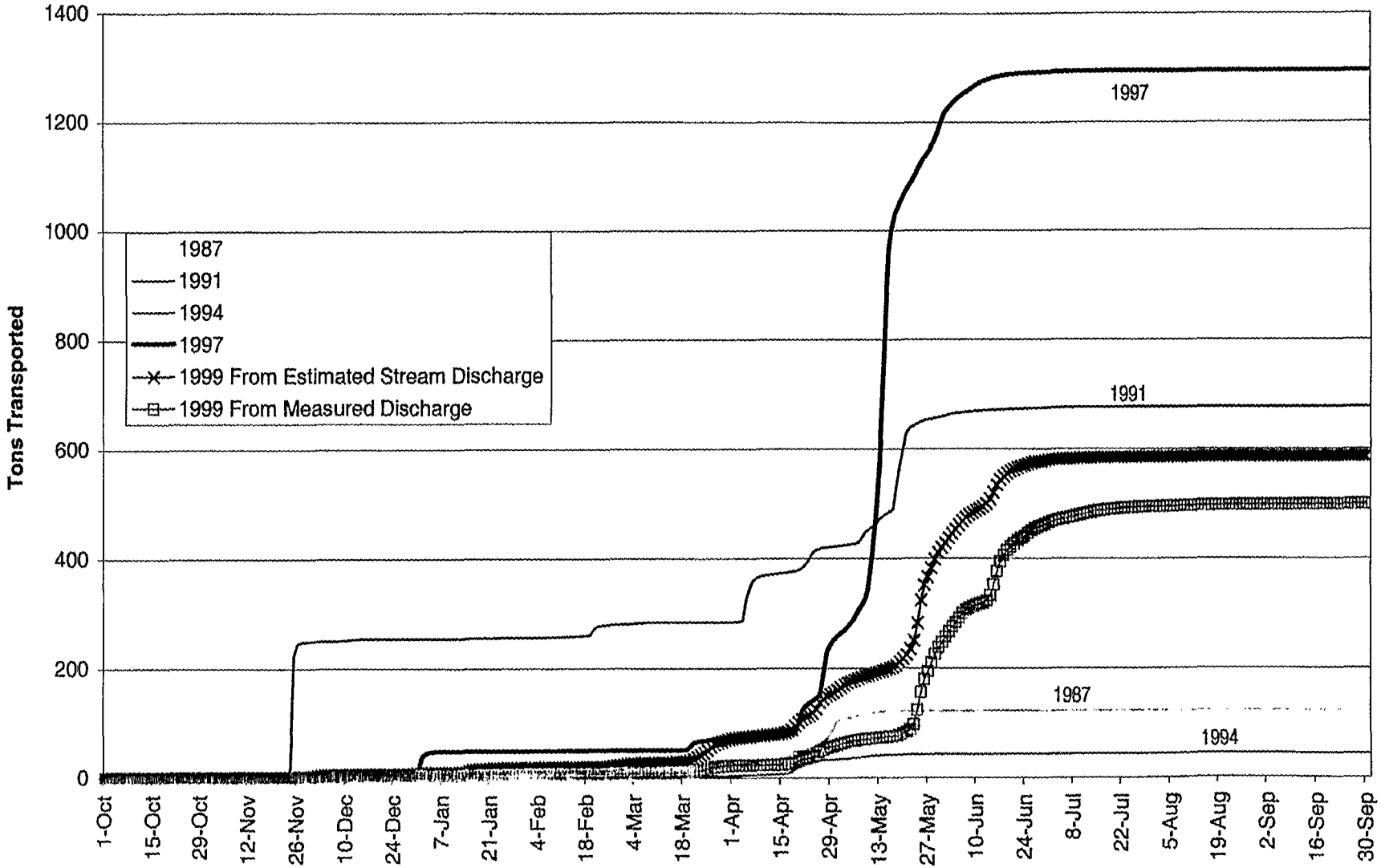
Ninemile Creek Series
07/13/01

Figure 3.2-6

Estimated Cumulative Sand Sediment Transport Ninemile Creek



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Ninemile Creek Series
07/13/01

Figure 3.2-7

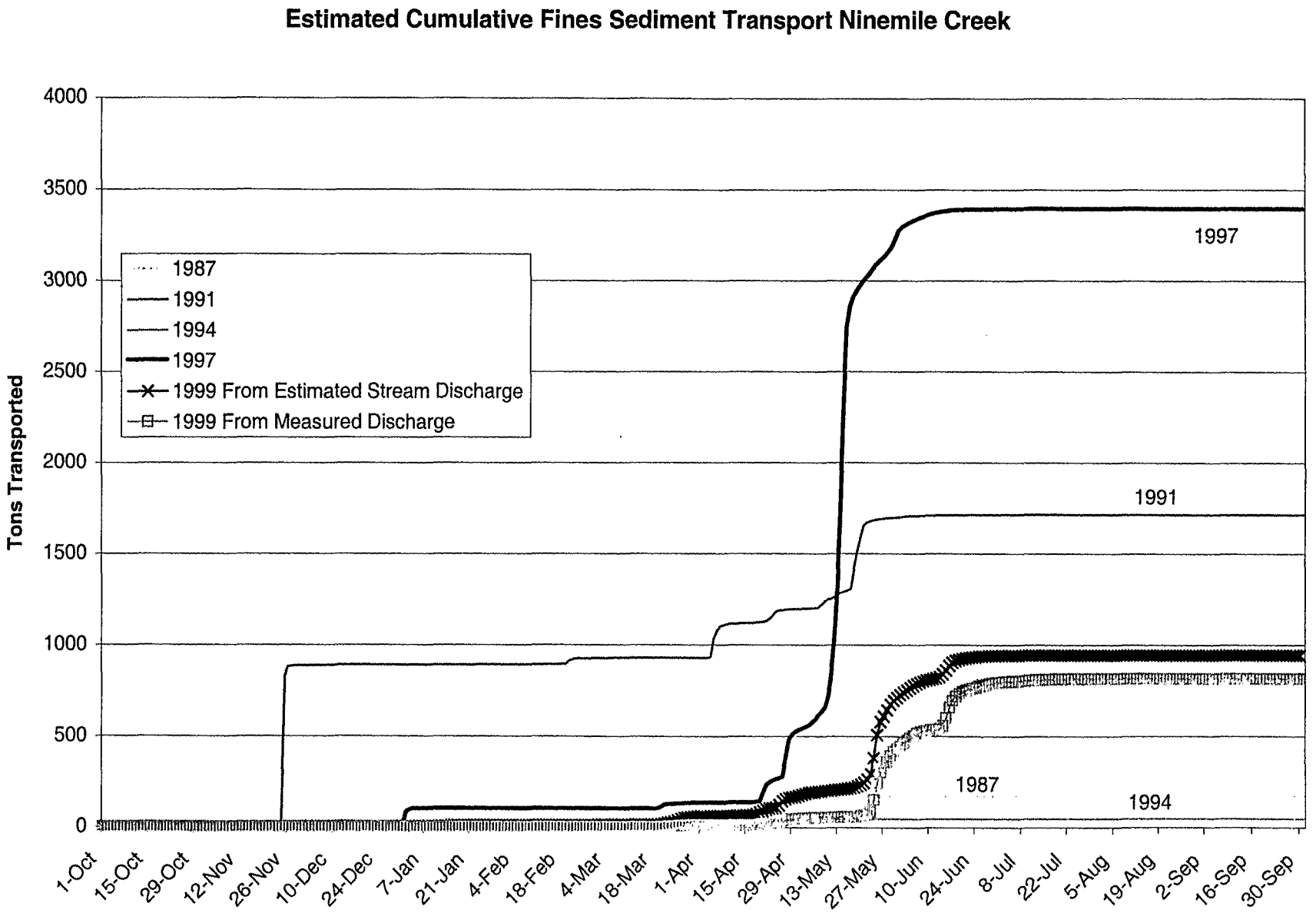

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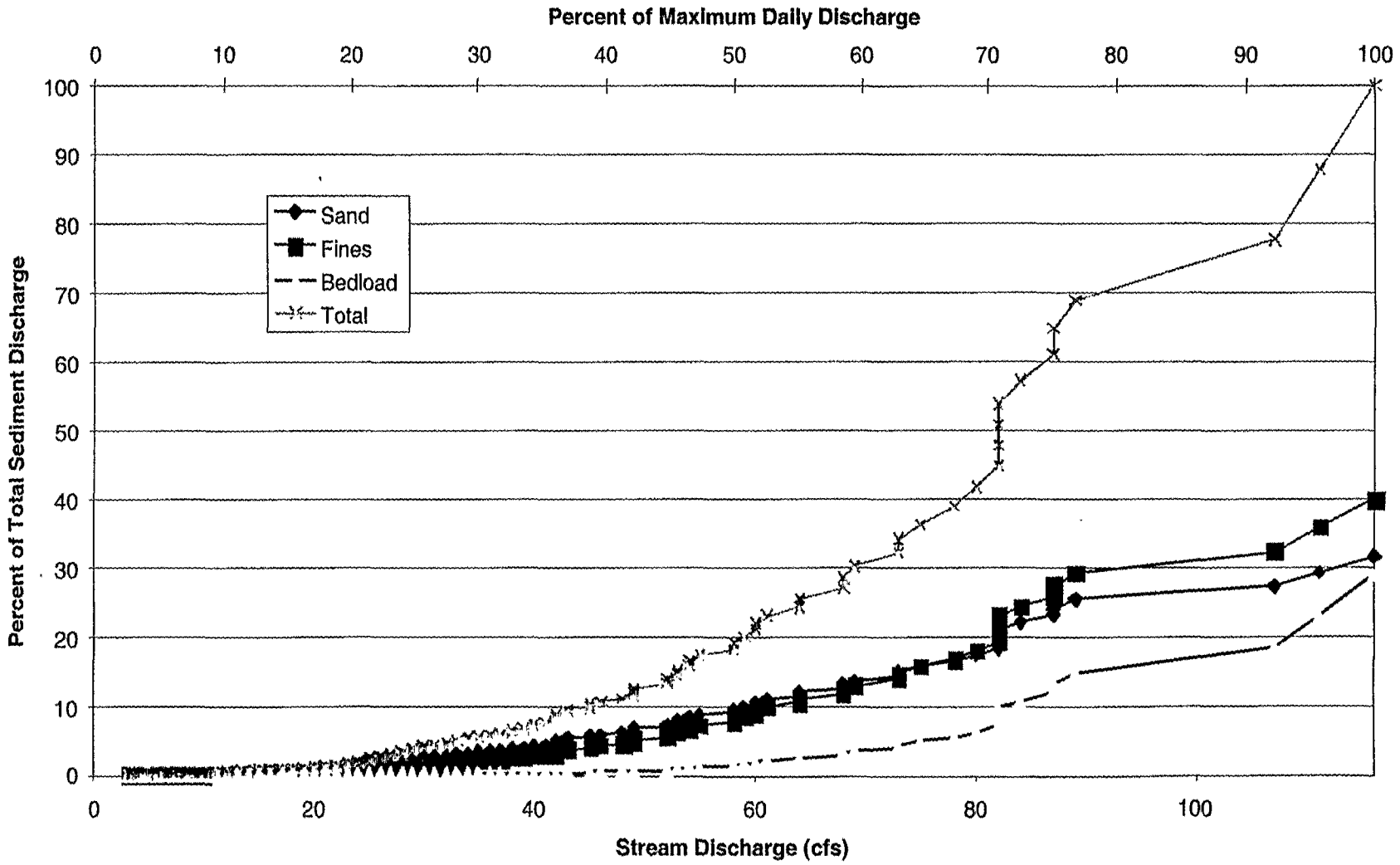
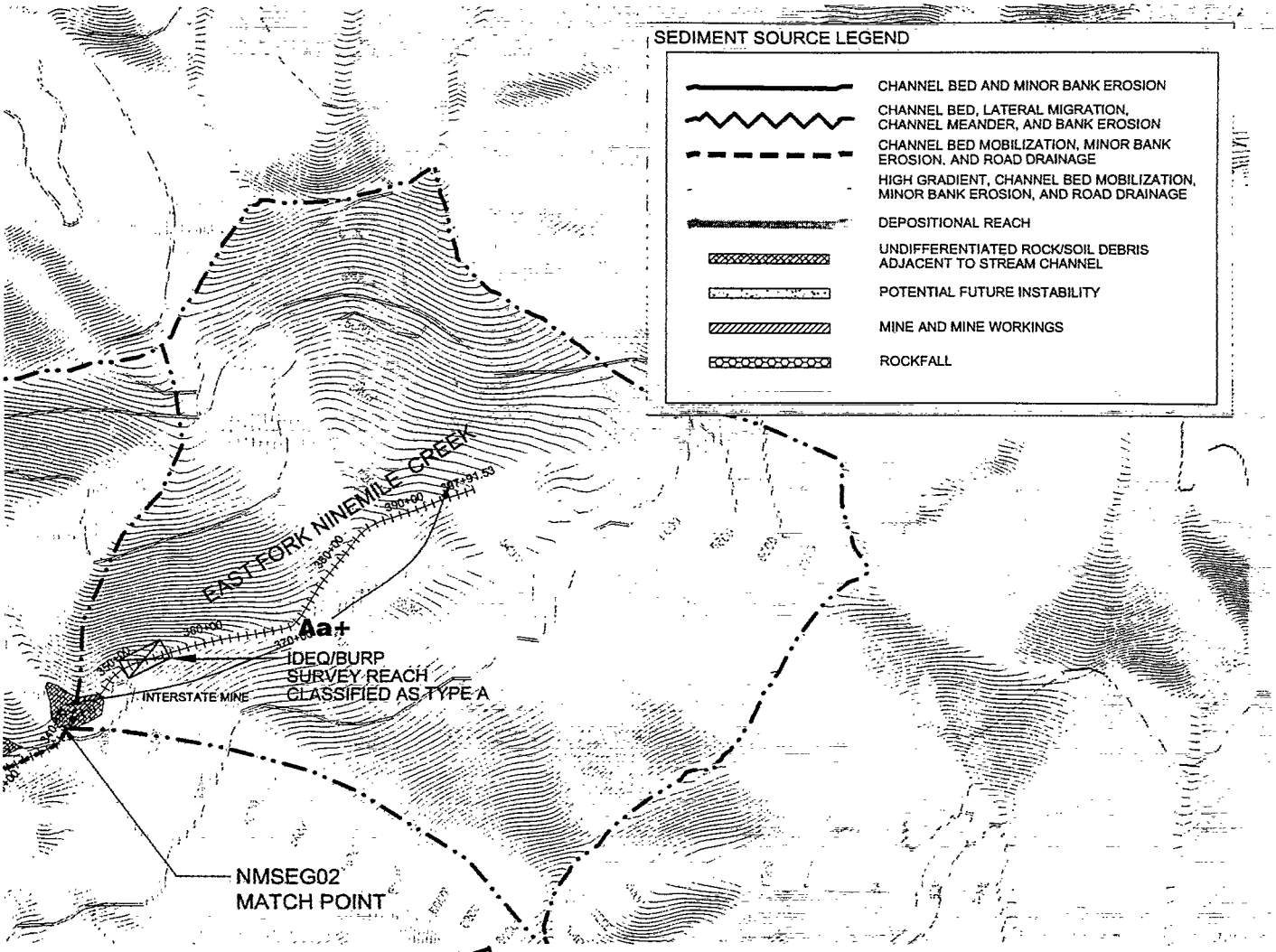
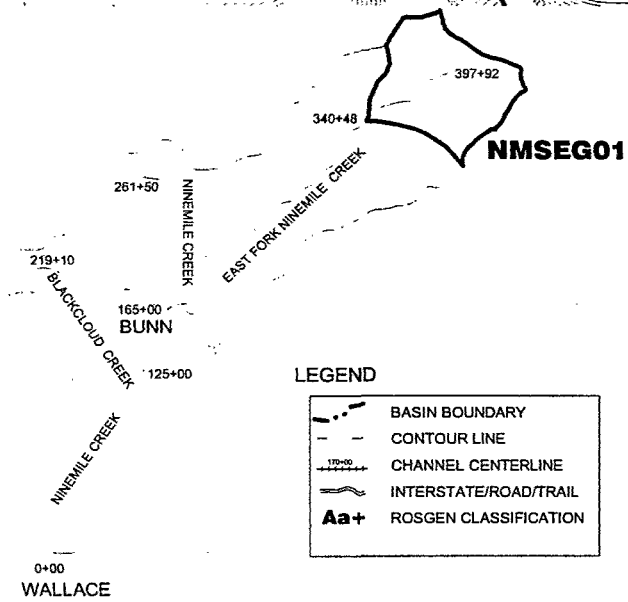
Figure 3.2-8

Ninemile Creek, Percent of Total Annual Sediment Discharge Versus Stream Discharge, Water Year 1999



EPA REGION 8	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 3.2-9





NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

N W E S

0 2000 4000
Scale in Feet

EPA REGION 10	54-50-0C2Q Coeur d'Alene Basin RI/FS RI REPORT	Doc. Control: 4162500.6615.05.a Generation: 2 Path: n:\Coverages\Others\Shannon&Wilson\Ninemile Filename: Ninemile_Site.dwg 07/18/2001	**Figure 3.2-10** **Ninemile Creek Segment 01 Site Plan**

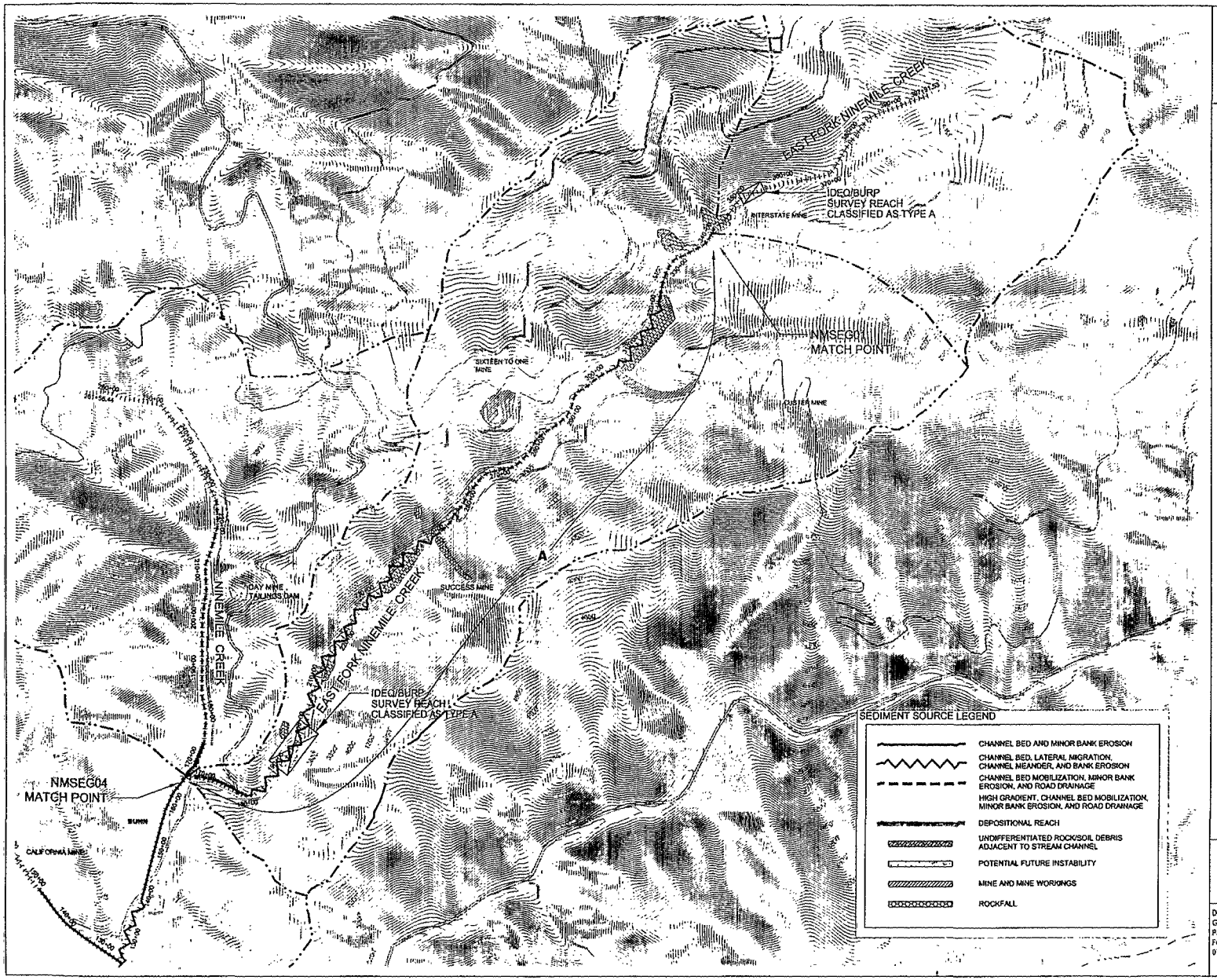
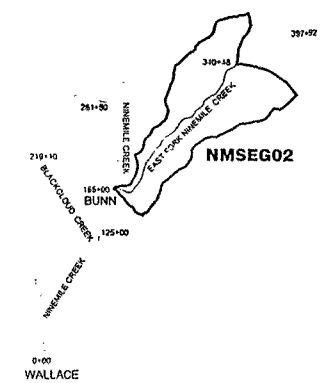


Figure 3.2-11
Ninemile Creek Segment 02 Site Plan



LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY. COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM
3. CONTOUR INTERVAL IS 25 FEET
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N W E S

0 2000 4000
Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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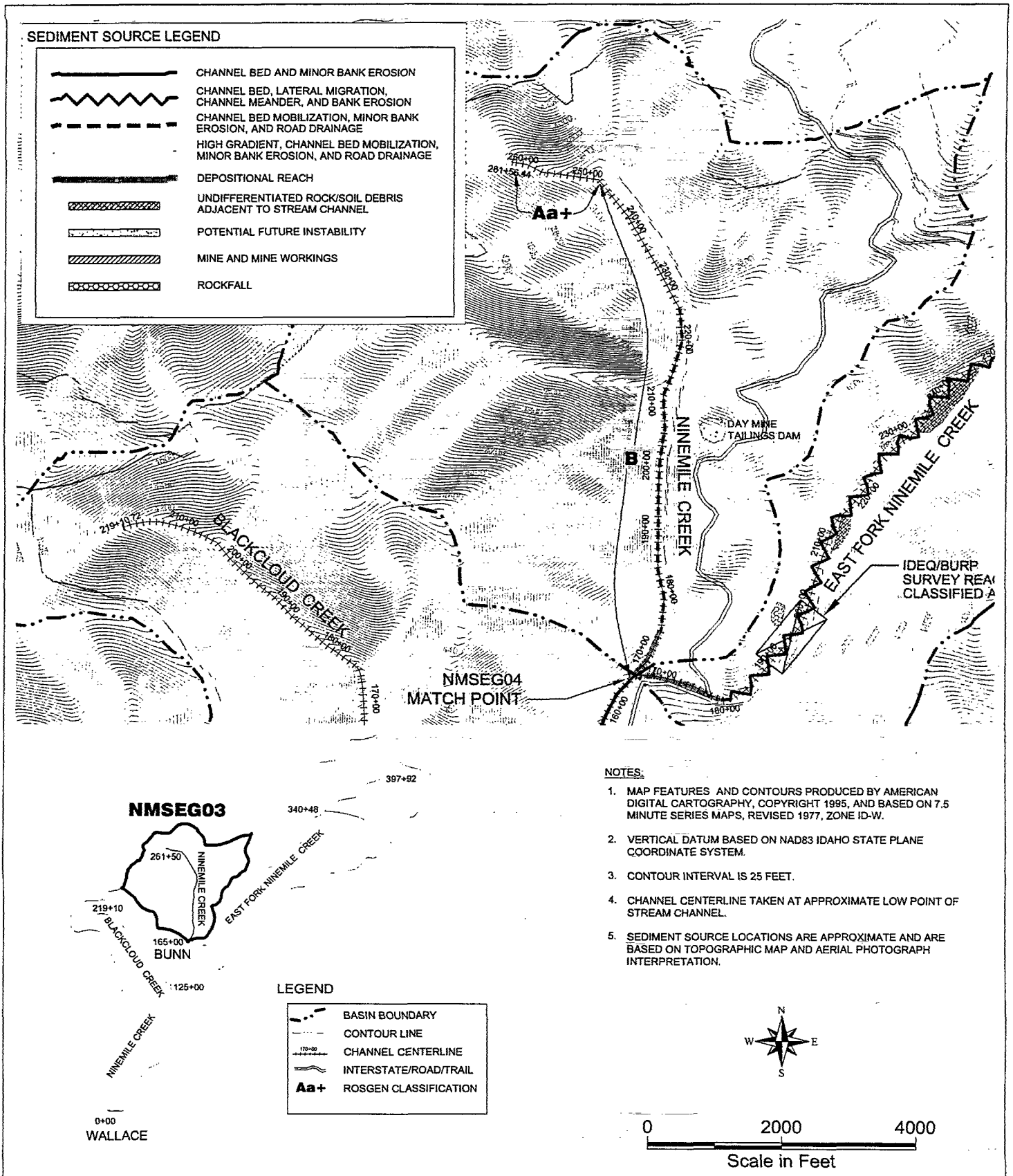
Filename: Ninemile_Site.dwg
07/18/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 18, 2001



NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc. Control: 4162500.6615.05.a Generation: 2 Path: n:\Coverages\Others\Shannon&Wilson\Ninemile Filename: Ninemile_Site.dwg 7/16/01	**Figure 3.2-12** **Ninemile Creek Segment 03 Site Plan**

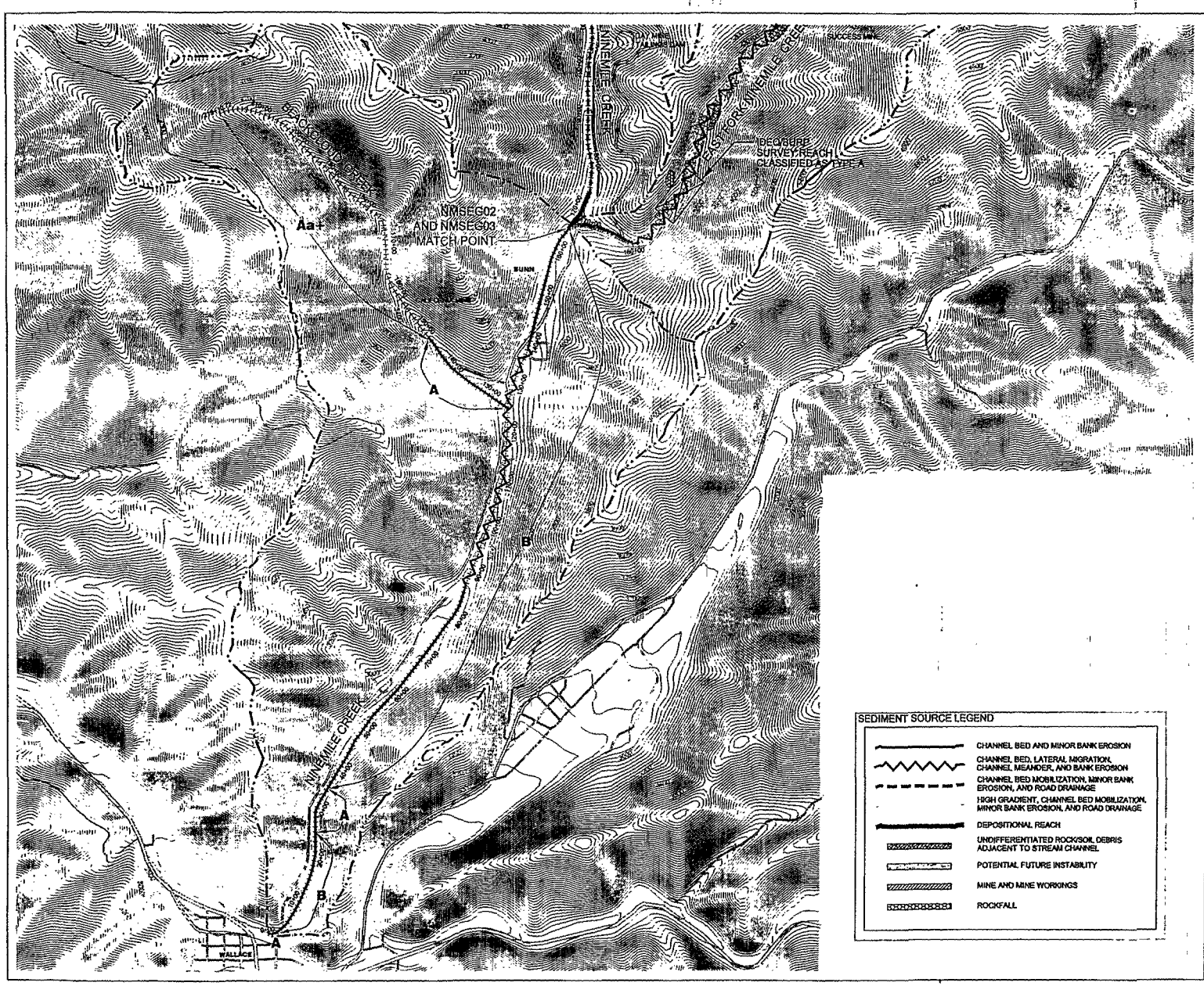
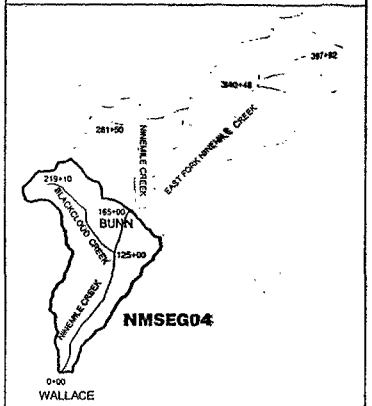


Figure 3.2-13
Ninemile Creek Segment 04 Site Plan



LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
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5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N W E S

0 2000 4000
Scale in Feet

54-50-0C2Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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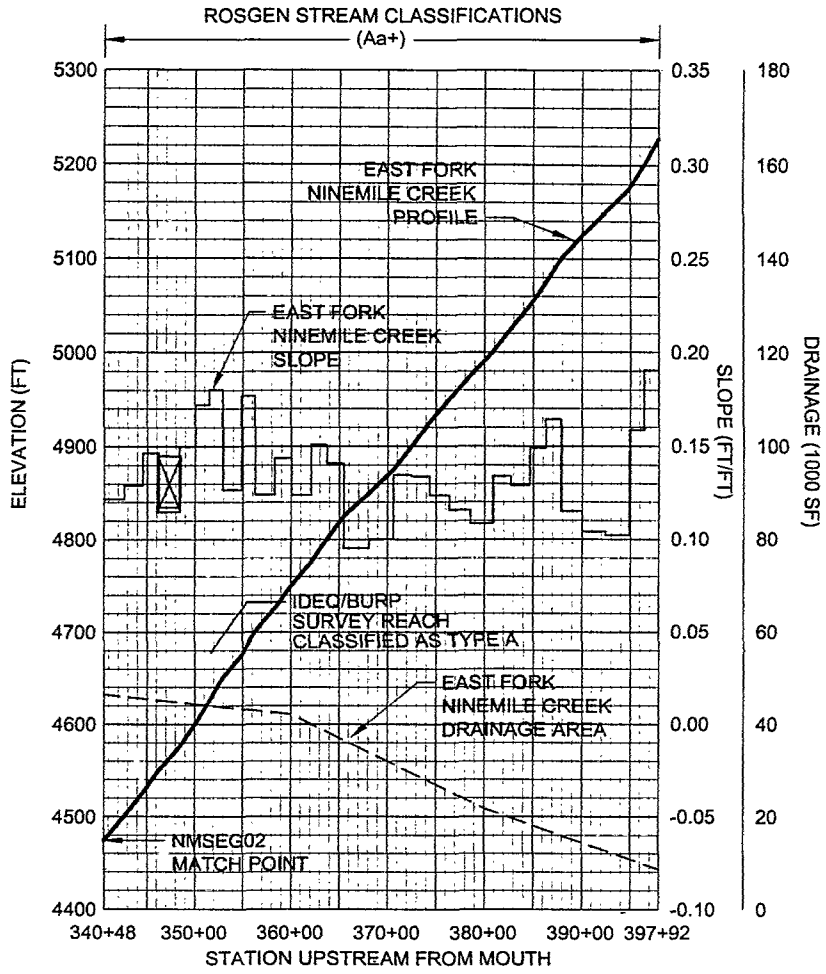
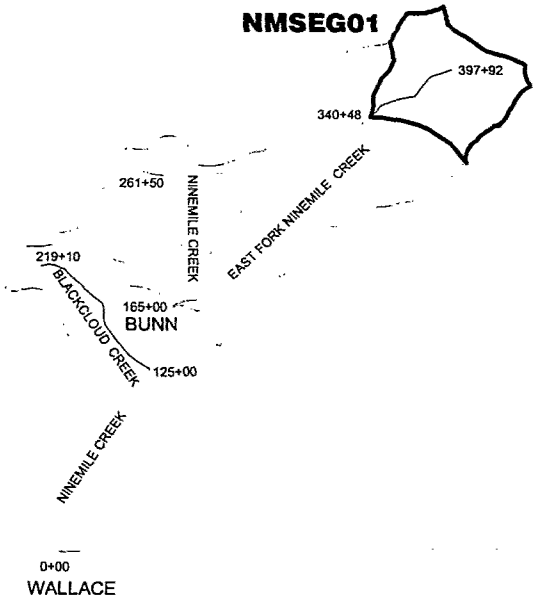
07/18/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 18 2001





LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 2 I:Groups/Public/Cda/Drawings/ Ninemile_Section.dwg Layout: NMSeg01 07/16/01	**Figure 3.2-14** **Ninemile Creek NMSeg01 Section** **Rosgen Stream Classification**

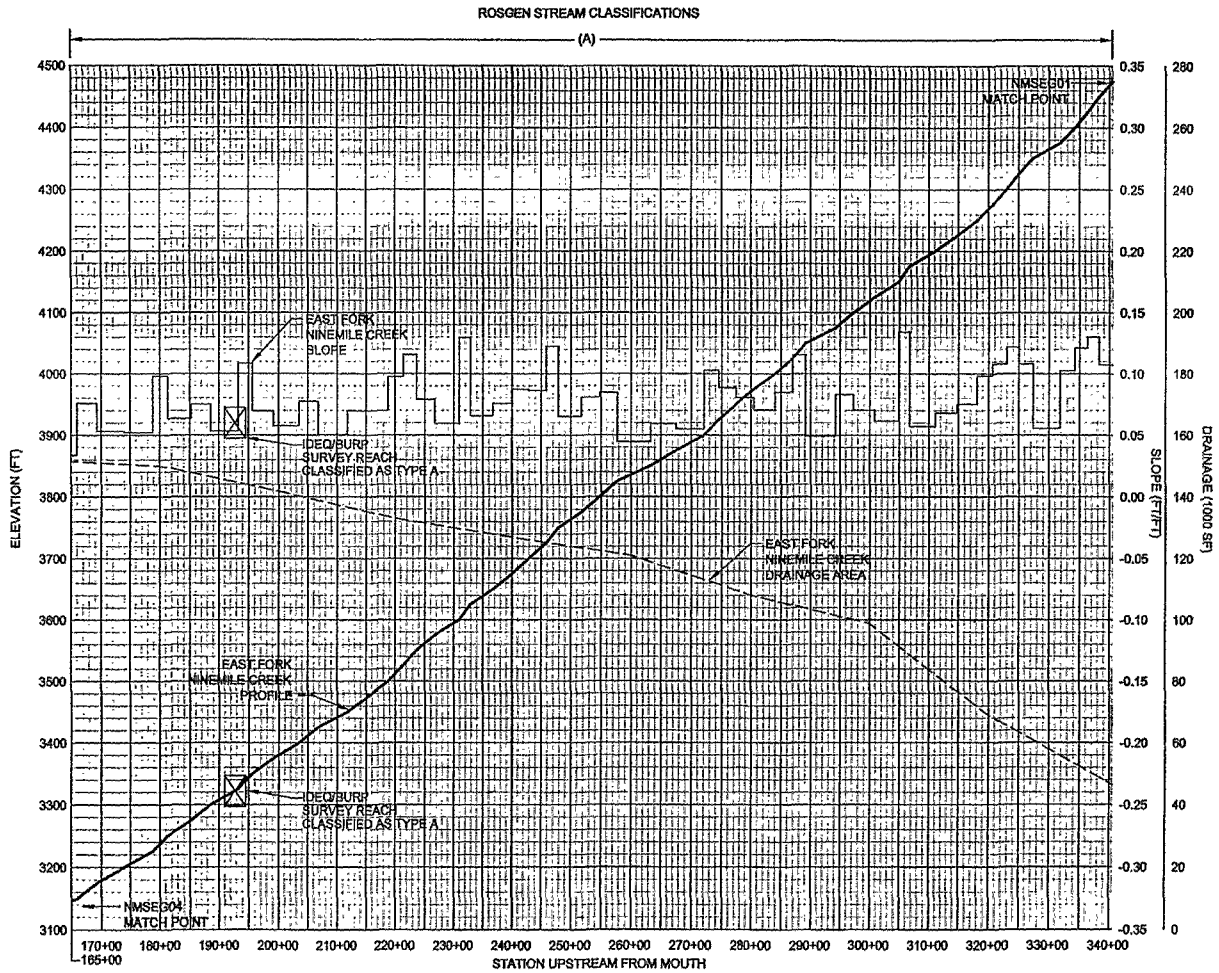
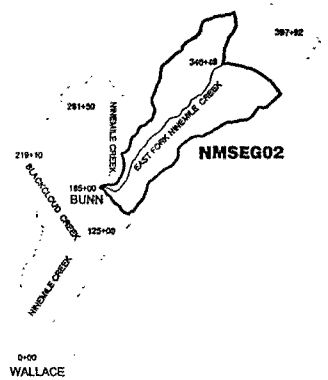


Figure 3.2-15
Ninemile Creek NMSeg02 Section
Rosgen Stream Classification



LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

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Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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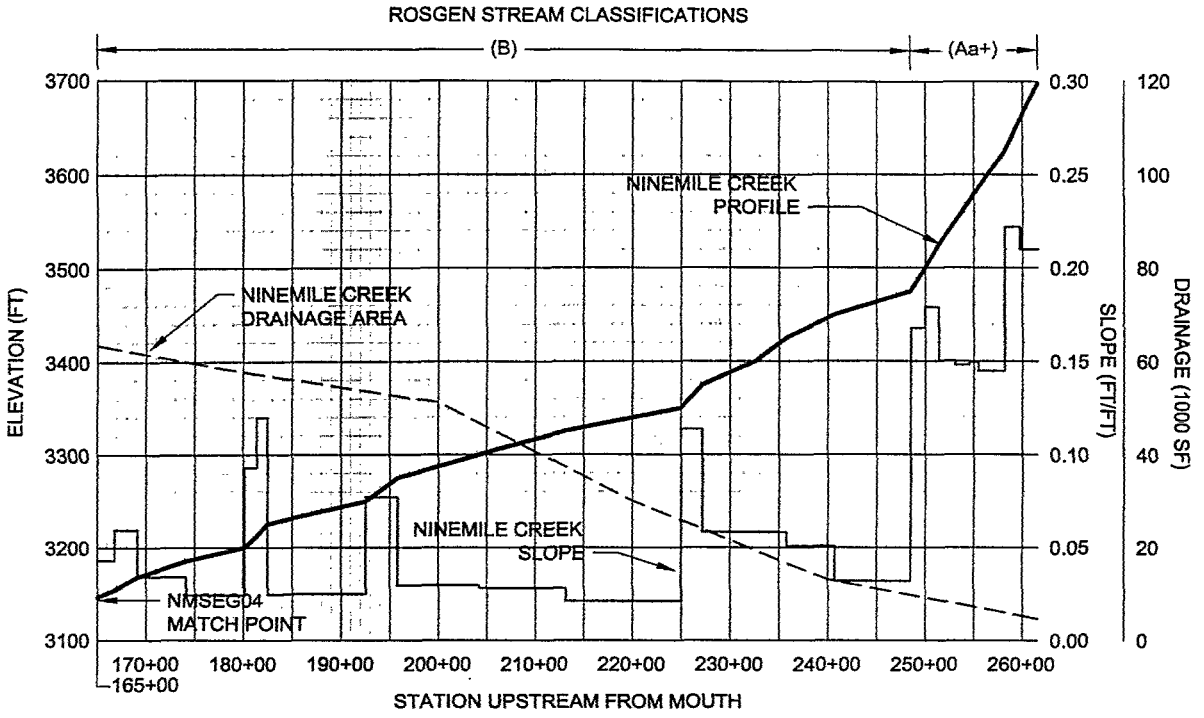
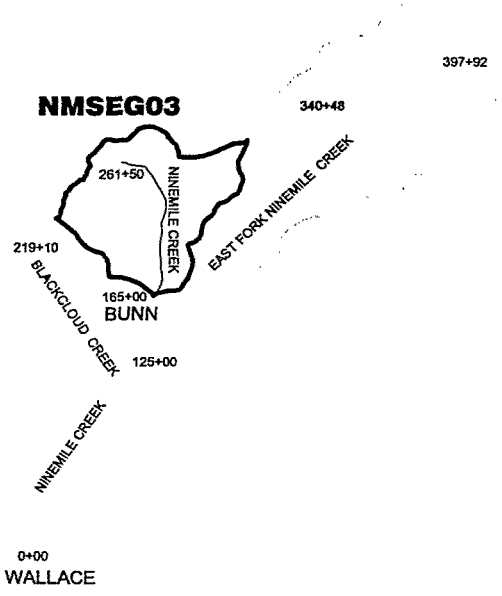
Layout: NMSeg02
07/16/01





LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc. Control: 4162500.6615.05.a Generation: 2 Path: n:\Coverages\Others\Shannon&Wilson\Ninemile Filename: Ninemile_Section.dwg Edit Date: 07/18/2001	**Figure 3.2-16** **Ninemile Creek NMSeg03 Section** **Rosgen Stream Classification**

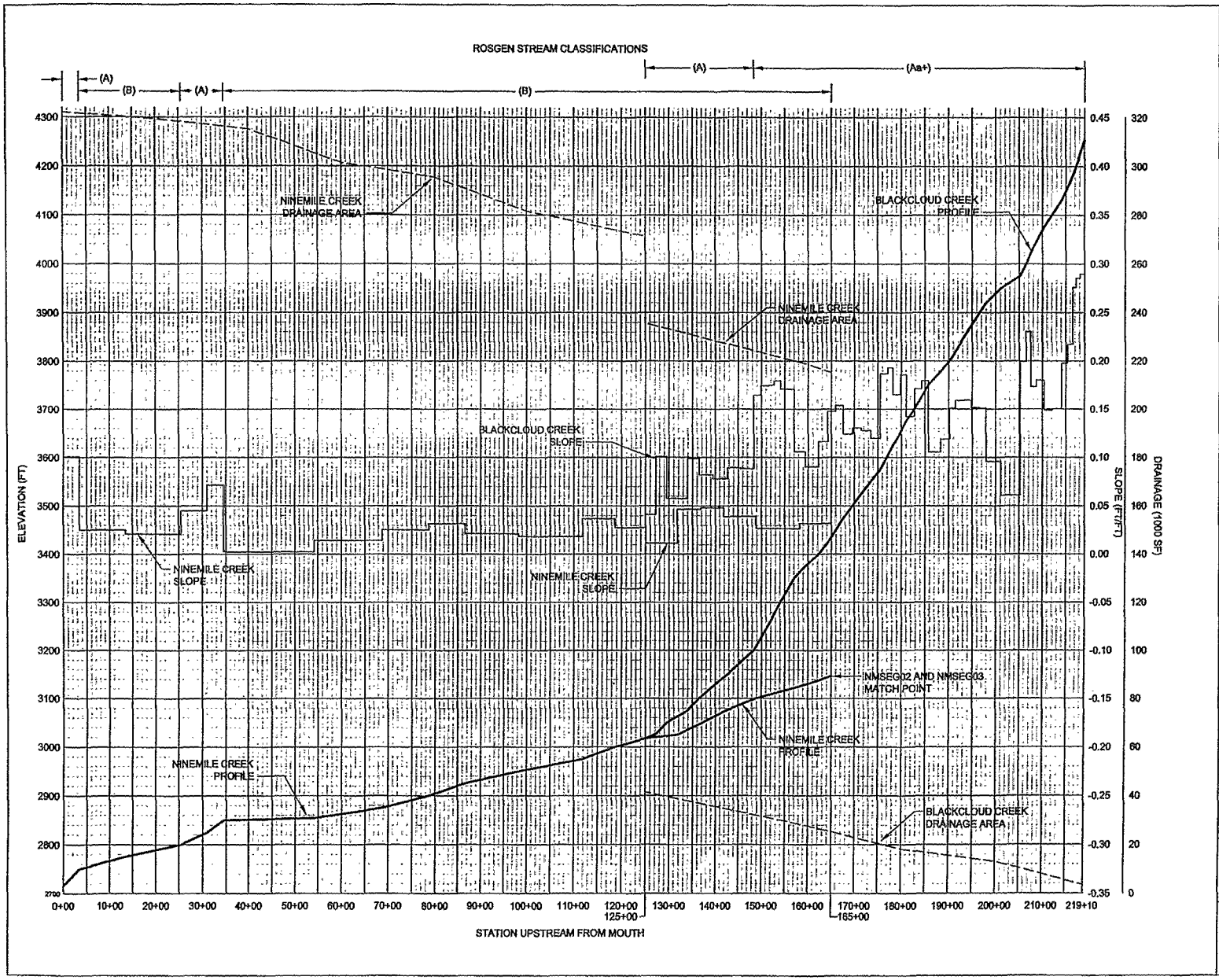
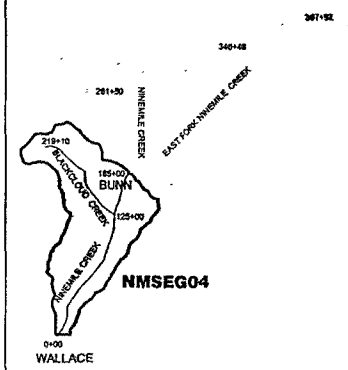


Figure 3.2-17
Ninemile Creek NMSeg04 Section
Rosgen Stream Classification



LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

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Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc. Control: 4152500.0515.05.a
Generation: 2
Path: n:\Coverages\Other\Shannon\Wilson\Ninemile
Filename: Ninemile_Section.dwg
7/18/2001

Table 3.2-1
Historical Estimates of Sediment Transport at Mouth of Ninemile Creek Based on Discharge Estimates Derived From Placer Creek and Sediment Transport Data From Ninemile Creek, Water Year 1999

Year	Sands (tons)	Fines (tons)	Bedload (tons)	Total (tons)
1990	313	494	954	1,761
1991	677	1,714	17,240	19,631
1992	32	27	5	63
1993	114	156	148	418
1994	43	48	23	114
1995	287	627	4,385	5,298
1997	1,294	3,394	26,519	31,208
Yearly Average of Sediment Transport				8,356

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the four segments of the Ninemile Creek watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels (Part 1, Section 5.1); and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x) and 100 times (100x) the screening level were identified. The magnitudes of exceedance (10x and 100x) were arbitrarily selected to delineate areas of contamination.

The screening levels used in this evaluation were selected from applicable risk-based screening criteria and available background concentrations. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., U.S. EPA Region IX PRGs), regional baseline or background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the Feasibility Study.

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4.0. Data source references are included as Attachment 1. Chemical data collected in Ninemile Creek and used in this evaluation are presented at the end of this report. Data summary tables include sampling location, data source reference, collection date, depth, and reported concentration. Screening level exceedances are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-9. All chemical data collected and compiled for this study are included in Attachment 2.

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening level (SL) to which the detected concentration is compared.

Source areas within Ninemile Creek are listed in Tables 4.1-1 through 4.1-4. These tables are based on source areas initially identified by the BLM (1999) and further refined by CH2M HILL and URS during the RI/FS process. The tables include source area names, source area ID, source area acres, description, the number of samples collected within each source area listed by matrix type, and metals exceeding 1x, 10x, and 100x the screening levels in surface soil, subsurface soil, sediment groundwater, and surface water. The tables reflect source area descriptive measurements initially generated in the CSM and subsequently refined by the FS.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-9) are included in Tables 4.1-1 through 4.1-4; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Tables 4.1-1 through 4.1-4.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment NMSeg01

4.1.1.1 Surface Water

Six surface water samples were collected and analyzed for total and dissolved metals in segment NMSeg01. One sample for total metals showed concentrations of cadmium, copper, iron, lead, manganese, and zinc greater than 10x the screening levels and concentrations of copper, lead, and zinc greater than 100x the screening levels. The same sample showed dissolved metals at concentrations greater than 10x the screening level for cadmium, lead, manganese, and zinc greater than 10x the screening levels. Dissolved metals concentrations of cadmium and zinc exceeded 100x the screening levels.

4.1.1.2 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment NMSeg01 that may be significant contributors of metals to Ninemile Creek. Summary source area data are presented in Table 4.1-1.

Three of the 10 source areas in this segment were sampled for surface water and one source area was sampled for sediment. Samples collected in the Ninemile Creek Impacted Floodplain showed concentrations of cadmium, lead, and zinc that exceeded 10x the screening level. Lead in sediment exceeded 100x the screening level.

4.1.2 Segment NMSeg02

4.1.2.1 Surface Soil

Sixty-three surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Cadmium, copper, lead and zinc were detected at concentrations that exceeded 10x the screening level at several to many sampling locations. Copper, lead and zinc were also detected at concentrations that exceeded 100x the screening level at some of these locations.

4.1.2.2 Subsurface Soil

Eight subsurface soil samples were collected and analyzed for total metals. Antimony, lead, and zinc were detected at concentrations that exceeded 10x the screening levels at one to several locations. One sample location showed a concentration of lead that exceeded 100x the screening level.

4.1.2.3 Sediment

Six sediment samples within segment NMSeg02 were collected and analyzed for total metals. Cadmium, lead and zinc were detected at concentrations that exceeded 10x the screening levels at several locations and that exceeded 100x the screening level at one location.

4.1.2.4 Groundwater

Four groundwater samples within segment NMSeg02 were collected and analyzed for total and dissolved metals. Total metals concentrations of manganese and zinc exceeded 10x the

screening levels. For dissolved metals, cadmium, manganese and zinc were found to exceed 10x screening levels. Dissolved concentrations of manganese and zinc exceeded 100x the screening levels.

4.1.2.5 Surface Water

Two hundred and thirty-six surface water samples within segment NMSeg02 were collected and analyzed for total metals. Total metals results indicate concentrations of cadmium, copper, iron, lead, manganese, and zinc that exceeded 10x the screening levels. Cadmium, copper, lead, manganese and zinc were detected at concentrations that exceeded 100x the screening levels.

Two hundred and thirty-three surface water samples were analyzed for dissolved metals. Multiple dissolved metals surface water samples showed concentrations of cadmium, copper, lead, manganese, and zinc that exceeded 10x and 100x the screening levels.

4.1.2.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment NMSeg02 that may be significant contributors of metals to Ninemile Creek. Summary source area data are presented in Table 4.1-2. Eight of the 27 source areas in segment NMSeg02 were sampled with numerous elevated metals concentrations. Cadmium, lead, manganese, and zinc were detected at concentrations that exceeded 100x the screening levels.

Based on the results summarized in this table, surface and subsurface soil, groundwater and sediment serve as significant contaminant sources in Ninemile Creek.

4.1.2.7 Major Source Areas

Based on a cumulative assessment of chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water (URS 2000, Appendix G), major source areas of concern were identified. The technical memorandum identifies discrete mine/mill sites and tailings impoundments. The Interstate Callahan mine/mill site has undergone some remediation but may still be a source area. The three major source areas identified in segment NMSeg02 include:

- Rex No.2/Sixteen-to-one Mine and Mill
- Tamarack Rock Dumps, Millsite, 400 Level, and Tamarack No. 5
- Success Mine Rock Dump and Success No. 3 (includes Alameda Mine)

These source areas are known to have high concentrations of metals resulting from historical mining activities. Figures 4.1-10 through 4.1-12 illustrate significant features for the three discrete source areas. Common features highlighted in the figures include: tailing piles, waste rock piles, mine adits of known location, mining and mill-related structures, residential properties, the river, major roads and additional site-specific details. Associated site photos are attached (Figures 4.1-13 through 4.1-21).

4.1.3 Segment NMSeg03

4.1.3.1 Surface Soil

Three surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. All samples showed concentrations less than 10x the screening levels.

4.1.3.2 Surface Water

Four surface water samples were collected and analyzed for total and dissolved metals. Concentrations were all less than 10x the screening levels.

4.1.3.3 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment NMSeg03 that may be significant contributors of metals to Ninemile Creek. Summary source area data are presented in Table 4.1-3. Six source areas are located within segment NMSeg03. No samples were collected at these sites.

4.1.4 Segment NMSeg04

4.1.4.1 Surface Soil

Five surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Results show that lead and zinc exceeded 10x the screening levels at two to four locations.

4.1.4.2 Subsurface Soil

Seven subsurface soil samples were collected and analyzed for total metals. Concentrations of lead and zinc at one sampling location exceeded 10x the screening level.

4.1.4.3 Sediment

Thirteen sediment samples were collected and analyzed for total metals. Antimony, arsenic, cadmium, lead, and zinc concentrations in several sampling locations exceeded 10x the screening level. Cadmium, and lead were detected at concentrations that exceeded 100x the screening levels.

4.1.4.4 Groundwater

Twenty groundwater samples were collected and analyzed for total and dissolved metals in segment NMSeg04. Results for total metals show two to several samples with cadmium, copper, iron, lead, manganese, and zinc concentrations exceeding 10x the screening levels. Cadmium, copper, lead, and zinc exceeded 100x the screening levels at several locations. Sampling results for dissolved metals show cadmium, copper, lead, and zinc at concentrations that exceeded 10x the screening level. They also show cadmium, copper, lead, and zinc in several samples at concentrations that exceeded 100x the screening level.

4.1.4.5 Surface Water

One hundred and sixty-six surface water samples were collected and analyzed for total metals and 165 surface water samples were collected and analyzed for dissolved metals. Total metals analyses for cadmium, iron, lead, manganese, and zinc show concentrations that exceed 10x the screening levels in at least one sampling location each. Lead and manganese were each detected at concentrations at one sampling location that exceeded 100x the screening levels. The concentration of total zinc exceeded 100x the screening level in 100 samples.

Surface water samples for dissolved metals indicated concentrations that exceeded 10x the screening levels for cadmium, iron, lead, manganese and zinc in at least one sampling location each. Cadmium, lead, manganese, and zinc were also detected at concentrations that exceeded 100x the screening levels for dissolved metals.

4.1.4.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment NMSeg04 that may be significant contributors of metals to Ninemile Creek. Summary source area data are presented in Table 4.1-4.

Five of 27 source areas in this segment were sampled. Cadmium, lead and zinc were detected at concentrations greater than 100x the screening levels at four of these source areas. Based on the results summarized in this table, surface and subsurface soil, groundwater and sediment serve as significant contaminant sources in Ninemile Creek.

4.1.4.7 Major Source Areas

Based on a cumulative assessment of chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water (URS 2000, Appendix G), major source areas of concern were identified. The technical memorandum identified discrete mine/mill sites and tailings impoundments. Evaluation of potential source areas conducted for this RI/FS resulted in addition of floodplain reaches and other specific source areas. The major source area identified in segment NMSeg04 is the Dayrock Mine and Tailings Repository.

Figure 4.1-22 illustrates significant features for the above source area. Common features highlighted in the figure include tailing piles, waste rock piles, mine adits of known location, mining and mill-related structures, residential properties, the river, major roads and additional site-specific details.

4.1.5 Adit and Seep Summary

Most adits and seeps with drainage that have been identified and sampled have flows under 1 cfs and relatively low concentrations of metals. However, very high concentrations of total zinc were measured in three of the adits and two of the seeps identified in the Ninemile Creek watershed (Gearheart et al. 1999). A total of fifteen adits and four seeps were identified. Available adit and seep data for Ninemile Creek are summarized in Table 4.1.5-1. Discharge, average total zinc concentration, average total zinc mass loading, and associated source areas are listed. Zinc mass loading from the Success No. 3 adit and the seeps at the Interstate-Callahan Mill, the Interstate-Callahan Rock Dumps, and the Rex No. 2 were greater than 1 pound per day. Total zinc mass loading for all adits and seeps identified in Ninemile Creek is estimated to be less than 20 pounds per day.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and Extent further discussed the use of the plotting discrete sampling events versus the probabilistic analysis of the mass loading data in Fate and Transport.

This section presents the instantaneous discrete mass loading measurements made during several low- and high-flow sampling events. The locations sampled during each event are plotted on a map of the watershed (Figures 4.2-1 through 4.2-12). Each sampling location shows the cumulative mass loading of lead or zinc and the difference in mass load from the next upstream location. The difference in mass load is indicated on the maps by the term "delta." The events were selected to show variations in mass loading throughout the stream system. The events selected are not intended to represent all the available mass loading data. Nor are the data considered representative of overall loading conditions in the watershed. This data should be compared with probabilistic results of Section 5, which take into account data variability. All available data are used to the extent possible in the probabilistic analysis presented in Section 5.0. The remainder of this section presents the indicator metal correlation and selected maps with a discussion of discrete sampling events on a watershed basis.

4.2.1 Indicator Metal Correlation

In Section 4.2 of the Canyon Creek Watershed Nature and Extent, eight of the chemicals of potential concern (COPCs) are compared to total lead and dissolved zinc. These two metals appear to be reasonable indicators of the other chemicals of potential concern. The following mass loading discussion is limited to total lead and dissolved zinc.

4.2.2 Ninemile Creek Watershed Mass Loading

Of the available sampling data, five sampling events were selected and mapped. Table 4.2-1 summarizes the sampling events, sampling locations and calculated mass loads for total lead and dissolved zinc. The low-flow events used were October 1991 (Figures 4.2-1 and 4.2-7), November 1997 (Figures 4.2-2 and 4.2-8), November 1998 (Figures 4.2-3 and 4.2-9) and December 1998 (Figures 4.2-4 and 4.2-10). The high flow events used were May 1991 (Figures 4.2.1-5 and 4.2-11) and May 1998 (Figure 4.2-6 and 4.2-12). The following sections discuss observations made from plotting the low- and high-flow mass loading data.

4.2.2.1 Total Lead Mass Loading

Loading observations are as follows:

Sampling location NM291 is located downstream of segment NMSeg01 and is used as an indicator of upstream mass loading. As shown on Figures 4.2-1, 4.2-2 and 4.2-3, this sampling location has a total lead mass load of less than 1 pound per day for three low-flow sampling events. Figures 4.2-4 and 4.2-5 show that during high-flow, total lead loading was also less than 1 pound per day. The Interstate rock dumps and impacted flood plains are upstream of this sampling location.

In segment NMSeg02 between NM 291 and NM295, the highest low-flow lead loading was 1 pound per day. During high-flow events, the highest lead loading was 3 pounds per day. The Rex No. 2/Sixteen-To-One Mine and non-discrete sources (i.e., riparian sediment, mass wasting, or groundwater) are the likely sources of this load.

Between location NM295 and the downstream end of segment NMSeg02 the highest low-flow total lead loading measured is 5 pounds per day at Location NM297 (December 1998). During high-flow the highest lead loading measured in this section of stream was 14 pounds per day. The two largest potential sources to account for the loading increase are the Success Mine and the BLM source areas named the EF Ninemile Creek Impacted Riparian, EF Ninemile Creek SVNRT Rehab and EF Ninemile Creek Hecla Rehab.

Segment NMSeg03 has few BLM source areas identified and is not considered a contributor to Ninemile Creek.

In Segment NMSeg04, the total lead mass loading at low flow ranges from 1 to 5 pounds per day with differences in mass load ranging from -2 to 3 pounds per day. The loading is variable throughout the segment. During high-flow, the loads ranged from 1 to 11 pounds per day. The Dayrock Mine and the Dayrock Mine Tailings Piles/SVNRT Repository are located in the upper portion of the segment.

In summary, the low- and high-flow events plotted indicate that mass loading in Ninemile Creek, when compared to Canyon Creek, is lower. The total lead load during low flow conditions is small (1 to 4 lb/day at mouth). The total lead load during high flow conditions ranged from 9 to 11 lb/day at mouth. Differencess in mass load range from -1 to 0 near mouth at low flow. Segment 2 contributes most of the total lead load, with Segments 1, 3, and 4 contributing little

load. Within Segment 2, most of the high-flow load comes from the reach from Success to the confluence (5 to 12 lb/day).

4.2.2.2 Dissolved Zinc Mass Loading

Loading Observations are as follows:

Sampling location NM291 is located downstream of segment NMSeg01. As shown on Figures 4.2-7 through 4.2-9, the highest low-flow cumulative dissolved zinc loading at this location was 4 pounds per day. Figure 4.2-11 shows the highest measured high-flow dissolved zinc loading was 15 pounds per day (May 1991). The Interstate Rock Dumps and impacted flood plains are upstream of this sampling location.

In segment NMSeg02 between NM 291 and NM295, the highest low-flow dissolved zinc loading was 159 pounds per day. During high-flow events, the highest zinc loading was 236 pounds per day (May 1998). The Rex No. 2/Sixteen-To-One Mine, the Tamarack Mine and Millsite, and other non-discrete sources are the likely sources of this load.

Between location NM295 and the downstream end of segment NMSeg02 the highest low-flow total zinc loading measured is 319 pounds per day at location NM297 (December 1998). During high flow, the highest zinc loading measured in this section of stream was 616 pounds per day measured at location NM298 (May 1998). The two largest potential sources to account for the loading increase are the Success Mine and the BLM source area named the EF Ninemile Creek Impacted Riparian, EF Ninemile Creek SVNRT Rehab and EF Ninemile Creek Hecla Rehab.

Segment NMSeg03 has few BLM source areas identified and is not considered a contributor to Ninemile Creek.

In Segment NMSeg04, zinc mass loading at low-flow ranges from 40 to 382 pounds per day. The loading is variable throughout the segment. During high-flow, the loads ranged from 341 to 541 pounds per day. The Dayrock Mine and the Dayrock Mine Tailings Piles/SVNRT Repository are located in the upper portion of the segment.

In summary, the low- and high-flow events plotted indicate that there is significant zinc loading of the stream system. The greatest increases in dissolved zinc loading at low-flow occurred below the Interstate Callahan Mine and associated workings and throughout the lower half of segment NMSeg02. At high-flow, increases in the dissolved zinc loading were noted in the same stream sections as under low-flow conditions. At high flow at the mouth of the creek, the highest

total lead and dissolved zinc loadings measured were 11 and 541 pounds per day, respectively (May 1991).

4.2.2.3 Groundwater Mass Loading

The mass loading of metals in groundwater at the mouth of Ninemile Creek is expected to be small compared to the loading of metals in surface water. This is based on a shallow depth to bedrock near the mouth of the canyon, which forces groundwater to discharge to surface water, a condition similar to Canyon Creek.

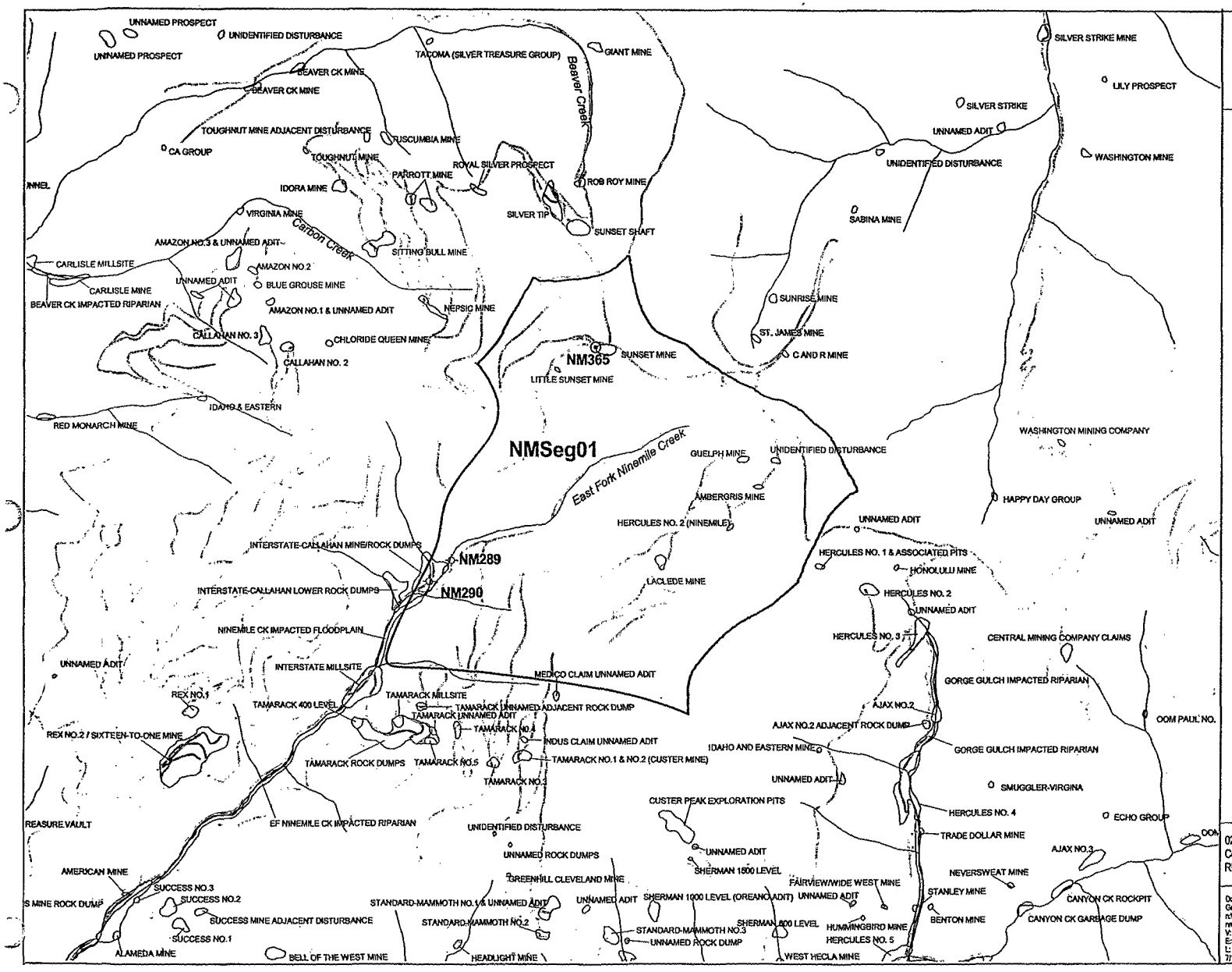

Figure 4.1-1
Ninemile Creek Segment NMSeg01 Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 4/6/00.

SCALE 1:24,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.6615.05.a
Generation 1
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nm_3-2-00_from056.apr
V: NMSegment1
E:SW
L: NMSeg01Surface Water
7/19/01

This map is based on Idaho State Plane Coordinates West Zone. North American Datum 1983

Date of Plot: July 19, 2001

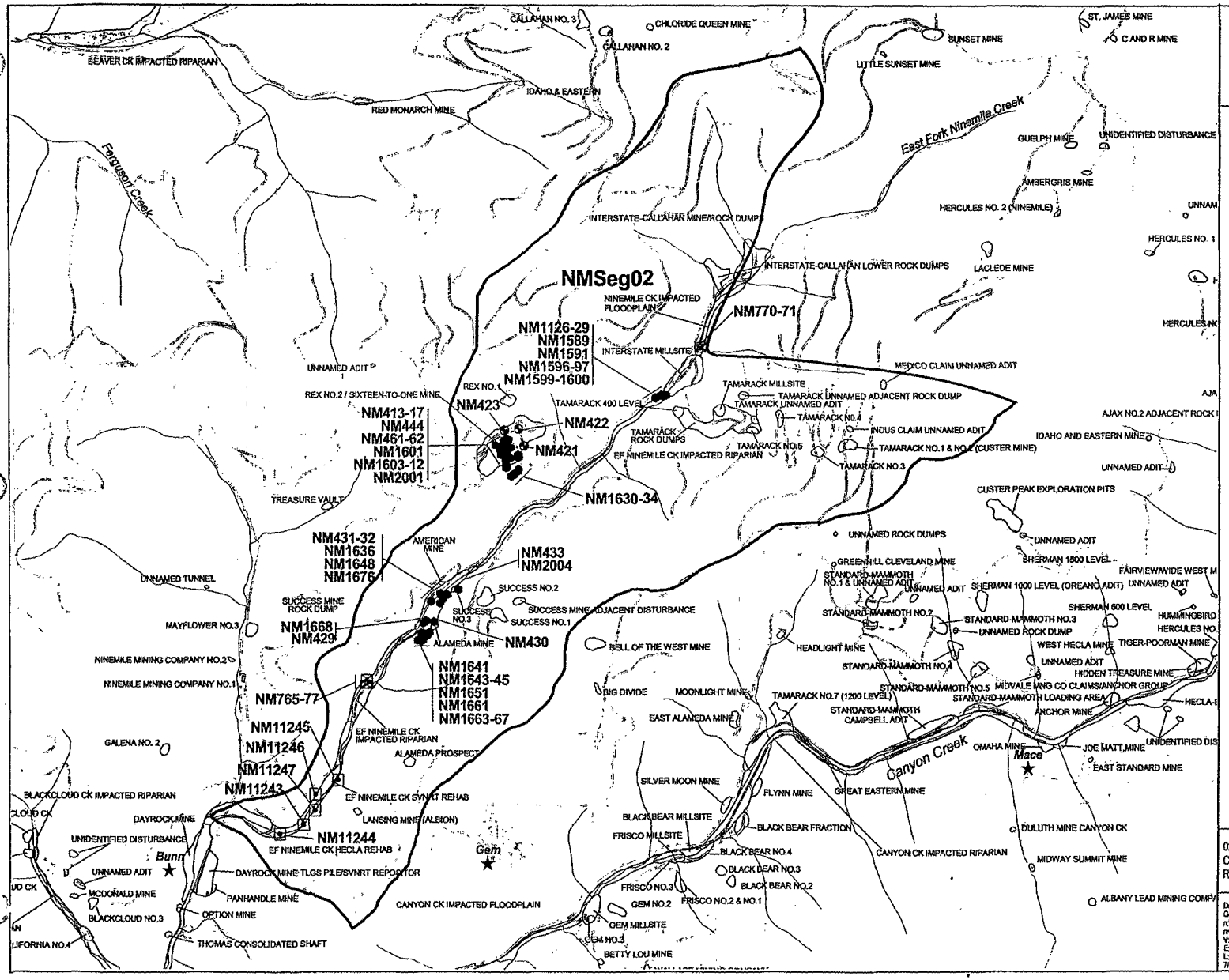

Figure 4.1-2
Ninemile Creek Segment NMSeg02 Source Areas and Soil Sediment Sampling Locations

LEGEND

- Ground Sampling Location
- Monitoring Well Sampling Location
- Floodplain Sampling Location
- Test Pit Sampling Location
- Stream
- Road
- City
- Ninemile River Segment 2
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4152300.6515.05.a
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E:SS
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7/19/01

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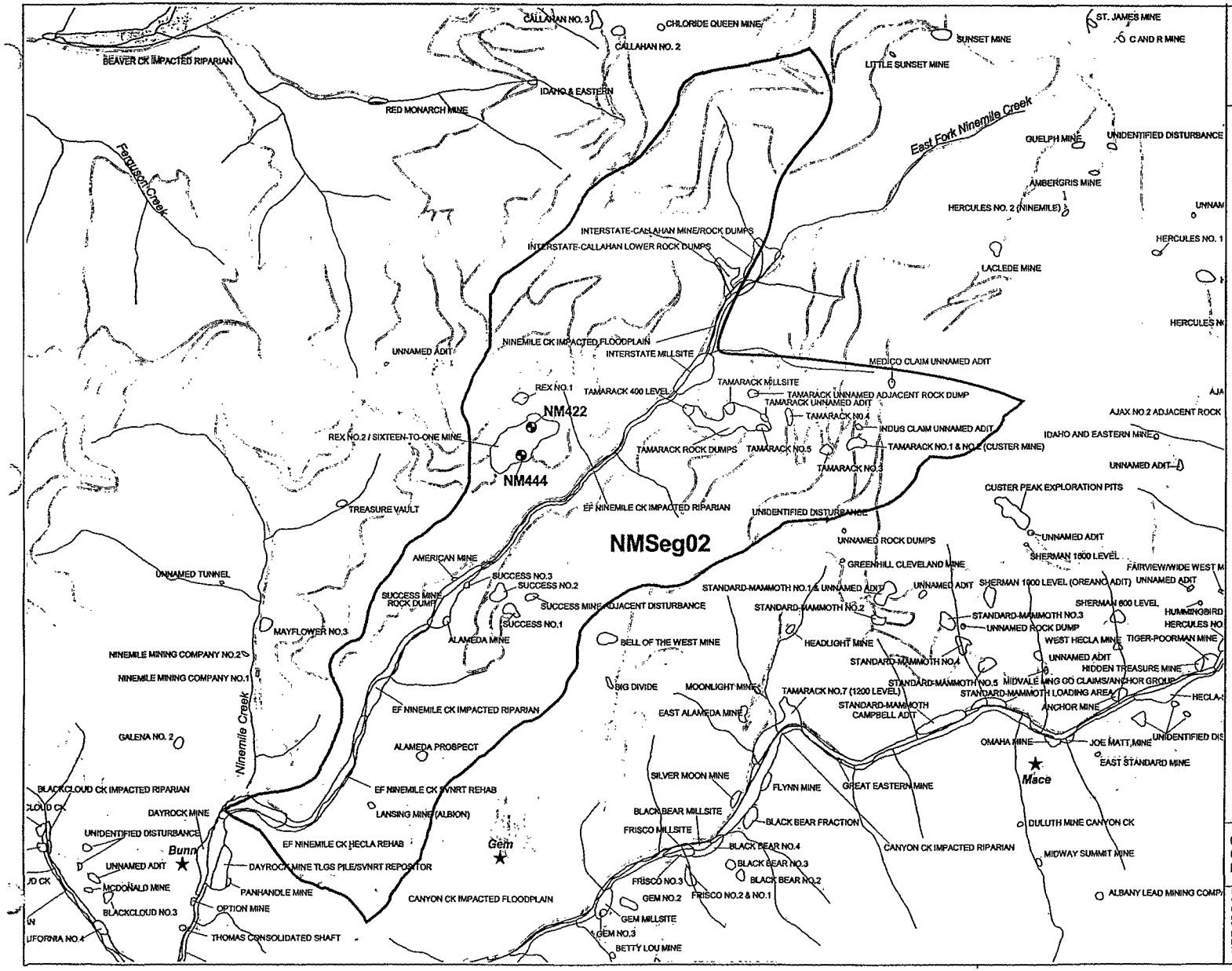

Figure 4.1-3
Ninemile Creek Segment NMSeg02 Source Areas and Groundwater Sampling Locations

LEGEND

- Monitoring Well Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 2
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 — 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4182500.8615.05.a
Generation 1
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nm_3-2-00_from055.apr
V: NM02 Groundwater
E:GW
L: NMSEC02 Groundwater
7/19/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 19 2001

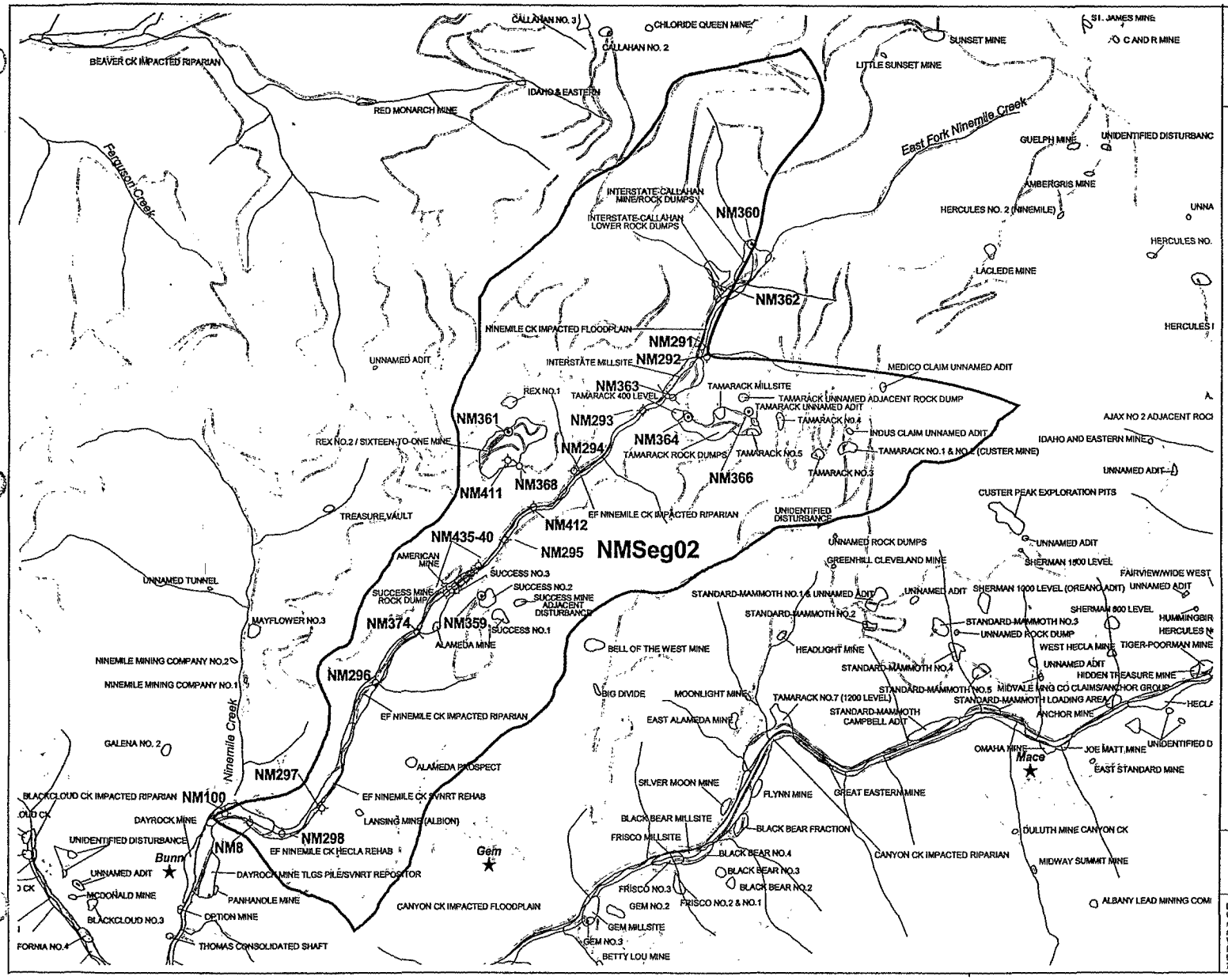

Figure 4.1-4
Ninemile Creek Segment NMSeg02 Source Areas and Surface Water Sampling Locations

LEGEND

- Seep Sampling Location
- Adit Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 2
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.6515.05.a
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V: NMSeg02 Surface Water Samples
E:SW
L: NMSeg02 Surface Water
7/16/01

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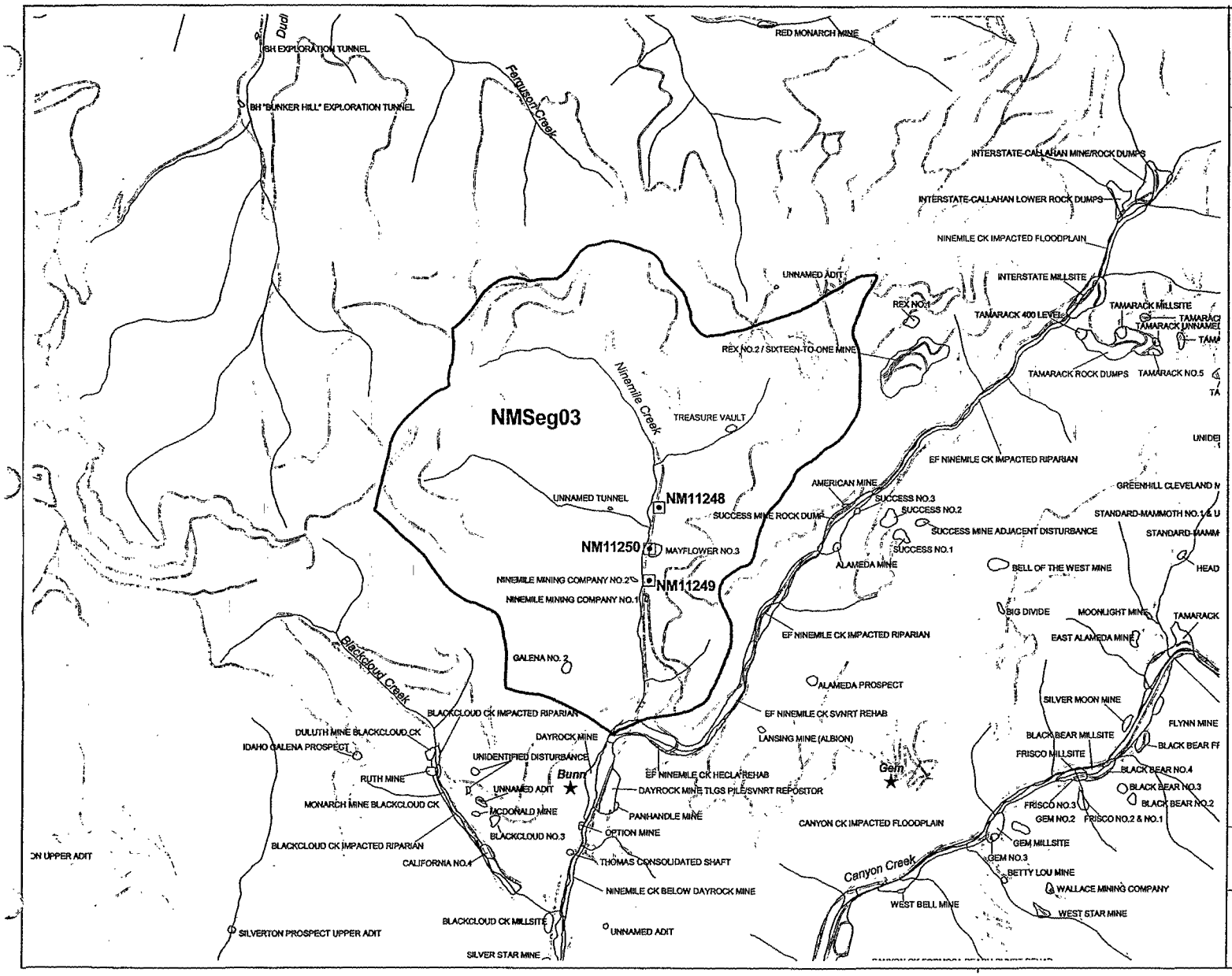

Figure 4.1-5
Ninemile Creek Segment NMSeg03
Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Floodplain Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.0615.05.a
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V: NMSeg03 soil
E:SS
L: NMSeg03 SOIL
7/19/01

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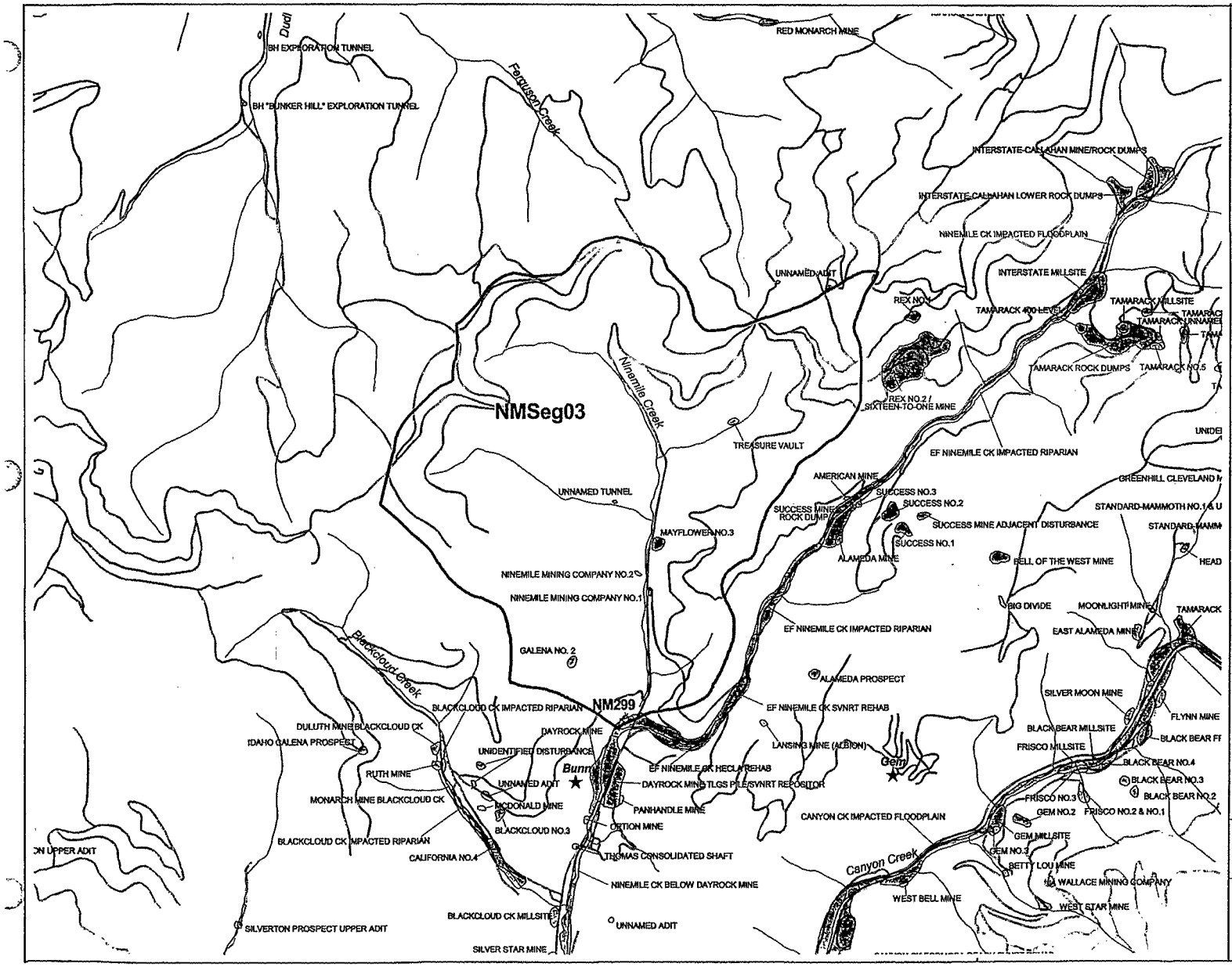

Figure 4.1-6
Ninemile Creek Segment NMSeg03
Source Areas and Surface Water Sampling Locations

LEGEND

- River Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 416200.0615.05.a
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E:SW
L: NMSeg03 SW
7/19/01

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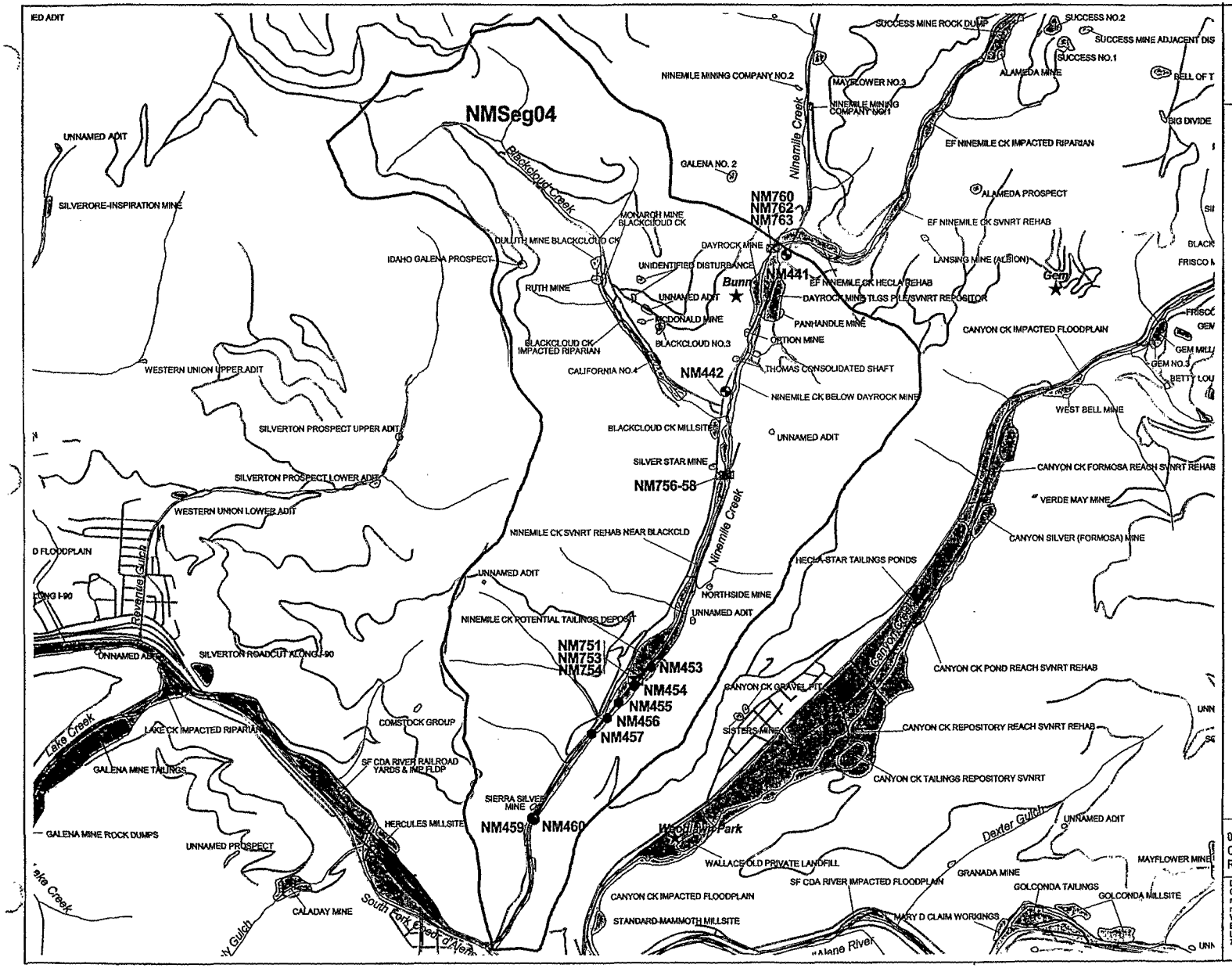

Figure 4.1-7
Ninemile Creek Segment NMSeg04
Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Ground Sampling Location
- Monitoring Well Sampling Location
- Test Pit Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 4
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 — 0.5 Miles

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Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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7/19/01

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Date of Plot: July 19, 2001

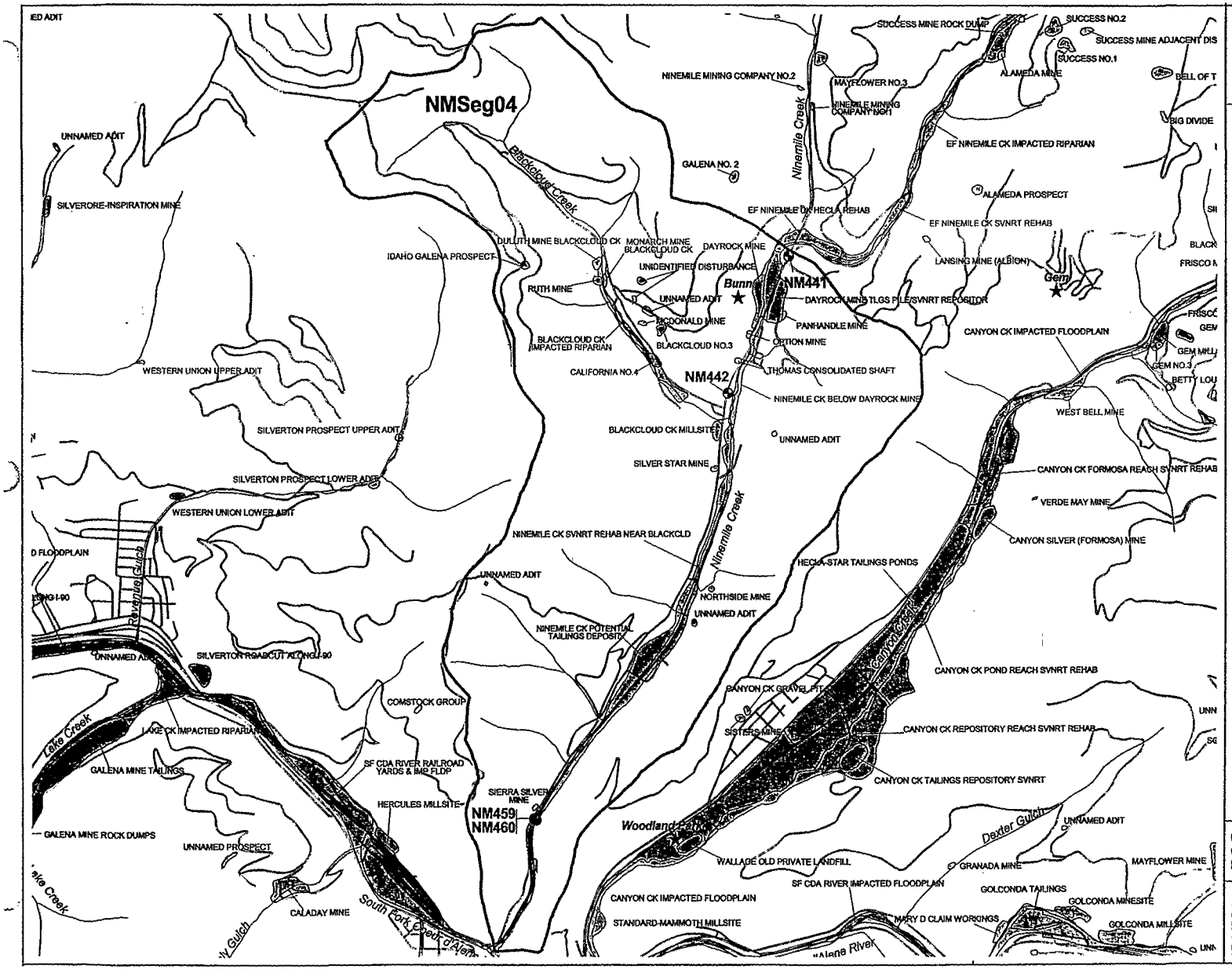
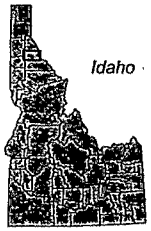


Figure 4.1-8
Ninemile Creek Segment NMSeg04 Source Areas and Groundwater Sampling Locations

LEGEND

- Monitoring Well Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 4
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 — 0.5 Miles

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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EGW
L: NMSeg04 Groundwater
7/19/01

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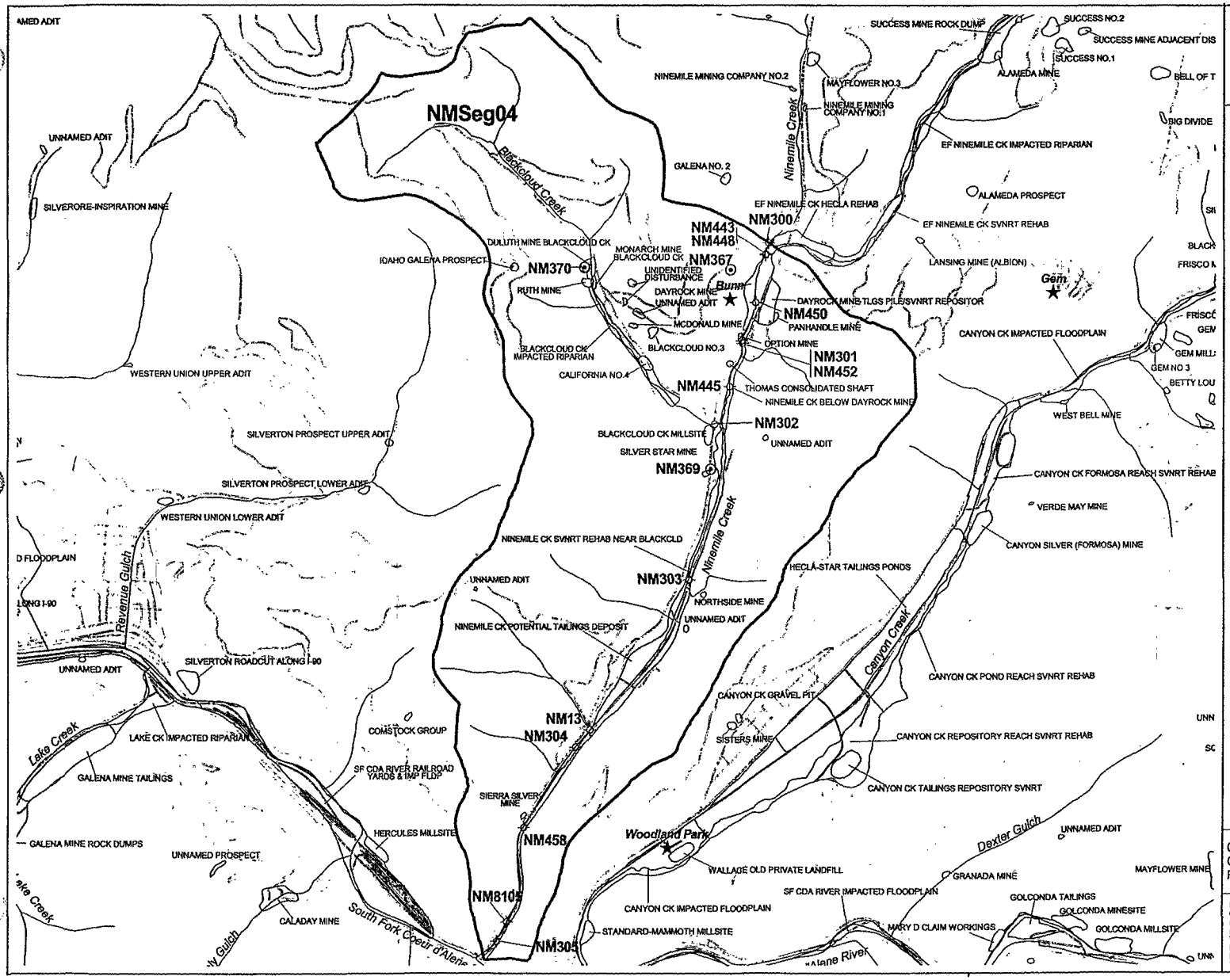

Figure 4.1-9
Ninemile Creek Segment NMSeg04 Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Ninemile Creek Segment 4
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

0 0.5 Miles

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Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4182500.8615.05.a
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7/19/01

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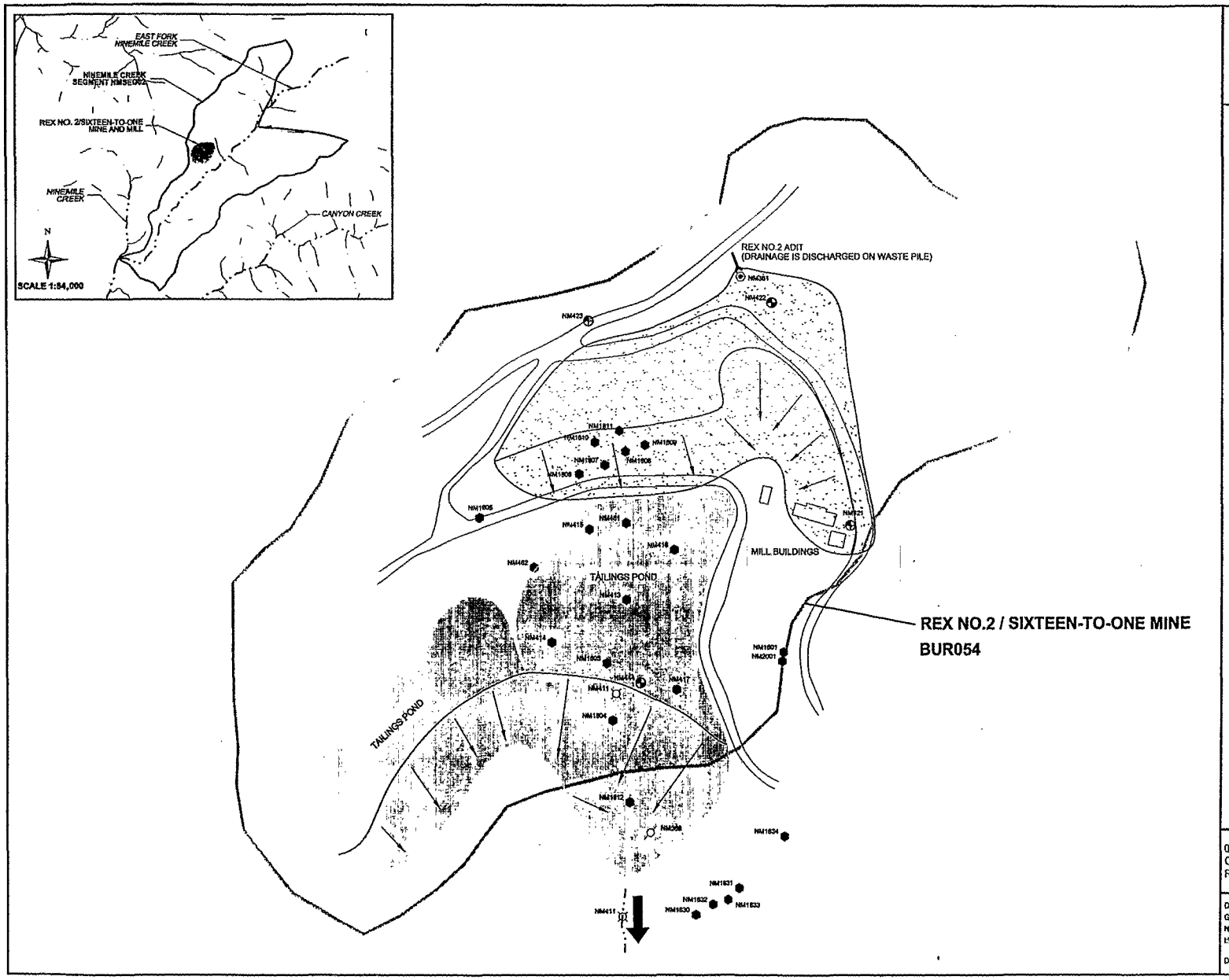

Figure 4.1-10
Rex No. 2/Sixteen-To-One Mine and Millsite Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Tailings
- Adit Surface Water Sample
- Monitoring Well Groundwater Sample
- Monitoring Well Soil Sample
- Seep Surface Water Sample
- Surface/Near Surface Soil Sample
- River Surface Water Sample
- BLM Source Area

Location Map

SCALE 1:1,800
0 75 150 Feet

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4182500.8615.05.a
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Date: 07/19/01

This Map is based on Idaho State Plane Coordinates West Zone. North American Datum 1983

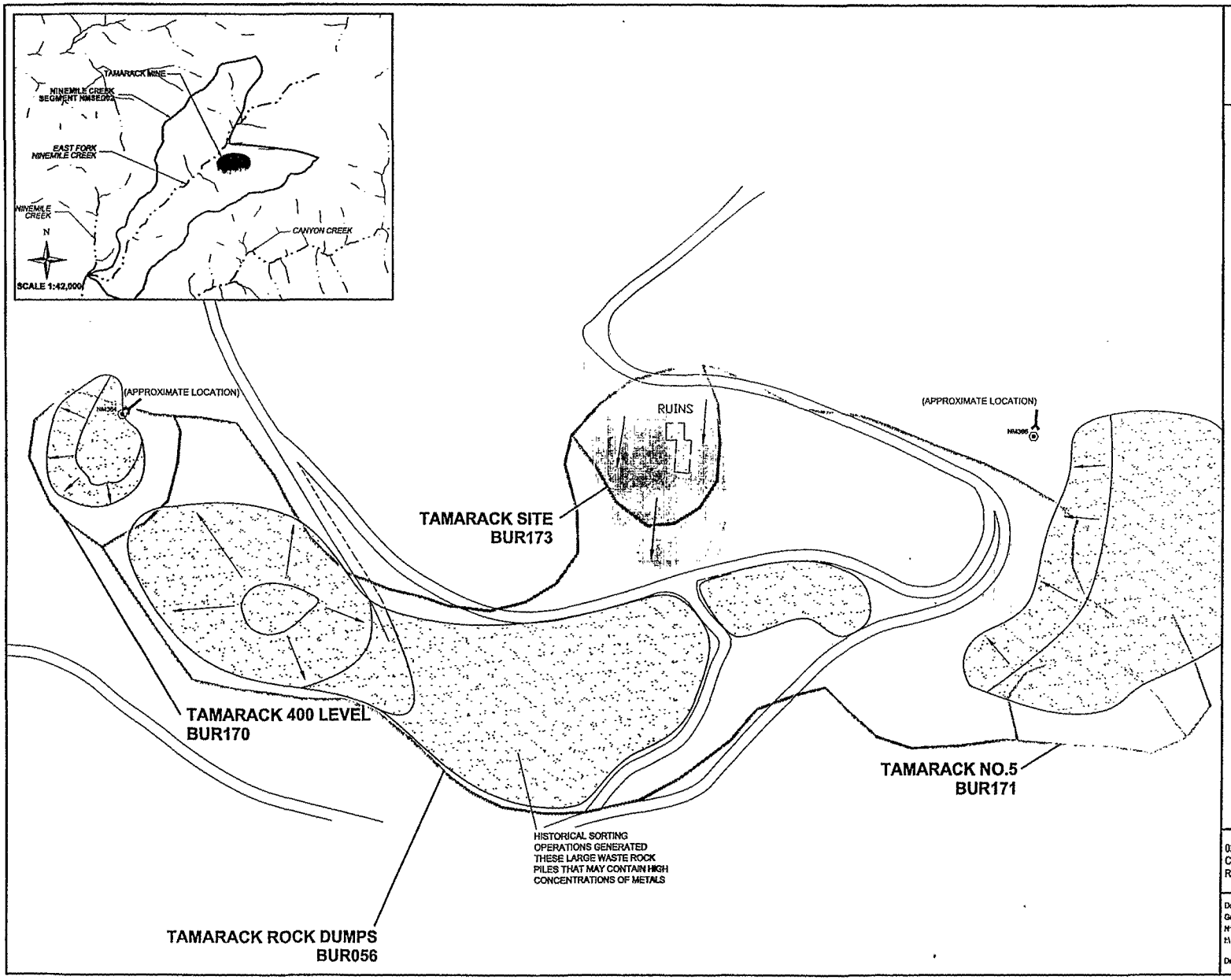

Figure 4.1-11
Tamarack Mine Site Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Waste Material
- Adit Surface Water Sample

Location Map

SCALE 1:1,800
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N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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Date: 07/19/01

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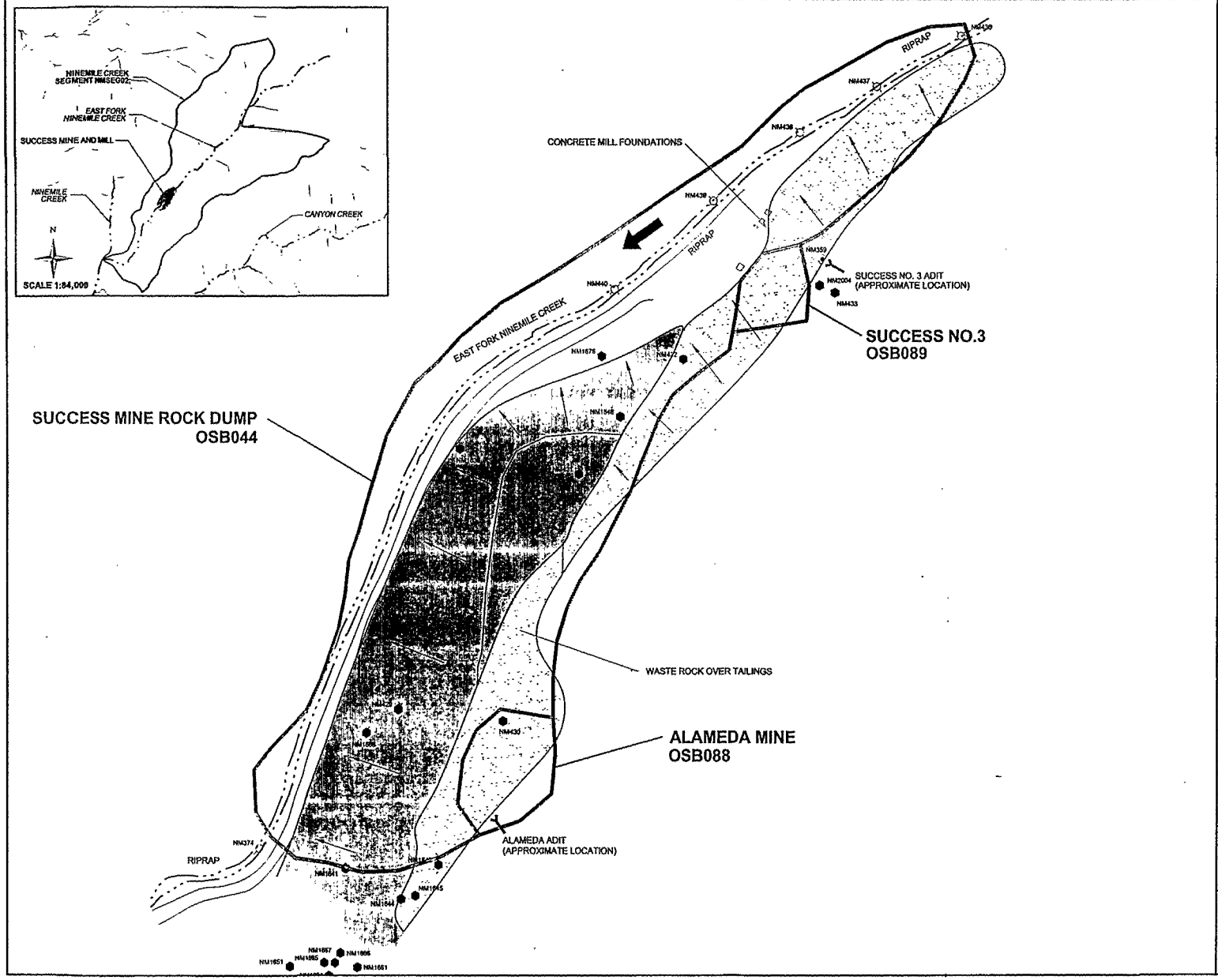
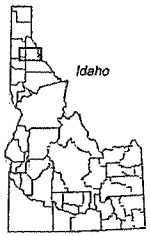


Figure 4.1-12
Success Mine and Millsite Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Tailings
- Adit Surface Water Sample
- River Surface Water Sample
- Surface/Near Surface Soil Sample



Location Map

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027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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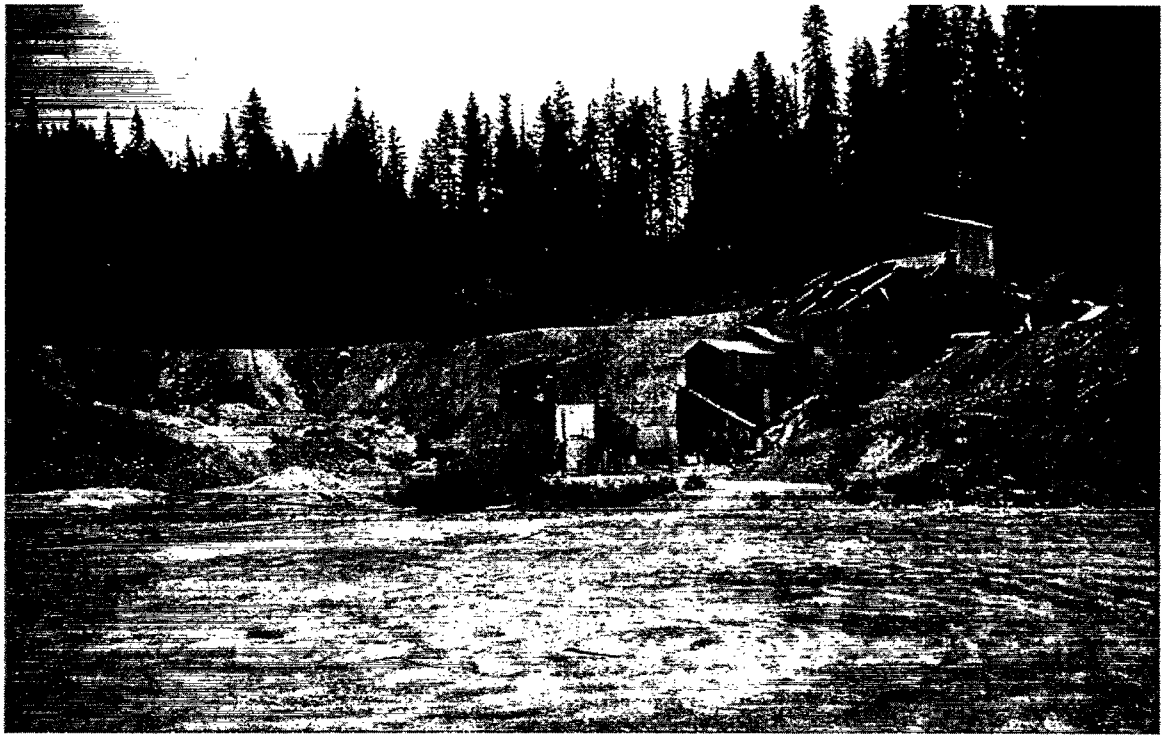


Figure 4.1-13 – Rex No. 2/Sixteen-to-one Mine and Mill
North facing view of Mill Site.

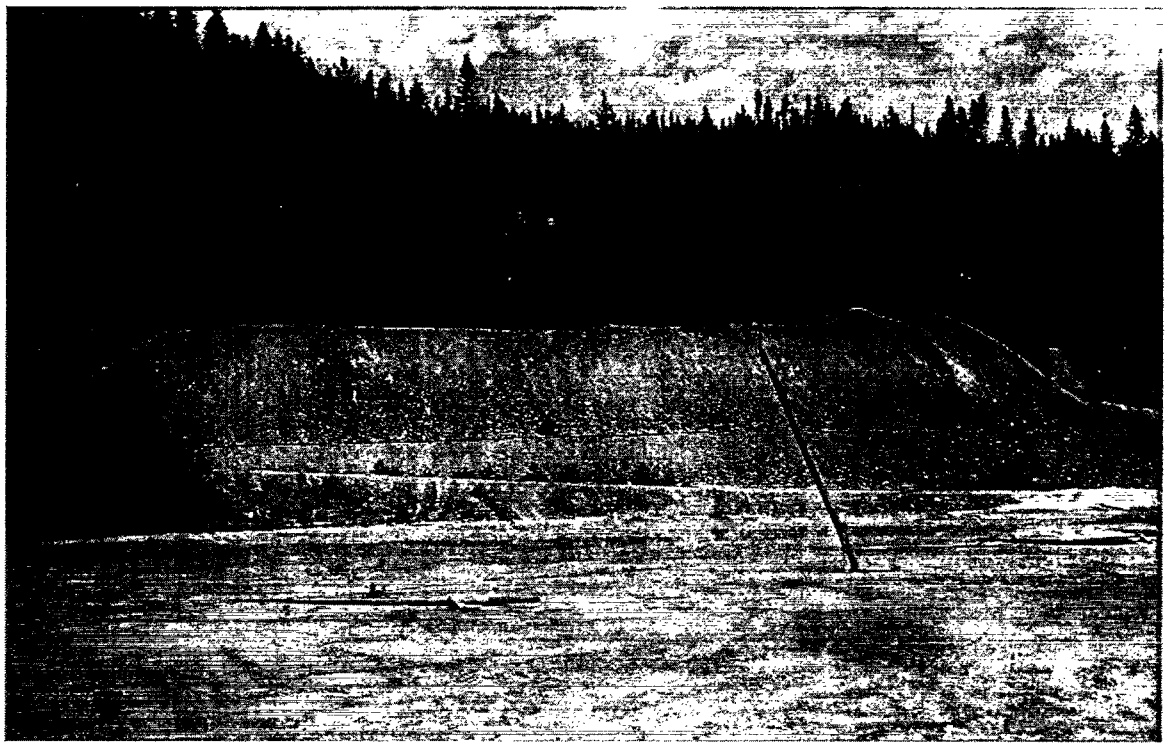


Figure 4.1-14 – Rex No. 2/Sixteen-to-one Mine and Mill
North facing view of Tailings Pile.

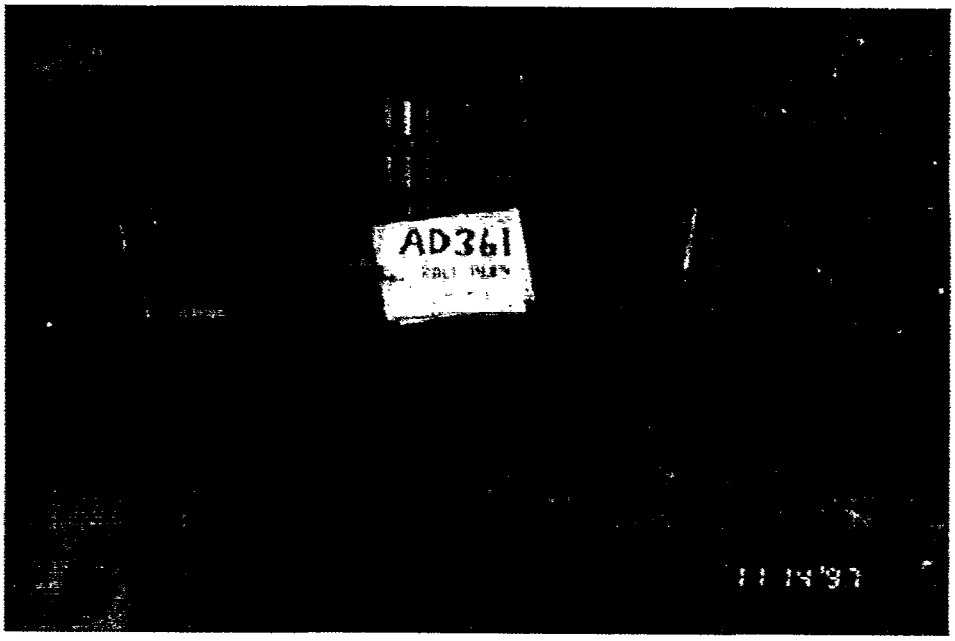


Figure 4.1-15 – Rex No. 2/Sixteen-to-one Mine and Mill Adit

Figure 4.1-16 - Tamarack
Tailings Pile.

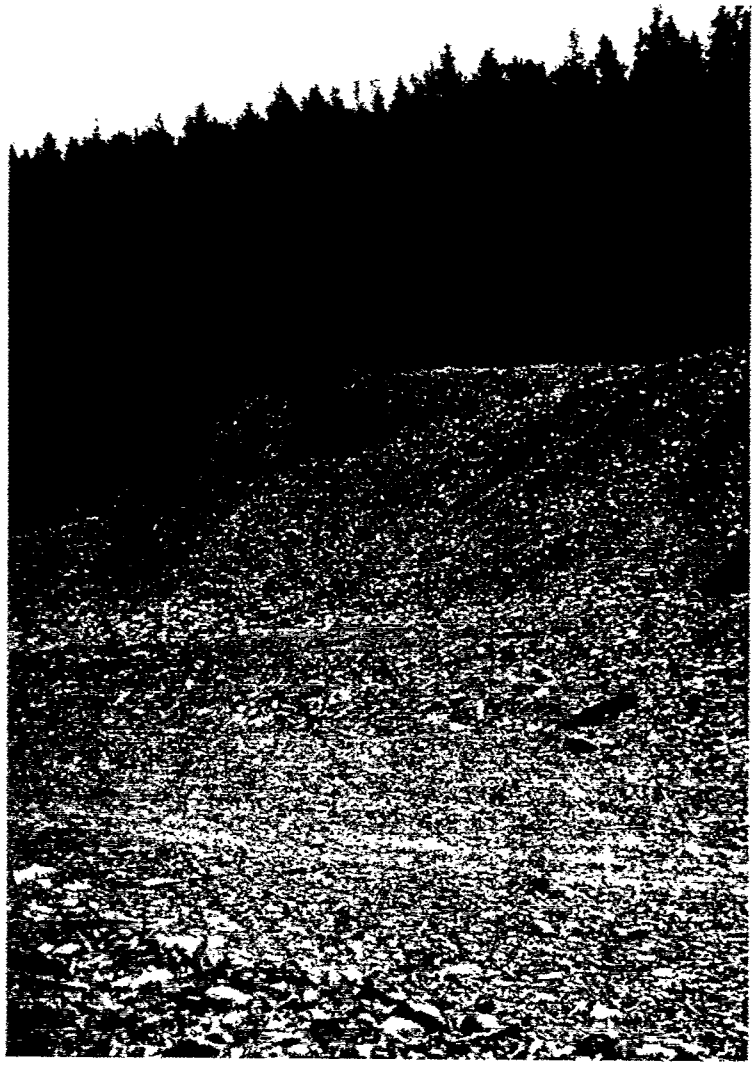


Figure 4.1-17 – Success Mine and Mill
Success No. 3 rock dump.

Figure 4.1-18 - Success Mine and Mill
Alameda Adit

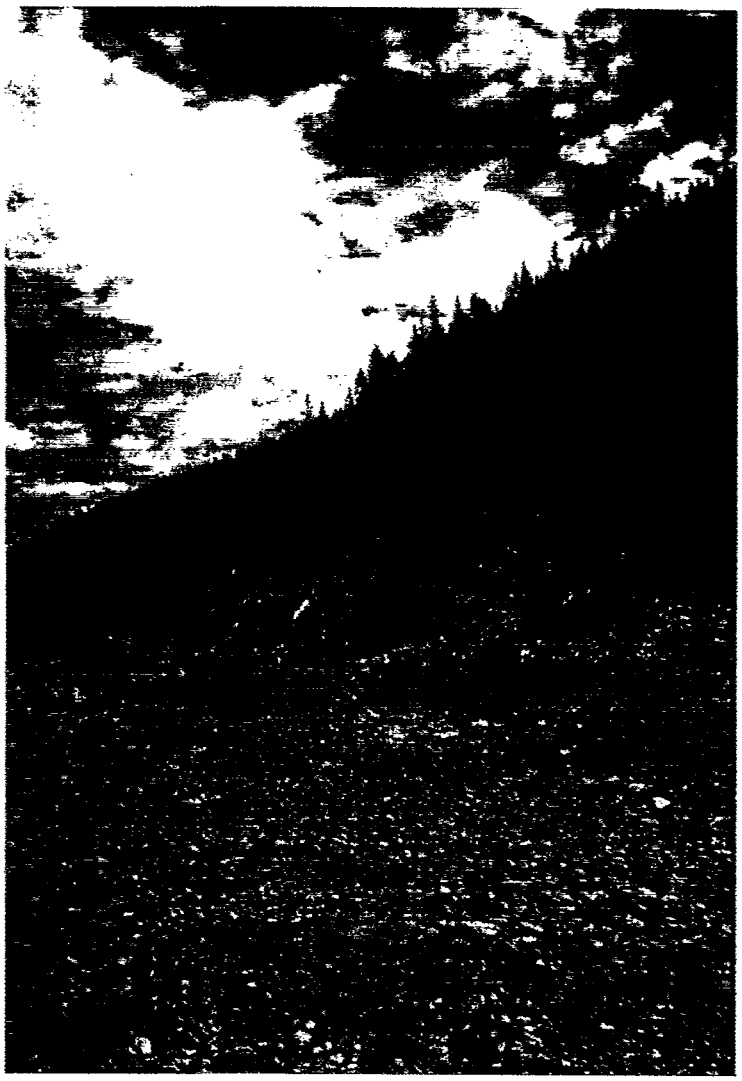


Figure 4.1-19 - Success Mine and Mill
Success No. 3 tailings pile.

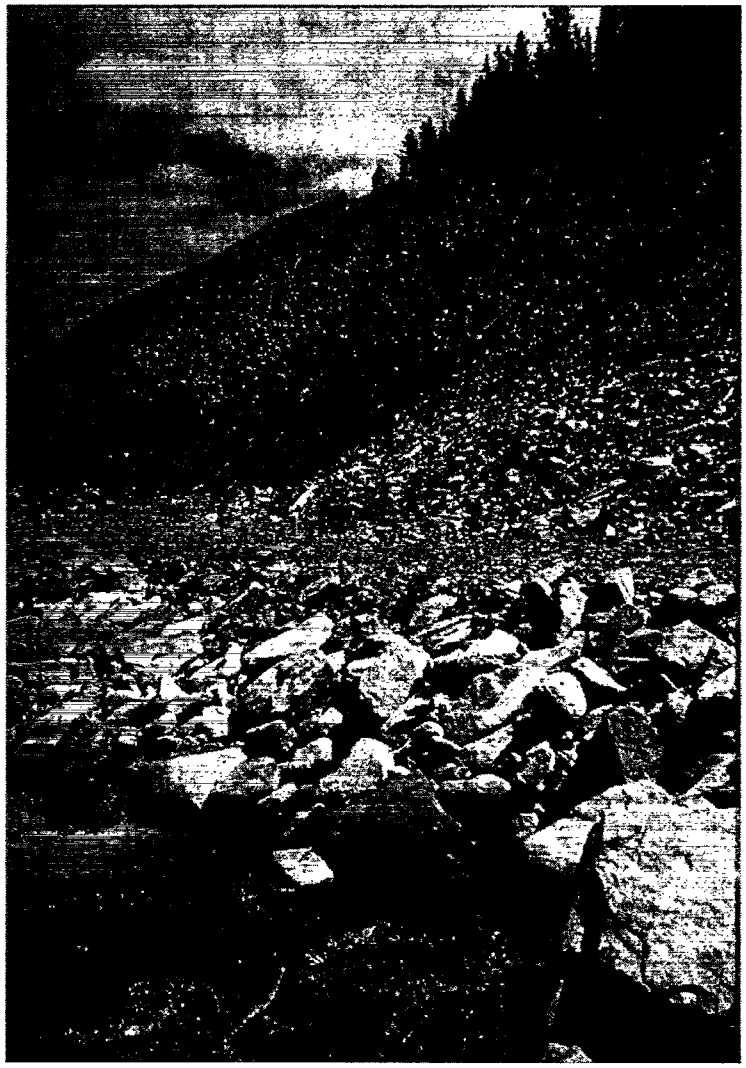
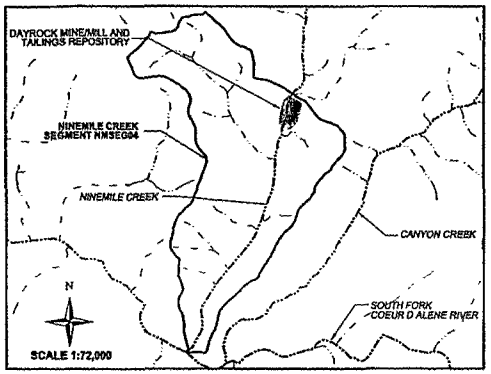


Figure 4.1-20 - Success Mine and Mill
Success No. 3 waste rock and tailings pile along Stream.

Figure 4.1-21 - Success Mine and Mill
Success No. 3 adit



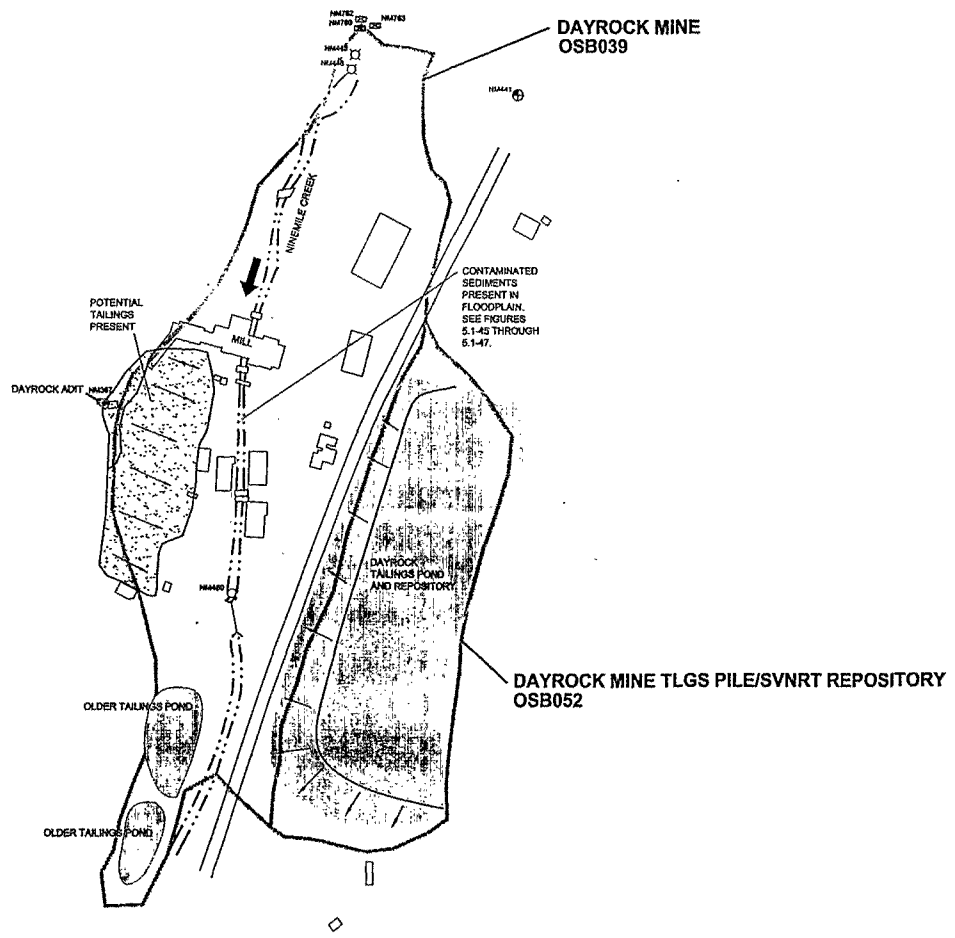


Figure 4.1-22
Dayrock Mine/Mill and Tailings Repository Site Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Tailings
- Adit Surface Water Sample
- Monitoring Well Groundwater Sample
- River Surface Water Sample
- Test Pit Soil Sample
- BLM Source Area

Location Map

SCALE 1:2,400
0 100 200 Feet

N

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4182500.8615.05.a
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Date: 07/19/01

This Map is based on Idaho State Plane Coordinates, West Zone North American Datum 1983

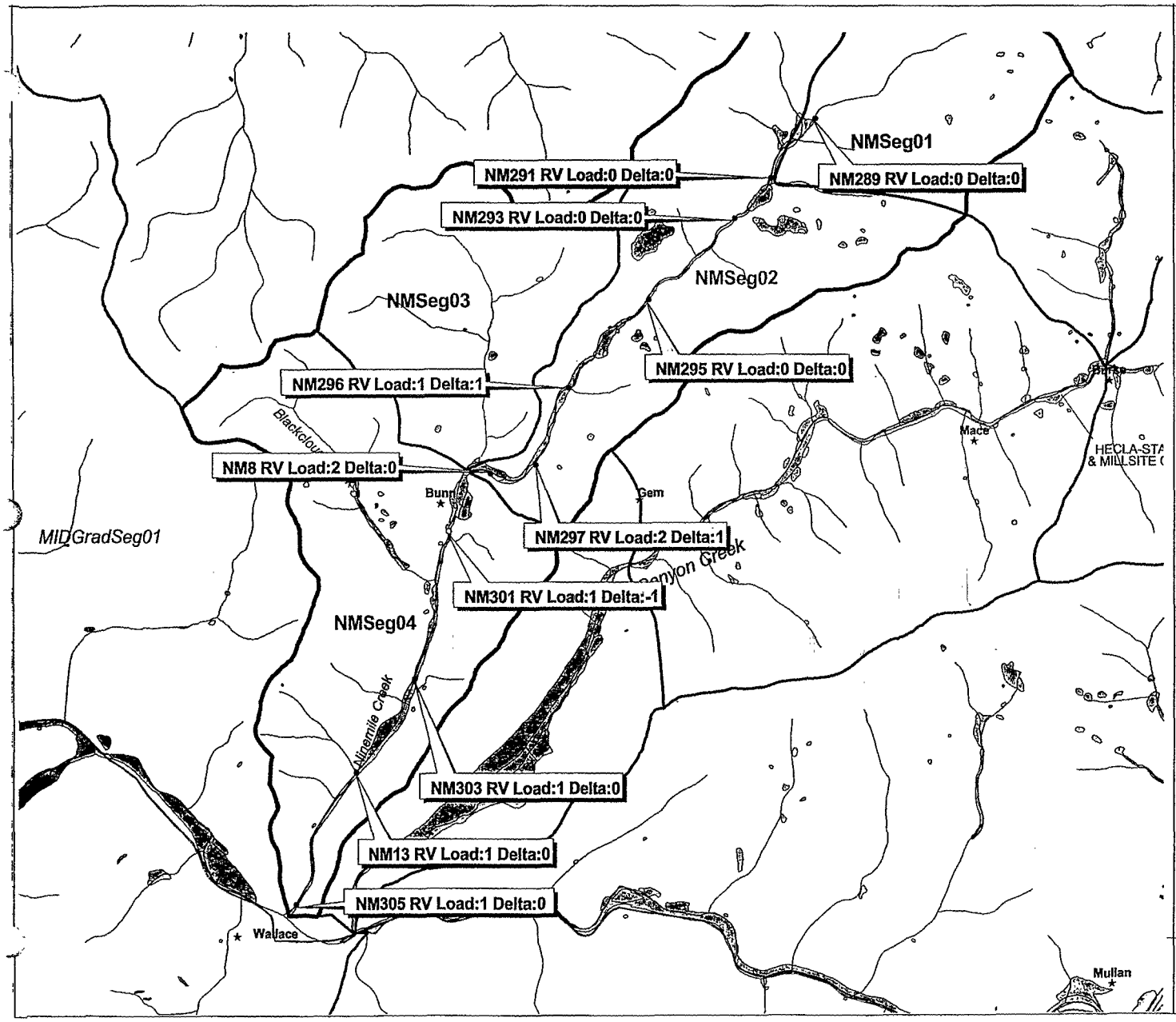

Figure 4.2-1
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results Oct. 1991

LEGEND

Sampling Location

Values are lbs/day

NM 13 RV Load: 1 Delta: 1

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000

0 1 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

EPA
REGION 10

Document Control 4162500.8615.05.a
Generation 1
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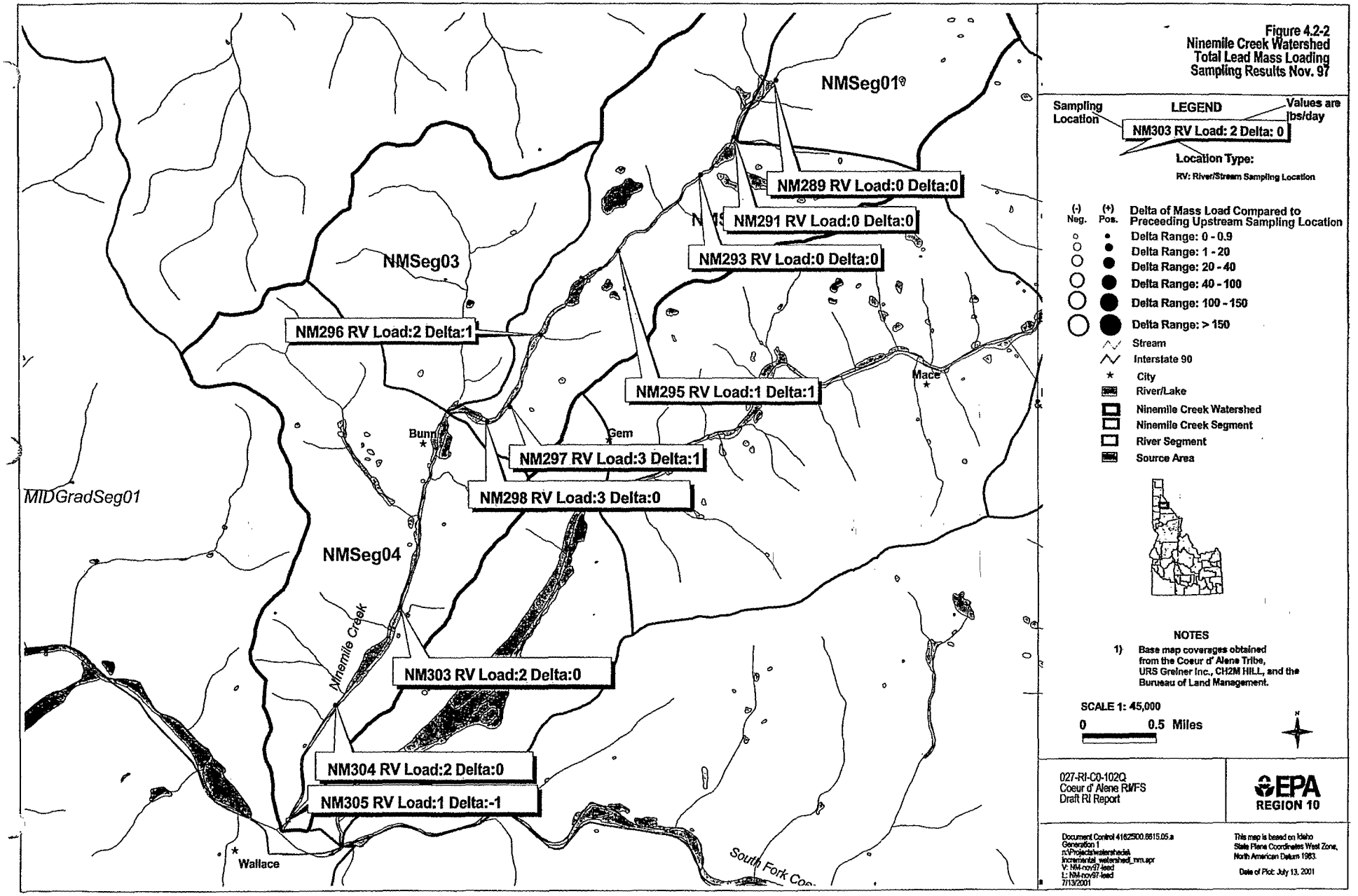
V: NM-oct91-lead
L: Final RI NM-oct91-lead
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001


NMSeg01
NMSeg03
NMSeg04
MIDGradSeg01
NM289 RV Load:0 Delta:0
NM291 RV Load:0 Delta:0
NM293 RV Load:0 Delta:0
NM296 RV Load:2 Delta:1
NM295 RV Load:1 Delta:1
NM297 RV Load:3 Delta:1
NM298 RV Load:3 Delta:0
NM303 RV Load:2 Delta:0
NM304 RV Load:2 Delta:0
NM305 RV Load:1 Delta:-1
Mace
Gem
Wallace
Ninemile Creek
South Fork Co
Figure 4.2-2
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results Nov. 97
LEGEND
Sampling Location
Values are lbs/day
NM303 RV Load: 2 Delta: 0
Location Type:
RV: River/Stream Sampling Location
(-) Neg.
(+) Pos.
Delta of Mass Load Compared to Preceeding Upstream Sampling Location
Delta Range: 0 - 0.9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150
Stream
Interstate 90
City
River/Lake
Ninemile Creek Watershed
Ninemile Creek Segment
River Segment
Source Area
NOTES
1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.
SCALE 1: 45,000
0 0.5 Miles
N
027-RI-C0-102Q
Coeur d' Alene RI/FS
Draft RI Report
EPA
REGION 10
Document Control 4162500.6615.05.a
Generation 1
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V: NM-nov97-lead
L: NM-nov97-lead
7/13/2001
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.
Date of Plot: July 13, 2001

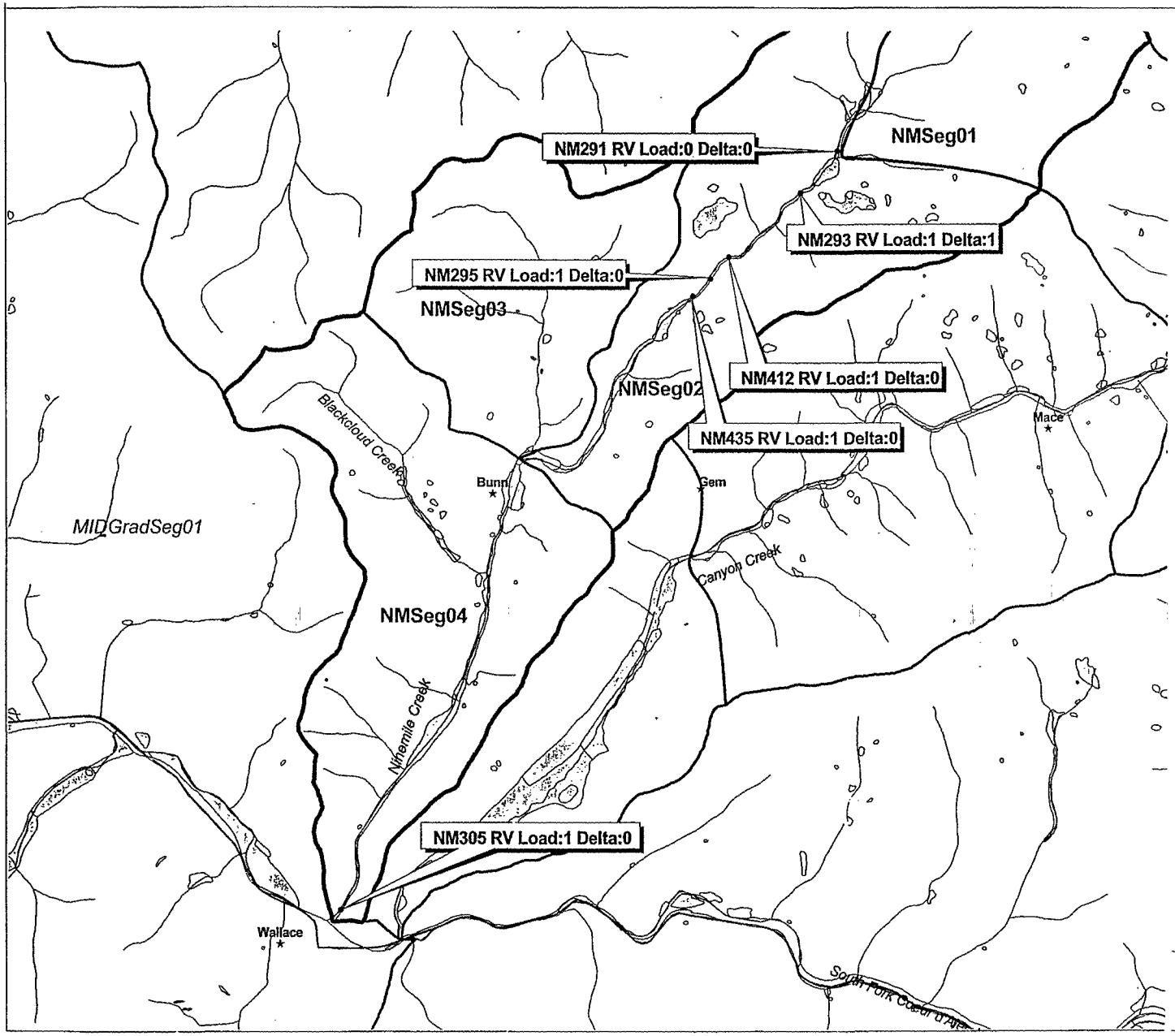

Figure 4.2-3
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results Nov. 1998

LEGEND

Sampling Location — Values are lbs/day

NM305 RV Load: 6 Delta: 0

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000

0 — 1 Miles

N

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

Document Control 4162500.6615.05.ai
Generation 1
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V: NM-nov98-lead
L: NM-nov98-lead
08/08/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 8, 2001

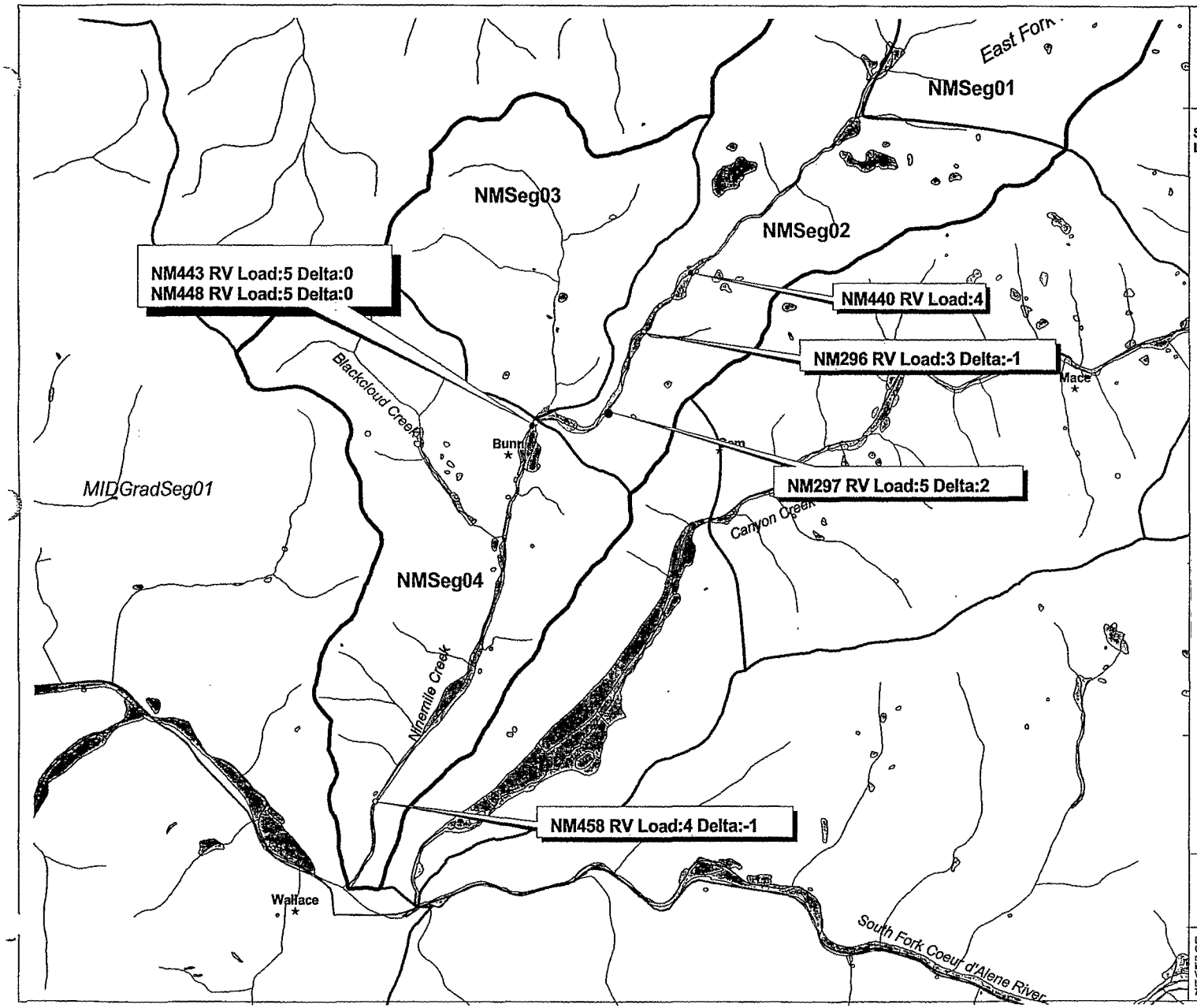

Figure 4.2-4
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results Dec. 1998

LEGEND

Sampling Location — Values are lbs/day

NM277 RV Load: 112 Delta: 66

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000

0 — 1 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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Document Control 4162500.6615.05.a
Generation 1
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V: NM-dec98-lead
L: Final RI NM-dec98-lead
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

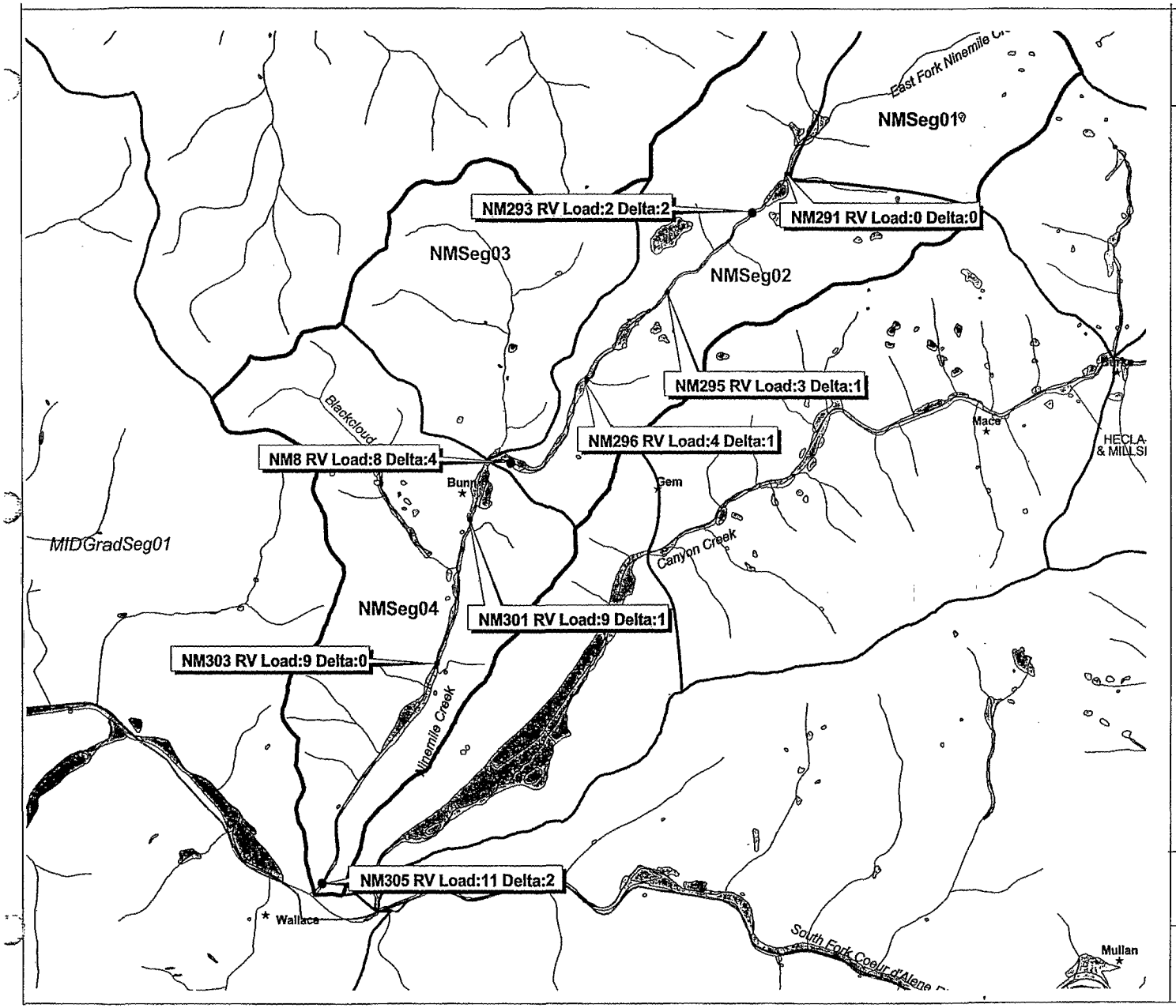

Figure 4.2-5
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results May 1991

LEGEND

Sampling Location — Values are lbs/day

NM8 RV Load: 8 Delta: 4

Location Type:
RV: River/Stream Sampling Location

(-) Neg.	(+) Pos.	Delta of Mass Load Compared to Preceeding Upstream Sampling Location
○	•	Delta Range: 0 - 0.9
○	•	Delta Range: 1 - 20
○	•	Delta Range: 20 - 40
○	•	Delta Range: 40 - 100
○	•	Delta Range: 100 - 150
○	•	Delta Range: > 150

Stream
Interstate 90
City
River/Lake
Ninemile Creek Watershed
Ninemile Creek Segment
River Segment
Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 45,000
0 — 1 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
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Document Control 4162500.6815.05.a
Generation 1
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V: NM-may91-lead
L: Final RI NM-may91-lead
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

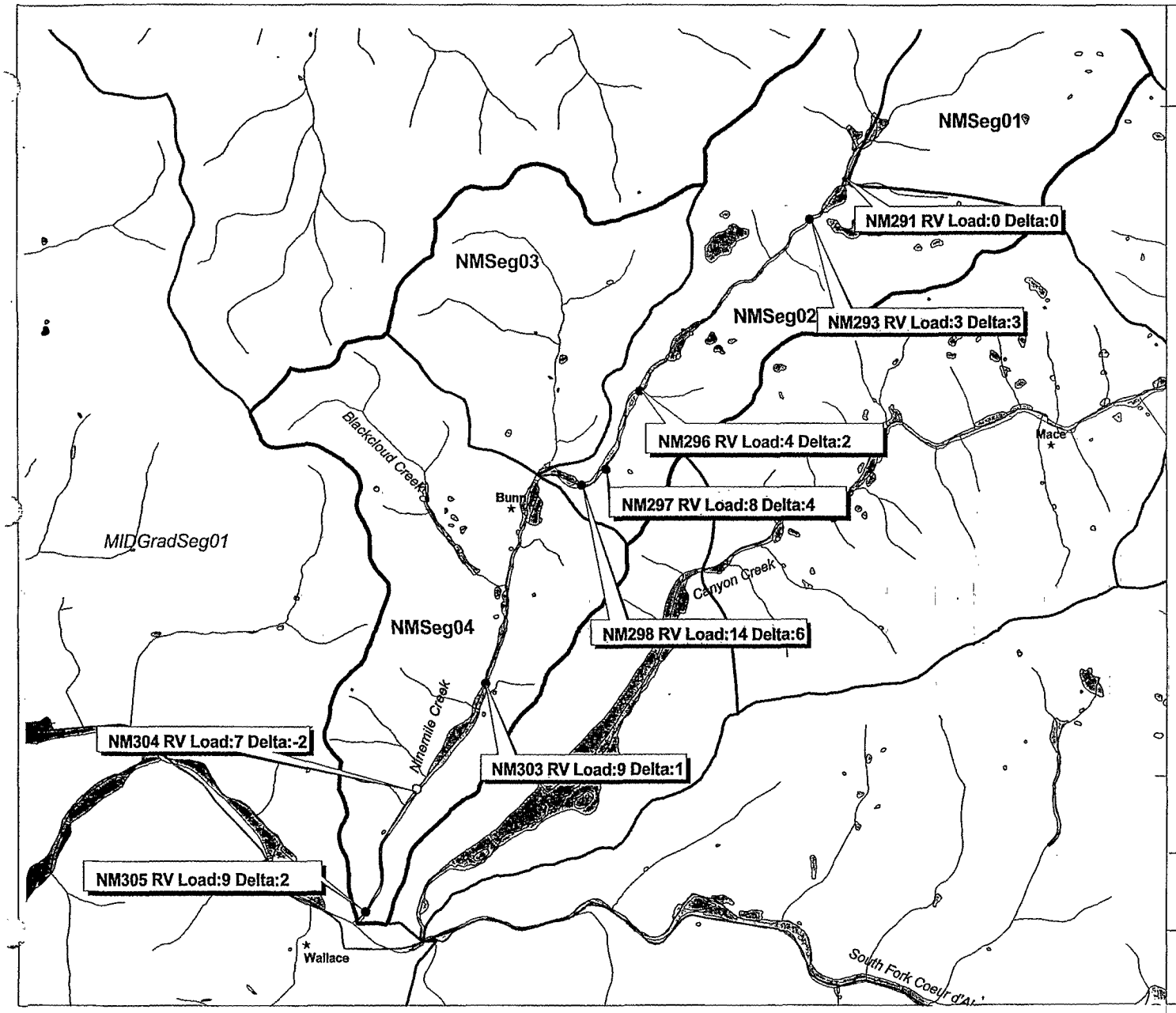


Figure 4.2-6
Ninemile Creek Watershed
Total Lead Mass Loading
Sampling Results May 1998

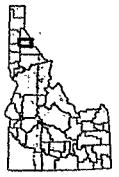
LEGEND

Sampling Location — NM294 RV Load: 19 Delta: -3 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area



NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

0 SCALE 1: 45,000 1 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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Document Control 4162500.6615.05.a
Generation 1
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V: NM-may-98-lead
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7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

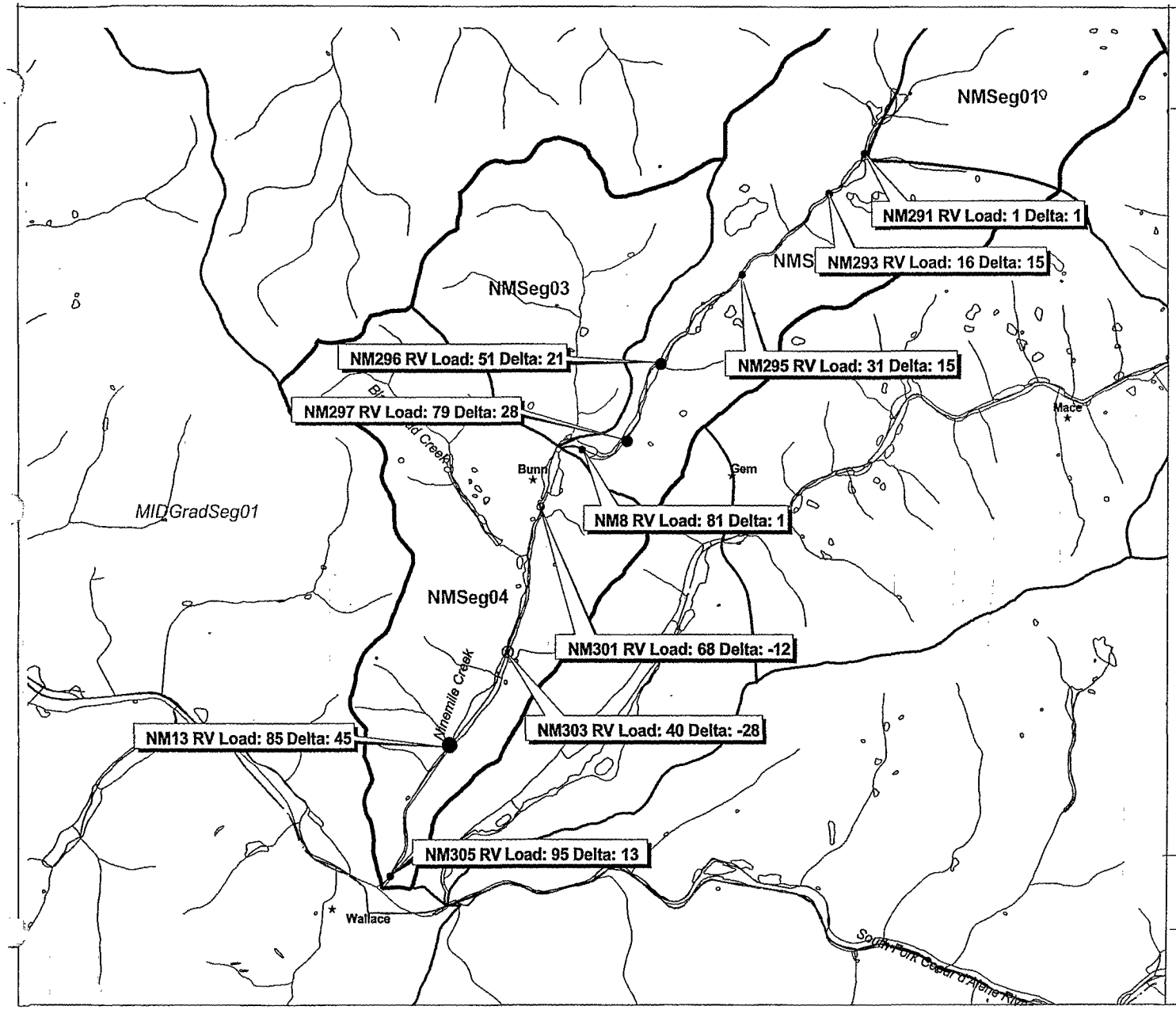

Figure 4.2-7
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results Oct. 1991

LEGEND

Sampling Location — Values are lbs/day

NM 13 RV Load: 85 Delta: 45

Location Type:
RV: River/Stream Sampling Location

(-) Neg.	(+) Pos.	Delta of Mass Load Compared to Preceeding Upstream Sampling Location
○	•	Delta Range: 0 - 0.9
○	•	Delta Range: 1 - 20
○	●	Delta Range: 20 - 40
○	●	Delta Range: 40 - 100
○	●	Delta Range: 100 - 150
○	●	Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

0 — 1 Miles

SCALE 1: 45,000

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

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Document Control 4162500.8615.05.a
Generation 1
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V: NM-oct91-zinc
L: NM-oct91-zinc
7/19/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 19, 2001

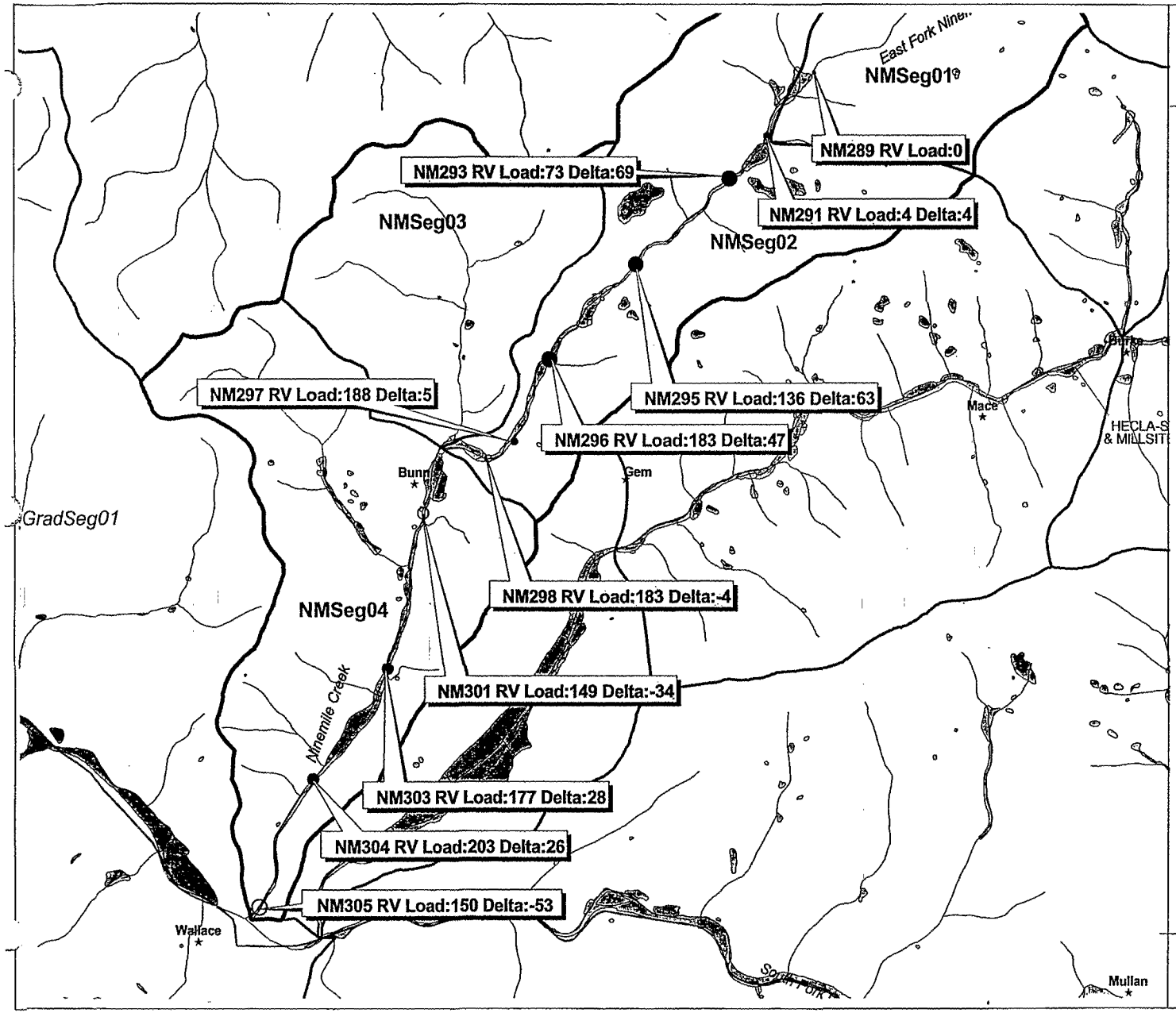

Figure 4.2-8
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results Nov. 1997

LEGEND

Sampling Location — Values are lbs/day

NM305 RV Load: 150 Delta: 0

Location Type:
RV: River/Stream Sampling Location

(-) Neg.	(+) Pos.	Delta of Mass Load Compared to Preceeding Upstream Sampling Location
○	•	Delta Range: 0 - 0.9
○	•	Delta Range: 1 - 20
○	●	Delta Range: 20 - 40
○	●	Delta Range: 40 - 100
○	●	Delta Range: 100 - 150
○	●	Delta Range: > 150

Stream
Interstate 90
City
River/Lake
Ninemile Creek Watershed
Ninemile Creek Segment
River Segment
Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000
0 — 0.5 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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Document Control 4162500.6615.05.a
Generation 1
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Incremental_watershed_nm.apr
V: NM-nov97-zinc
L: Final NM-nov97-zinc
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

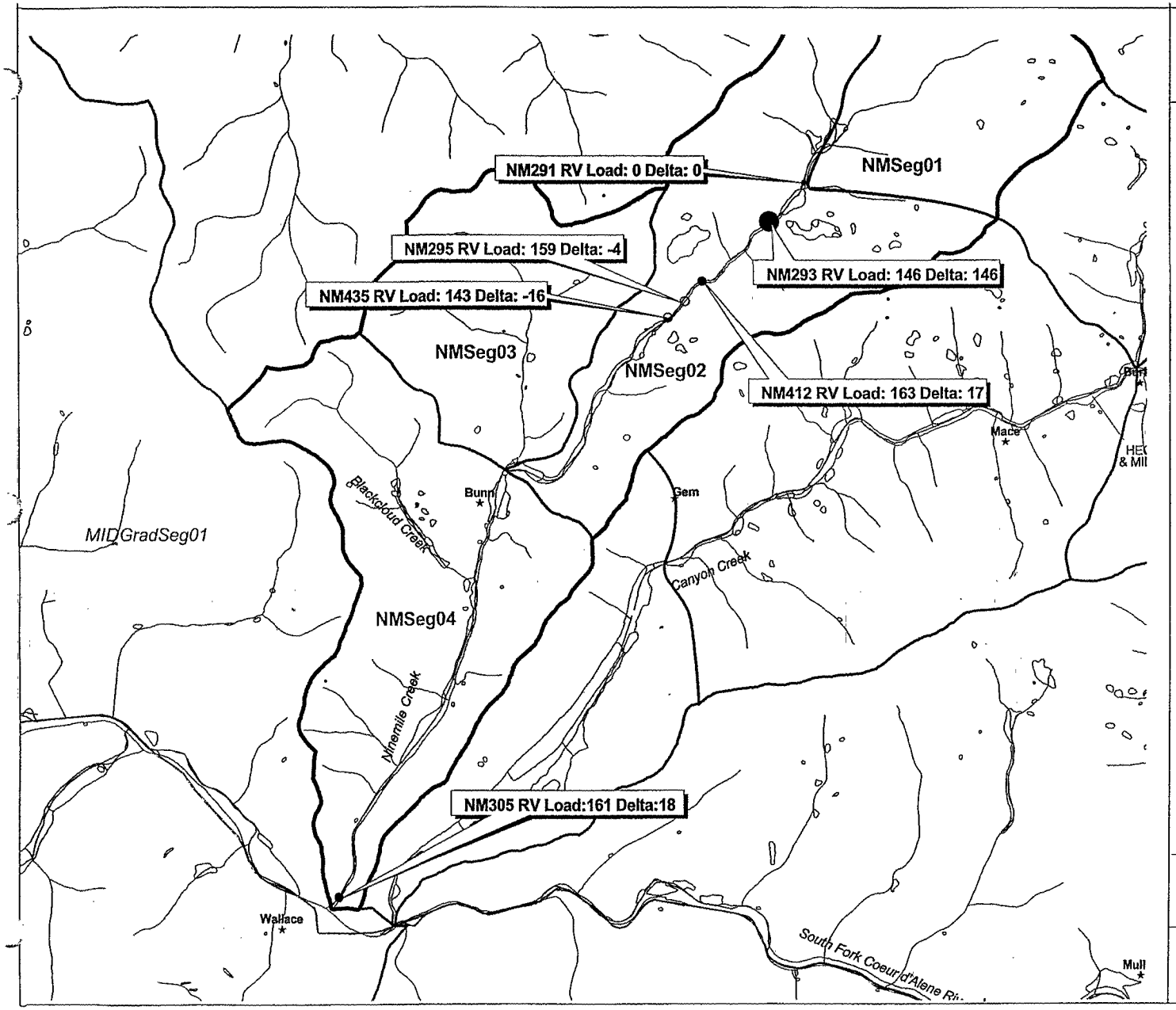

Figure 4.2-9
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results Nov. 1998

LEGEND

Sampling Location — Values are lbs/day

NM435 RV Load: 143 Delta: -16

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

0 — 1 Miles

SCALE 1: 45,000

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V: NM-nov98-Zinc
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7/19/2001

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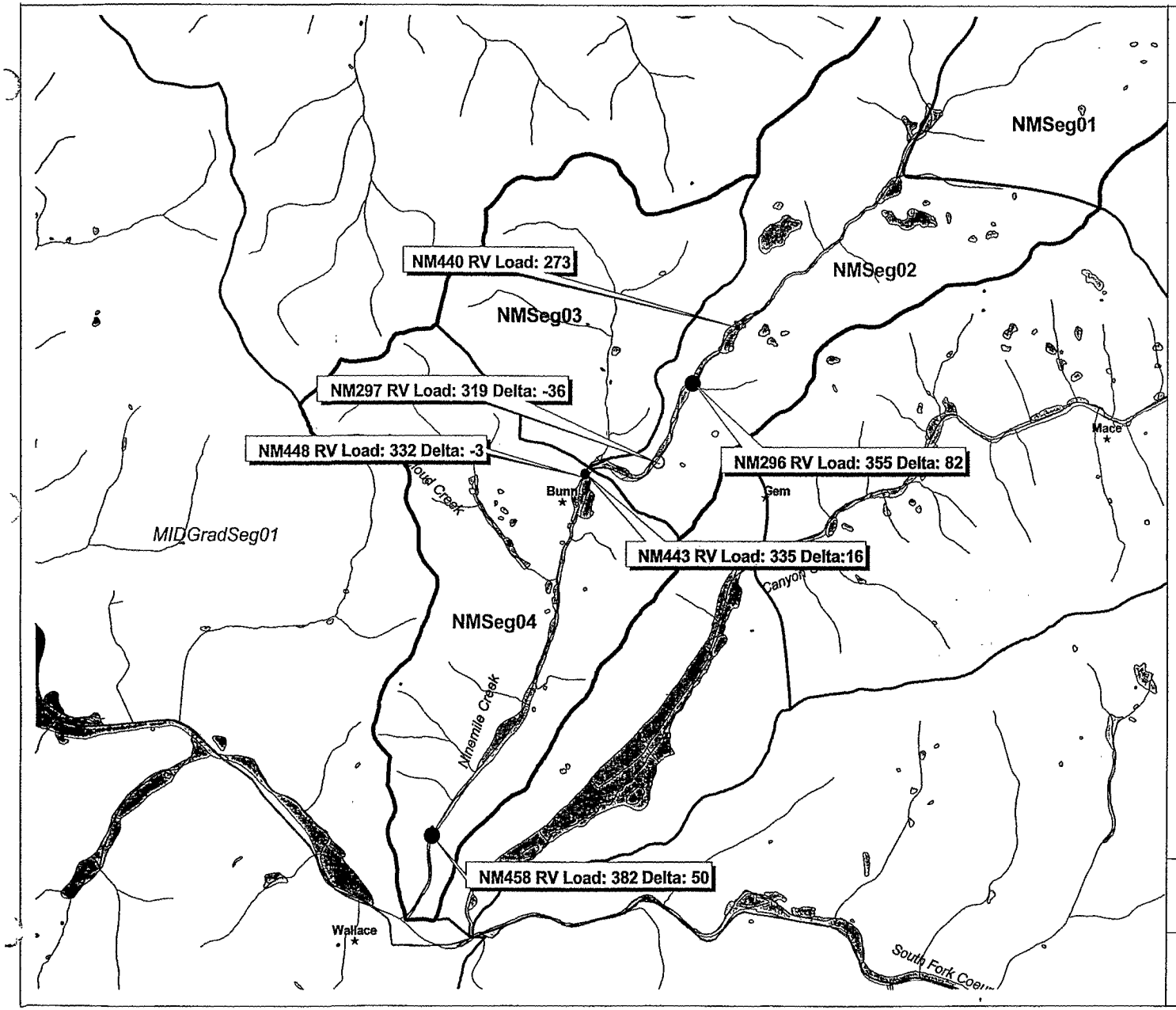


Figure 4.2-10
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results Dec. 1998

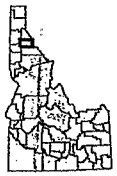
LEGEND

Sampling Location — NM440 RV Load: 273 Delta: 0 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area



NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000

0 — 1 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

EPA REGION 10

Document Control 4162500.6615.05.a
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V: NM-dec98-zinc
L: Final RI NM-dec98-zinc
7/17/2001

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Date of Plot: July 17, 2001

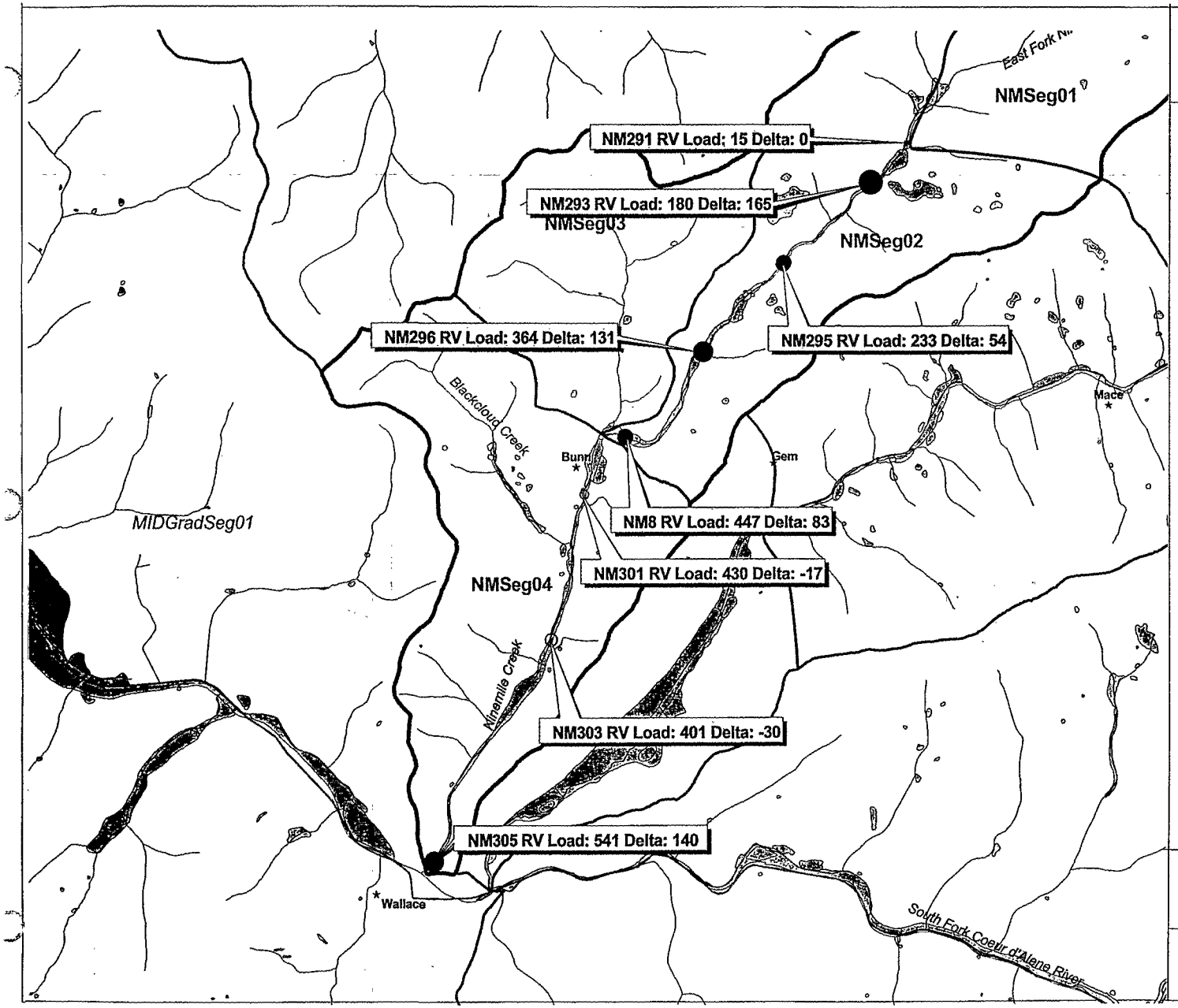

Figure 4.2-11
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1991

LEGEND

Sampling Location — Values are lbs/day

NM305 RV Load: 541 Delta: 140

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 45,000

0 — 1 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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Document Control 4162500.8615.05.a
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7/17/2001

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Date of Plot: July 17, 2001

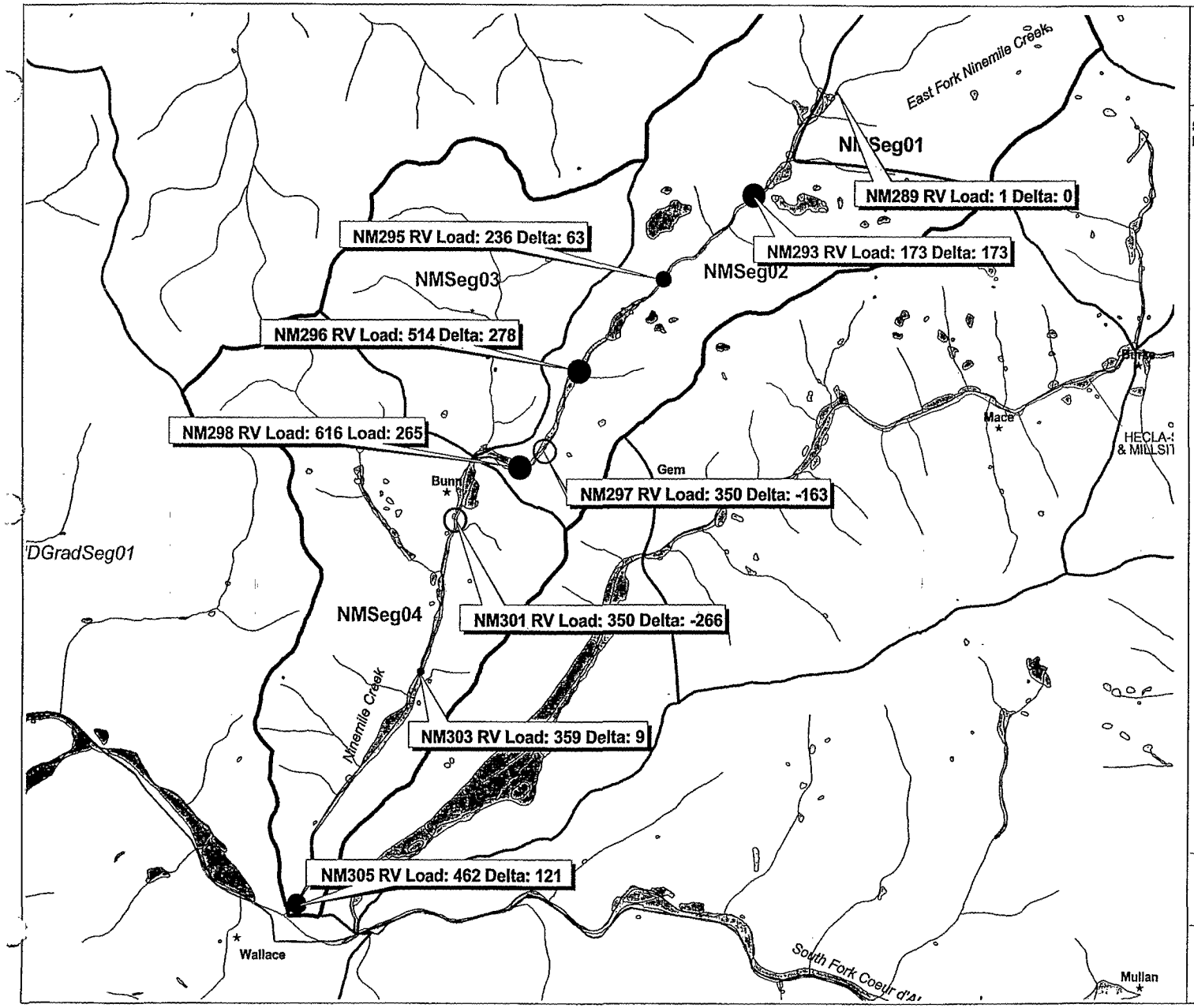


Figure 4.2-12
Ninemile Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1998

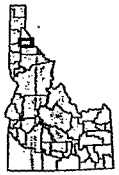
LEGEND

Sampling Location — NM301 RV Load: 350 Delta: 0 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Source Area



NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 45,000

0 — 1 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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V: NM-may98-zinc
L: Final RI NM-may98-zinc
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

Table 4.1-1
Potential Source Areas Within Nine Mile Creek - segment NmSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
AMBERGRIS MINE	BUR083	0.32	Upland waste rock				
GUELPH MINE	BUR081	0.61	Upland waste rock				
HERCULES NO. 2 (NINEMILE)	BUR084	0.27	Upland waste rock				
INTERSTATE-CALLAHAN LOWER ROCK DUMPS	BUR160	4.20	Upland waste rock (erosion potential)				
INTERSTATE-CALLAHAN MINE/ROCK DUMPS	BUR053	8.45	Adit drainage Seep Upland waste rock (erosion potential)	SW 7	SWD: Cd-2, Pb-1, Zn-3 SWT: Cu-1, Fe-1, Zn-5		
LACLEDE MINE	BUR077	1.14	Upland waste rock				
LITTLE SUNSET MINE	BUR052	0.16	Upland waste rock				
NINEMILE CREEK IMPACTED FLOODPLAIN	BUR140	5.50	Floodplain sediments	SD 2 SW 29	SDT: Ag-1, Cd-1, Cu-2, Fe-1, Hg-2, Mn-2, Sb-1 SWD: Cd-27, Pb-13, Zn-27 SWT: Cd-1, Pb-2, Zn-20	SDT: Cd-1, Pb-1, Zn-2 SWT: Zn-7	SDT: Pb-1
SUNSET MINE	BUR051	1.81	Adit drainage Upland waste rock				
UNIDENTIFIED DISTURBANCE	BUR082	0.42	Upland waste rock				

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1-2
Potential Source Areas Within Nine Mile Creek - segment NmSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
ALAMEDA MINE	OSB088	0.51	Floodplain waste rock	SS	1	SST: Cd-1	SST: Pb-1, Zn-1	
ALAMEDA PROSPECT	OSB045	0.84	Upland waste rock					
AMERICAN MINE	OSB048	0.15	Upland waste rock					
EF NINEMILE CK HECLA REHAB	OSB040	9.35	Floodplain sediments	SD SW	2 10	SDT: Ag-1, Cd-1, Cu-2, Sb-1, Zn-1 SWD: Cu-1, Mn-2 SWT: Cd-2, Cu-1, Mn-2, Pb-2, Zn-2	SDT: Cd-1, Pb-2, Sb-1, Zn-1 SWD: Cd-3, Mn-1, Pb-3, Zn-2 SWT: Cd-2, Pb-2, Zn-2	SWD: Cd-1, Pb-1, Zn-2 SWT: Zn-1
EF NINEMILE CK IMPACTED RIPARIAN	OSB056	10.97	Floodplain sediments	DR FL PL RK SL SW	1 1 1 3 1 48	SST: Cd-4, Cu-3, Fe-3, Pb-2, Zn-5 SWD: Cd-2, Mn-4, Pb-12 SWT: Cd-38, Fe-1, Mn-4, Pb-36	SST: Pb-2 SWD: Cd-39, Mn-4, Pb-33, Zn-39 SWT: Cd-8, Mn-3, Zn-29	SST: Pb-1 SWD: Cd-5, Zn-5 SWT: Zn-16
EF NINEMILE CK IMPACTED RIPARIAN	OSB057	9.67	Floodplain sediments	SD SW	4 69	SDT: Ag-2, Cu-2, Hg-2, Mn-1 SWD: Cu-3, Mn-1, Pb-1 SWT: Cd-14, Cu-2, Mn-2, Pb-58	SDT: Cd-2, Pb-3, Zn-2 SWD: Cd-50, Mn-1, Pb-62, Zn-16 SWT: Cd-55, Cu-1, Pb-10, Zn-9	SDT: Cd-1, Zn-1 SWD: Cd-17, Pb-4, Zn-50 SWT: Pb-1, Zn-59
EF NINEMILE CK SVNRT REHAB	OSB058	12.14	Floodplain sediments	SS SW	3 52	SST: As-2, Cd-2, Cu-3, Zn-3 SWD: Cu-1, Mn-3 SWT: Cd-8, Cu-2, Mn-1, Pb-22	SST: Pb-1 SWD: Cd-25, Pb-27, Zn-12 SWT: Cd-42, Pb-28, Zn-8	SST: Pb-2 SWD: Cd-26, Pb-24, Zn-39 SWT: Pb-1, Zn-43
INDUS CLAIM UNNAMED ADIT	BUR196	0.31	Upland waste rock					
INTERSTATE MILLSITE	BUR055	8.96	Floodplain sediments Seep Upland tailings	SW	2	SWD: Fe-1 SWT: Sb-1	SWD: Cu-1 SWT: Fe-1, Pb-1	SWD: Cd-2, Cu-1, Mn-1, Pb-2, Zn-1 SWT: Cd-2, Cu-2, Mn-1, Pb-1, Zn-1
LANSING MINE (ALBION)	OSB046	0.35	Upland waste rock					
MEDICO CLAIM UNNAMED ADIT	BUR197	0.46	Upland waste rock					
REX NO.1	BUR139	1.31	Upland waste rock					
REX NO.2 / SIXTEEN-TO-ONE MINE	BUR054	21.40	Adit drainage Seep Upland Tailings (flotation tailings) Upland waste rock (potential intermixed tailings)	GW PL RK SB SL SS SW	4 9 8 8 3 8 6	GWD: Mn-1, Pb-2 GWT: Cd-4, Fe-2, Mn-3, Pb-2 SBT: As-4, Cd-4, Cu-1, Pb-1, Zn-2 SST: As-3, Cd-7, Cu-6, Fe-4, Pb-5, Zn-5 SWD: Cu-1, Fe-1, Mn-1, Pb-1 SWT: Cd-5, Cu-4, Fe-2, Pb-6	GWD: Cd-4, Mn-1, Zn-3 GWT: Mn-1, Zn-3 SBT: Pb-3, Sb-1, Zn-3 SST: Cd-1, Cu-2, Pb-8, Zn-6 SWD: Cd-5, Mn-2, Pb-2, Zn-3 SWT: Cd-1, Mn-2, Zn-4	GWD: Mn-1, Zn-1 GWT: Zn-1 SBT: Pb-1 SST: Pb-3, Zn-1 SWD: Pb-1, Zn-2 SWT: Zn-2
SUCCESS MINE ADJACENT DISTURBANCE	BUR062	0.68	Upland waste rock					

Table 4.1-2
Potential Source Areas Within Nine Mile Creek - segment NmSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
SUCCESS MINE ROCK DUMP	OSB044	10.26	Floodplain sediments Groundwater Upland Tailings (jig tailings) Upland waste rock	PL RK SL SS SW	1 3 2 3 6	SST: As-1, Cd-3, Cu-5, Fe-3, Zn-4 SWD: Cu-2 SWT: Fe-1, Mn-5, Pb-3	SST: Cd-1, Pb-7, Zn-2 SWD: Cu-1, Mn-5, Pb-4 SWT: Cd-5, Cu-3, Pb-2	SST: Zn-1 SWD: Cd-5, Zn-4 SWT: Zn-1
SUCCESS NO.1	BUR061	1.42	Upland waste rock					
SUCCESS NO.2	BUR060	2.14	Upland waste rock					
SUCCESS NO.3	OSB089	0.27	Adit drainage Upland waste rock	SW	1	SWD: Cu-1, Pb-1 SWT: Pb-1	SWT: Cu-1	SWD: Cd-1 SWT: Cd-1
TAMARACK 400 LEVEL	BUR170	0.95	Adit drainage Upland waste rock (potential intermixed tailings)	SW	2	SWD: Cd-1, Pb-1, Zn-2 SWT: Zn-2		
TAMARACK MILLSITE	BUR173	0.97	Upland tailings					
TAMARACK NO.1 & NO.2 (CUSTER MINE)	BUR059	1.74	Upland waste rock					
TAMARACK NO.3	BUR058	0.97	Upland waste rock					
TAMARACK NO.4	BUR057	0.91	Upland waste rock					
TAMARACK NO.5	BUR171	0.66	Adit drainage Upland waste rock (potential intermixed tailings)	SW	2	SWD: Cd-1, Mn-1, Pb-1, Zn-2 SWT: Cu-1, Mn-1, Pb-2, Zn-1	SWT: Zn-1	
TAMARACK ROCK DUMPS	BUR056	13.34	Upland waste rock (potential intermixed tailings)					
TAMARACK UNNAMED ADIT	BUR172	0.43	Upland waste rock					
TAMARACK UNNAMED ADJACENT ROCK DUMP	BUR205	0.65	Upland waste rock					

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1-3
Potential Source Areas Within Nine Mile Creek - segment NmSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
GALENA NO. 2	OSB041	0.82	Upland waste rock				
MAYFLOWER NO.3	OSB043	1.34	Upland waste rock				
NINEMILE MINING COMPANY NO.1	OSB081	0.14	Upland waste rock				
NINEMILE MINING COMPANY NO.2	OSB042	0.19	Upland waste rock				
TREASURE VAULT	OSB049	0.55	Upland waste rock				
UNNAMED TUNNEL	OSB087	0.10	Upland waste rock				

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1-4
Potential Source Areas Within Nine Mile Creek - segment NmSeg04

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BLACKCLOUD CK IMPACTED RIPARIAN	OSB084	1.23	Floodplain sediments				
BLACKCLOUD CK IMPACTED RIPARIAN	OSB085	8.96	Floodplain sediments				
BLACKCLOUD CK MILLSITE	OSB061	1.50	Upland tailings				
BLACKCLOUD NO.3	OSB083	0.77	Upland waste rock				
CALIFORNIA NO.4	OSB038	1.28	Floodplain waste rock				
DAYROCK MINE	OSB039	11.76	Adit drainage Buildings & structures Floodplain sediments Upland tailings Upland waste rock	SW 7	SWD: Cu-1, Mn-5 SWT: Cu-6, Mn-5, Pb-5, Zn-1	SWD: Fe-1, Pb-5 SWT: Cd-5, Fe-1, Pb-1	SWD: Cd-5, Mn-1, Zn-5 SWT: Mn-1, Zn-4
DAYROCK MINE TLGS PILE/SVNRT REPOSITORY	OSB052	5.55	Floodplain tailings				
DULUTH MINE BLACKCLOUD CK	OSB032	0.84	Floodplain waste rock	SW 1	SWD: Mn-1, Zn-1 SWT: Mn-1, Zn-1		
IDAHO GALENA PROSPECT	OSB031	0.56	Upland waste rock				
MCDONALD MINE	OSB034	0.30	Upland waste rock				
MONARCH MINE BLACKCLOUD CK	OSB082	0.54	Floodplain waste rock				
NINEMILE CK BELOW DAYROCK MINE	OSB059	5.43	Floodplain sediments	SW 7	SWD: Mn-5 SWT: Cd-2, Cu-4, Mn-4, Pb-7	SWD: Cd-4, Pb-7, Zn-2 SWT: Cd-5, Zn-2	SWD: Cd-3, Zn-5 SWT: Zn-5
NINEMILE CK POTENTIAL TAILINGS DEPOSIT	WAL033	31.73	Floodplain sediments	GW 5 SB 2 SD 5 SS 4 SW 104	GWT: Cd-4 SDT: Ag-3, As-2, Cu-3, Hg-1, Mn-3, Zn-2 SST: As-3, Cd-2, Cu-2, Zn-2 SWD: Mn-10, Pb-1 SWT: Cd-47, Cu-2, Fe-3, Mn-8, Pb-89	GWD: Cd-4, Zn-4 GWT: Zn-4 SDT: Cd-3, Pb-2, Sb-3, Zn-3 SST: Pb-4, Zn-2 SWD: Cd-96, Pb-100, Zn-73 SWT: Cd-55, Pb-11, Zn-47	SDT: Pb-3 SWD: Cd-5, Zn-28 SWT: Pb-1, Zn-54
NINEMILE CK SVNRT REHAB NEAR BLACKCLD	OSB060	15.87	Floodplain sediments	SD 2 SW 38	SDT: Ag-1, Cu-1, Hg-1, Mn-1, Sb-1 SWD: Mn-3, Zn-1 SWT: Cd-6, Cu-2, Mn-2, Pb-33	SDT: Cd-1, Pb-1, Zn-1 SWD: Cd-34, Pb-35, Zn-19 SWT: Cd-32, Pb-5, Zn-6	SWD: Cd-4, Pb-3, Zn-18 SWT: Zn-32
NORTHSIDE MINE	WAL006	0.25	Upland waste rock (erosion potential)				
OPTION MINE	OSB115	0.34	Upland waste rock (erosion potential)				
PANHANDLE MINE	OSB116	0.31	Upland waste rock				
RUTH MINE	OSB033	0.68	Upland waste rock (erosion potential)				
SIERRA SILVER MINE	WAL069	0.24	Upland waste rock				
SILVER STAR MINE	OSB055	0.36	Adit drainage Upland waste rock	SW 1			

Table 4.1-4
Potential Source Areas Within Nine Mile Creek - segment NmSeg04

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
THOMAS CONSOLIDATED SHAFT	OSB054	0.31	Adit drainage				
UNIDENTIFIED DISTURBANCE	OSB035	0.49	Upland waste rock				
UNIDENTIFIED DISTURBANCE	OSB036	0.25	Upland waste rock				
UNNAMED ADIT	OSB037	0.71	Upland waste rock				
UNNAMED ADIT	OSB114	0.22	Upland waste rock				
UNNAMED ADIT	WAL075	0.09	Upland waste rock				
UNNAMED ADIT	WAL078	0.27	Upland waste rock				

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1.5-1
Adit and Seep Data Summary

BLM ID	Source Name	Average discharge, cfs	Maximum Discharge, cfs	Average total zinc concentration, ug/L	Average total zinc load, lbs/day
Adits					
OSB089	Success No. 3	0.019	0.035	62,100	6.3
BUR054	Rex No. 2	0.017	0.027	1,995	0.18
BUR170	Tamarack 400 Level	0.083	0.083	111	0.050
BUR171	Tamarack No. 5	0.032	0.061	195	0.034
BUR053	Interstate-Callahan	0.072	0.14	60	0.023
OSB055	Silver Star	0.0096	0.0096	125	0.0065
OSB039	Dayrock	0.0068	0.0068	76	0.0028
BUR051	Sunset	No data	No data	28,400	No discharge data
BUR056	Tamarack Rock Dumps	No data	No data	No data	No data
BUR058	Tamarack No. 3	No data	No data	No data	No data
BUR081	Guelph	No data	No data	No data	No data
OSB032	Duluth (Blackcloud Cr.)	No data	No data	No data	No data
OSB054	Thomas Consolidated Shaft	No data	No data	No data	No data
OSB087	Unnamed tunnel	No data	No data	No data	No data
OSB088	Alameda	No data	No data	No data	No data
Seeps					
BUR055	Interstate-Callahan Mill	0.0043	0.007	350,000	8.1
BUR054	Rex No. 2	0.03	0.03	11,400	1.8
BUR053	Interstate-Callahan Rock Dumps	1.8	4.27	182	1.8
OSB044	Success	No data	No data	No data	No data

Notes:
Data compiled from the Restorations Alternative Plan (Gearheart et al. 1999). See Appendix J.

Table 4.2-1
Ninemile Watershed Mass Loading

							TOTAL LEAD			DISSOLVED ZINC		
Location	Sample Number	CSM Segment	Loc. Type	Sample Date	Flow CFS	Flow Delta	Concentration µg/L	Mass Load lbs/day	Delta* lbs/day	Concentration µg/L	Mass Load lbs/day	Delta* lbs/day
NM291	172022	1	RV	16-May-91	20	0.0	3	0	0	137	15	0
NM293	172023	1	RV	16-May-91	25.5	5.5	15	2	2	1310	180	165
NM295	172024	1	RV	16-May-91	31.2	5.7	16	3	1	1390	233	54
NM296	172025	1	RV	16-May-91	30.9	-0.3	24	4	1	2190	364	131
NM8	172019	1	RV	16-May-91	33.5	2.6	46	8	4	2480	447	83
NM301	172027	1	RV	16-May-91	39.2	5.7	42	9	1	2040	430	-17
NM303	172028	1	RV	16-May-91	39.6	0.4	41	9	0	1880	401	-30
NM305	172017	1	RV	16-May-91	50.5	10.9	40	11	2	1990	541	140
NM291	46379	1	RV	14-May-98	22.9	0.0	0.3	0	0	0	0	0
NM298	46387	1	RV	14-May-98	55.6	55.6	48.2	14	14	2060	616	616
NM289	46377	1	RV	14-May-98	18.1	-37.5	1	0	-14	11	1	-615
NM293	46381	1	RV	14-May-98	26.2	8.1	19.7	3	3	1230	173	172
NM294	46383	1	RV	14-May-98	0.14	-26.1	19.1	0	-3	4580	3	-170
NM295	46394	1	RV	15-May-98	31.5	31.4	13.9	2	2	1390	236	232
NM296	46393	1	RV	16-May-98	28	-3.5	26.8	4	2	3410	514	278
NM297	46392	1	RV	15-May-98	31.8	3.8	46.4	8	4	2050	351	-163
NM300	46385	1	RV	14-May-98	2.25	-29.6	36	0	-8	34	0	-350
NM301	46391	1	RV	15-May-98	33.4	31.2	44.7	8	8	1950	350	350
NM303	46384	1	RV	14-May-98	35.3	1.9	46.1	9	1	1890	359	9
NM304	46389	1	RV	15-May-98	32.3	-3.0	42	7	-1	1960	341	-18
NM305	46388	1	RV	15-May-98	43.8	11.5	39.7	9	2	1960	462	121
NM374	46472	1	SP	17-May-98	0.01	-22.9	1300	0	0	33900	1	-461
NM289	168491	1	RV	13-Nov-97	0.71	0.0	0.11	0	0	4.7	0	0
NM291	168492	1	RV	13-Nov-97	2.63	0.0	1.5	0	0	311	4	4
NM293	168494	1	RV	12-Nov-97	3.11	0.5	15.6	0	0	4380	73	69
NM294	168495	1	RV	13-Nov-97	0.03	-3.1	75	0	0	6230	1	-72
NM295	168496	1	RV	12-Nov-97	5.89	5.9	15.8	1	0	4300	136	135
NM296	16497	1	RV	12-Nov-97	4.15	-1.7	80.5	2	1	8180	183	46
NM297	16498	1	RV	12-Nov-97	4.19	0.0	129	3	1	8330	188	5
NM298	168524	1	RV	12-Nov-97	3.92	-0.3	138	3	0	8700	183	-4
NM300	168501	1	RV	11-Nov-97	0.91	-3.0	5	0	-3	77	0	-183
NM301	168502	1	RV	11-Nov-97	4.22	3.3	93.6	2	2	6570	149	149
NM303	168504	1	RV	11-Nov-97	5.88	1.7	60.2	2	0	5610	177	28
NM304	168505	1	RV	11-Nov-97	6.97	1.1	53.2	2	0	5410	203	25
NM305	168506	1	RV	11-Nov-97	5.38	-1.6	47.6	1	-1	5180	150	-53

Table 4.2-1 (Continued)
Ninemile Watershed Mass Loading

							TOTAL LEAD			DISSOLVED ZINC		
Location	Sample Number	CSM Segment	Loc. Type	Sample Date	Flow CFS	Flow Delta	Concentration µg/L	Mass Load lbs/day	Delta* lbs/day	Concentration µg/L	Mass Load lbs/day	Delta* lbs/day
NM291	49021	1	RV	15-Nov-98	0.04	0.0	2	0	0	5.5	0	0
NM293	49024	1	RV	15-Nov-98	1.79	1.7	126	1	1	0	0	0
NM294	49025	1	RV	15-Nov-98	0.04	-1.8	1	0	-1	43	0	0
NM412	49027	1	RV	15-Nov-98	2.51	2.5	75.7	1	1	12100	163	163
NM295	49028	1	RV	15-Nov-98	2.51	0.0	74.4	1	0	11800	159	-4
NM435	49029	1	RV	15-Nov-98	2.42	-0.1	72.3	1	0	11000	143	-16
NM305	202442	1	RV	25-Nov-98	8.31	5.9	134	6	5	0	0	-143
NM292	49022	1	SS	15-Nov-98	0.1	0.1	2.5	0	0	354	0	0
NM440	49131	1	RV	06-Dec-98	2.93	0.0	243	4	0	17300	273	0
NM296	49149	1	RV	06-Dec-98	3.86	0.9	160	3	-1	17100	355	82
NM297	49150	1	RV	06-Dec-98	3.64	-0.2	235	5	2	16300	319	-36
NM443	49151	1	RV	06-Dec-98	6.34	2.7	137	5	0	9820	335	16
NM448	49152	1	RV	06-Dec-98	6.46	0.1	131	5	0	9560	332	-3
NM458	49154	1	RV	06-Dec-98	10.2	3.8	80	4	-1	6950	382	50
NM302	49153	1	SS	06-Dec-98	0.53	-9.7	1	0	0	7.5	0	0
NM289	172123	1	RV	04-Oct-91	0.2	0.0	1	0	0	0	0	0
NM291	172125	1	RV	04-Oct-91	0.89	0.7	4	0	0	249	1	1
NM293	172126	1	RV	04-Oct-91	1.24	0.4	19	0	0	2410	16	15
NM295	172127	1	RV	04-Oct-91	1.93	0.7	19	0	0	2960	31	15
NM296	172128	1	RV	04-Oct-91	1.48	-0.5	106	1	1	6450	51	21
NM297	172129	1	RV	04-Oct-91	2.2	0.7	182	2	1	6700	79	28
NM8	172130	1	RV	04-Oct-91	2.2	0.0	130	2	0	6810	81	1
NM301	172132	1	RV	04-Oct-91	2.32	0.1	83	1	-1	5470	68	-12
NM303	172133	1	RV	04-Oct-91	2.24	-0.1	62	1	0	3340	40	-28
NM13	172134	1	RV	04-Oct-91	3.37	1.1	69	1	0	4710	85	45
NM305	172135	1	RV	04-Oct-91	4.02	0.6	51	1	0	4550	98	13
NM362	172124	1	SP	04-Oct-91	2.4	0.0	0.1	0	0	73	1	-97

*The Delta value reported at a sample location is the difference between Mass load at that location and the next upstream Sample location, except for side streams and adits which are the mass load at that location.

CFS - cubic feet per second
Flow Delta: - Is the increase or decrease in flow compared to the next upstream sampling station
lbs/day - pounds per day
RV - river sample
SS - samples collected in side stream off the main stream channel
SP - seep sample
µg/L - micrograms per liter

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Ninemile Creek Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report, Section 5.0 and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for each segment, as presented above in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in Ninemile Creek is presented in Section 5.4.

5.1 INTRODUCTION

Ninemile Creek contributes significant quantities of cadmium, lead, zinc, and other metals to the South Fork. The lowest and highest dissolved cadmium and zinc and total lead loadings measured during six sampling events (May, 1991; October, 1991; November, 1997; May, 1998; November, 1998, and May, 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

Segment NMSeg01 contains the headwaters of the East Fork of Ninemile Creek (East Fork) down to just above the Interstate mill site (Figure 4.1-1). The BLM identified eight source areas in this segment. Sampling of surface water collected near the downstream boundary of the segment indicates that metals concentrations are greater than ambient water quality criteria (AWQC); however, samples collected a short distance upstream do not exceed AWQC. This segment of the watershed is relatively undisturbed by mining-related activities, with intact, well-vegetated, and stable stream banks.

Segment NMSeg02 begins on the East Fork above the Interstate mill site and ends at the confluence of the East Fork with the main stem of Ninemile Creek (Figure 4.1-2). The BLM

identified 29 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC.

Segment NMSeg03 contains the headwaters of Ninemile Creek down to its confluence with the East Fork (Figure 4.1-5). The BLM identified six source areas in this segment. Sampling of surface water indicates few exceedances of AWQC. This segment of the watershed is relatively undisturbed by mining-related activities.

Segment NMSeg04 begins at the confluence of the main stem of Ninemile Creek with the East Fork and ends at the confluence of Ninemile Creek with the South Fork Coeur d'Alene River (Figure 4.1-7). The BLM identified 27 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC.

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2.

Data were evaluated for seven separate sampling locations. Expected values for discharge, metal concentrations, and mass loading were calculated. Results are summarized in Table 5.2-1 for discharge, dissolved cadmium and zinc and total lead concentrations, and total cadmium, lead, and zinc mass loading. Complete results for the seven sampling locations are tabulated in Appendix C. Only sampling locations with 10 or more individual data points for each parameter of interest were evaluated. In the Ninemile Creek watershed, the seven sampling locations, in order from upstream in the East Fork Ninemile Creek to the mouth of Ninemile Creek, are NM291, NM293, NM295, NM296, NM298, NM303, and NM305. The seven sampling locations are shown in Figure 5.2-1. The first sampling location, NM291, is located immediately upstream of the confluence of Wilson Creek and East Fork (East Fork) Ninemile Creek. Sampling location NM293 is less than one-half mile downstream from NM291 and immediately downstream from the Tamarack 400 level. The third sampling location progressing downstream on the East Fork is NM295. This sampling location is situated on the downstream end of the East Fork impacted riparian area, approximately one-quarter mile upstream from Success No. 3. Sampling location NM296 is located at the confluence of an unnamed creek with the East Fork more than one mile upstream from the town of Bunn. The last sampling location in

Segment NMSeg02 (NM298) that was analyzed is found approximately one-half mile upstream from the town of Bunn. All previous sampling locations mentioned were located in Segment NMSeg02. The last two sampling locations analyzed, NM303 and NM305, are located on Ninemile Creek near the Northside Mine and the mouth of Ninemile Creek, respectively. These sampling locations (NM303 and NM305) are located in Segment NMSeg04.

River stretches bracketed by sampling locations are designated reaches. For example, the portion of Ninemile Creek lying between sampling locations NM303 and NM305 is called a reach. Accordingly, there are six reaches encompassed by the seven sampling locations.

5.2.1 Estimated Discharge

An example of the lognormal distribution of discharge data at sampling location NM305 at the mouth of Ninemile Creek is shown in Figure 5.2-2. Data from sampling location NM305 are used throughout this discussion for consistency of presentation, it lies near the mouth of Ninemile Creek, and more data are available at this location than at other locations. In Figure 5.2-2, the discharge (in cfs) is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a variable (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative distribution function is plotted versus the normal standard variate in Figure 5.2-3. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-2, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-3. For example, for a discharge of 10 cfs, the normal standard variate is approximately -0.2 (Figure 5.2-2). Looking on Figure 5.2-3, this value corresponds to a cumulative probability of approximately 0.42; therefore, approximately 42 percent of the time, discharges at this location will be 10 cfs or less.

As shown in Figure 5.2-2, there is a good fit of the lognormal regression line (solid line in Figure 5.2-2) to the data. This goodness of fit, as evidenced by a high coefficient of determination ($r^2 = 0.93$), supports the assumption that discharges are lognormally distributed. The dotted line represents the true (ideal) lognormal distribution having the same mean (20) and coefficient of variation (1.19) as the actual data. The expected value, or average discharge rate, for Ninemile Creek at location NM305 is 19.8 cfs. Expected values for discharge at all seven sampling locations are summarized in Table 5.2-2.

Estimated gains or losses in discharge (EV) and the coefficients of variation (CV) for reaches on Ninemile Creek are listed in Table 5.2-3.

Three of the six reaches are gaining reaches and three are losing reaches. The first reach, between NM291 and NM293, loses an estimated 0.9 cfs. Other losing reaches are between NM295 and NM296 (2.1 cfs) and between NM296 and NM298 (0.6 cfs). The biggest gaining reach is bracketed by NM305 and NM303 (gain of 9.4 cfs), followed by the reach between NM293 and NM295 (3.9 cfs), and, finally, the reach between NM298 and NM303 (1.7 cfs). Losses occur where the gradient lessens, and gains occur where the valley narrows.

5.2.2 Estimated Cadmium, Lead, and Zinc Concentrations and Mass Loading

Dissolved cadmium and zinc, and total lead concentrations and loads were evaluated using the probabilistic model at the seven sampling locations (six reaches) that contained a minimum of ten data points. Data from the seven individual sampling locations are discussed below.

Based on a comparison of USGS and non-USGS data, total lead concentrations and loads may be underestimated. USGS data tend to show a lower percentage of dissolved lead than non-USGS data. The discrepancy may relate to the way water-quality samples are collected in the field.

Figures 5.2-4 through 5.2-9 illustrate the lognormal distribution of dissolved cadmium, total lead, and dissolved zinc concentrations and mass loading at sampling location NM305. The data follow a lognormal distribution as indicated by the high r-squared values (r^2). For dissolved concentrations, the r-squared values for zinc and cadmium were 0.97 and 0.93, respectively. The r-squared value for the total lead concentration was 0.89. The corresponding values for total zinc, lead, and cadmium loads were 0.84, 0.93, and 0.96, respectively.

To assist in interpreting and placing the results in context, screening levels, expected values (EV), and total maximum daily loads (TMDLs) are shown on the figures. Where the scale on the graph permitted, the screening level, and 10 times and 100 times the screening level are shown. The TMDLs are given at the 10th, 50th, and 90th percentiles. Often, it was necessary to multiply the TMDL by a scalar to fit it on the graph. The TMDLs used were those presented in the Draft Technical Support Document of June 2000 (USEPA 2000a). Strictly speaking, TMDLs for non-discrete sources are for dissolved loads. However, the TMDLs for dissolved loads were multiplied by a translator from EPA's Final Technical Support Document (USEPA 2000b), to convert the dissolved TMDL load to a total load. A translator is the ratio of total recoverable

metal to the dissolved metal. The only purpose of this exercise was to provide a reference and point of discussion for the total loads.

The screening level for dissolved cadmium in surface waters is 0.38 µg/L. Cadmium concentrations at NM305 were greater than the screening level. A large percentage of the measured cadmium concentrations exceeded 10 times the screening level. No dissolved cadmium concentrations exceeded 100 times the screening level (Figure 5.2-4). The estimated dissolved cadmium concentration of approximately 22 µg/L exceeded 58 times the screening level.

As shown in Figure 5.2-5, the majority of the total lead concentrations fall between 1 and 10 times the screening level (15 µg/L). Several data points exceeded 100 times the screening level. The estimated total lead concentration (approximately 92 µg/L) exceeds the screening level.

As shown in Figure 5.2-6, all dissolved zinc concentrations measured at sampling location NM305 are greater than 10 times the screening level (42 µg/L) with approximately one-half of the data points exceeding 100 times the screening level for dissolved zinc in surface water. The estimated dissolved zinc concentration (3,411 µg/L) exceeds 81 times the screening level.

The 90th percentile value of the TMDL for the dissolved cadmium load at the mouth of Ninemile Creek is 0.107 µg/L. This value was exceeded in all plotted data points where measurements were taken (Figure 5.2-7). The estimated dissolved cadmium load of 1.6 µg/L also exceeds 10 times the 90th percentile TMDL.

The 90th percentile TMDL for total lead loading at the mouth of Ninemile Creek (0.2 µg/L) was exceeded in every plotted measurement (Figure 5.2-8). The estimated total lead load at the mouth of Ninemile Creek is approximately 13 pounds/day. The estimated expected value exceeds 10 times the 90th percentile value for Ninemile Creek.

As shown in Figure 5.2-9, all plotted measured values of dissolved zinc loading exceeded the 90th percentile TMDL (9.72 pounds/day) for the dissolved zinc load at the mouth of Ninemile Creek (USEPA 2000a). Two of the measured values exceeded 100 times the 90th percentile TMDL and the estimated value of approximately 276 pounds/day.

Figures similar to Figures 5.2-4 to 5.2-9 were developed for each of the seven sampling locations. The results of these and additional analyses are presented in Appendix C. Data in Appendix C were used to compute the expected values and coefficients of variation for dissolved

and total zinc, lead, and cadmium concentrations and loads in the six reaches of Ninemile Creek. The resulting computations are presented in Tables 5.2-2 to 5.2-5. The calculations were performed in the same manner as described in the discharge section (Section 5.2.1).

The expected values of dissolved zinc concentrations and loads markedly increase or decrease depending on the reach as one progresses downstream in the Ninemile Creek Watershed. These trends are discussed below, reach by reach within the segments.

Total lead concentrations and loads behave similarly to zinc in that concentrations may increase or decrease depending on the specific reach evaluated. Changes in the estimated concentrations and loadings are further discussed in the reach-by-reach evaluation.

Analogous to zinc and lead, dissolved and total cadmium concentrations and loads may increase or decrease depending on the reach. Dissolved and total cadmium concentrations and loads are discussed in the reach-by-reach analysis.

5.2.2.1 Segment NMSeg01

Segment NMSeg01 comprises the upper part of the East Fork. This segment lies above the Interstate mill site and has several potential sources, but no mill sites. The first sampling location evaluated (NM291) is located in Segment NMSeg02, but lies near the downstream boundary of Segment NMSeg01. Surface water samples collected at NM291 indicated concentrations of metals in excess of screening levels by several fold. Samples collected a short distance upstream of NM291, specifically at NM289 and NM290, have metal concentrations that do not exceed screening levels. It is not known if location NM291 has been impacted by tailings and additional waste material at the Interstate mill site; however, there is no indication of important source areas upstream of the Interstate mill/mine.

Because NM291 is located near the downstream boundary of Segment NMSeg01, it will be discussed here in addition to further discussion found in Segment NMSeg02. Concentrations and loads measured at NM291 can be considered to represent respective contributions from Segment NMSeg01. The expected dissolved zinc concentration (approximately 318 µg/L) exceeds the screening level (42 µg/L) for dissolved zinc in surface waters by more than 7-fold. The estimated value of the dissolved zinc load (approximately 33.1 pounds/day) at NM291 exceeds the 90th percentile TMDL load (9.72 pounds/day) for the mouth of Ninemile Creek.

The estimated value of the total lead concentration (approximately 7.7 µg/L) does not exceed the screening level (15 µg/L) for total lead concentrations in surface waters. The estimated value of the total (0.318 pounds/day) lead load at NM291 exceeds the TMDL for total lead loads at the mouth of Ninemile Creek. As mentioned, TMDLs for total lead loads were calculated by multiplying the TMDL for the dissolved lead load by a translator. The translator is the ratio of total lead to dissolved lead (USEPA 2000b).

The estimated value of the dissolved cadmium concentration (1.1 µg/L) at NM291 exceeds the screening level for dissolved cadmium in surface waters (0.38 µg/L). The estimated value of the dissolved cadmium load at NM291 is approximately 0.03 pounds/day. This corresponds, approximately, to the 50th percentile TMDL (0.0273 pounds/day) loading capacity for the mouth of Ninemile Creek.

Possible contributors to the dissolved and total metal concentrations and loads at NM291 are the tailings and other waste material at the Interstate-Callahan mine/rock dumps. The estimated values of the total loadings from Segment 01 for zinc, lead, and cadmium are approximately 33 pounds/day, approximately 0.3 pounds/day, and approximately 0.03 pounds/day, respectively.

5.2.2.2 Segment NMSeg02

Most of the source areas in the Ninemile Creek watershed lie within Segment NMSeg02. Segment NMSeg02 begins above the Interstate mill site and continues downstream on the East Fork to its confluence with Ninemile Creek. Remediation work was conducted at the Interstate mill site to reduce metal concentrations and loadings. The effectiveness of this effort is unknown.

Five of the seven sampling locations from which data were analyzed lie within Segment NMSeg02 (NM291, NM293, NM295, NM296 and NM298). The estimated dissolved zinc load between sampling locations NM291 and NM293 increase by approximately 67 pounds per day. Based on the model, it is estimated that essentially all of the zinc will be in the dissolved form at the downstream sampling location (NM293) within this reach. The estimated dissolved zinc concentration (approximately 4,670 µg/L) at NM293 is more than 100 times higher than the screening level for dissolved zinc in surface water (42 µg/L).

Estimated values of total lead concentrations and loads increase within this reach (between NM291 and NM293) as the estimated discharge decreases slightly (Table 5.2-2). The estimated value of the total (approximately 25 µg/L) lead concentration at the downstream sampling

location (NM293) in this reach exceeded screening level for total lead (15 µg/L). The estimated value of the total lead load at NM293 exceed the 90th percentile TMDL for lead loads at the mouth of Ninemile Creek.

The estimated value of the increase in dissolved cadmium concentrations in this reach is more than 10 times higher than the screening level for dissolved cadmium in surface waters. The estimated values of the dissolved cadmium loads at the downstream station in this reach exceed the 90th percentile TMDL for total cadmium loading capacities at the mouth of Ninemile Creek.

The Interstate mill site and Tamarack complex are potential sources that could contribute to the increased concentrations and loadings of zinc, lead, and cadmium occurring in this reach of Segment NMSeg02.

The next reach (between NM293 and NM295) in the East Fork shows decreased estimated values of dissolved zinc concentrations, while the estimated dissolved zinc loads increase. Estimated increased loadings with decreases in estimated concentrations are partially explained by the estimated increase in discharge of 3.9 cfs. All screening levels and the TMDL for zinc are exceeded.

Similarly to zinc, estimated values of dissolved cadmium and total lead concentrations in this reach decreased, while estimated dissolved and total loads increased (Tables 5.2-3 to 5.2-8). Increased discharges of less contaminated water apparently increase the loads while diluting the concentrations of zinc, lead, and cadmium. Tailings and the Rex No. 2/Sixteen-to-One mine are possible contributors to the increased loading occurring within this reach.

Estimated values for dissolved cadmium and zinc, and total lead concentrations and loads continue to exceed screening levels and TMDLs (TMDLs are for mouth of Ninemile Creek) within the reach encompassed by sampling locations NM295 and NM296. Estimated values of dissolved and total concentrations and loads for zinc, lead, and cadmium increase within this reach (Tables 5.2-3 to 5.2-8). The estimated discharge decreased by 2.1 cfs in this reach. Accordingly, estimated increases in concentrations apparently account for increased loads by more than compensating for decreased discharges. Possible contributors to increased concentrations and loadings for zinc, lead, and cadmium within this reach include the Success mining complex and the Alameda mine.

Sampling locations NM296 and NM298 bracket the last reach within Segment NMSeg02. The downstream sampling location (NM298) lies near the downstream boundary of

Segment NMSeg02. Estimated values of dissolved zinc concentrations increase within this reach, while dissolved zinc loads decrease. It is possible that the estimated value for the decrease in discharge accounts for decreased loads for cadmium and zinc with increased concentrations. Lead, however, does not follow this trend. Estimated values of total lead loads increase while the estimated total lead concentrations decrease. All screening levels and TMDLs continue to be exceeded at the last sampling station (NM298) in Segment NMSeg02.

It is estimated, based on the probabilistic model, that the percentages of zinc, lead, and cadmium loads in the dissolved phase are approximately 100 percent, approximately 47 percent, and approximately 100 percent, respectively, at the last sampling location (NM298) within this segment.

Based on the probabilistic model, estimated total loads contributed by Segment NMSeg02 are approximately 177 pounds/day (zinc), approximately 8.2 pounds/day (lead), and approximately 1.2 pounds/day (cadmium).

5.2.2.3 Segment NMSeg03

Segment NMSeg03 encompasses Ninemile Creek above its confluence with the East Fork. Several potential sources (e.g., Ninemile Mining Co. complex, Galena No. 2, and Mayflower No. 3) are found within this segment but little evidence of metals contamination in surface water is found in the watershed. During low flows, concentrations of zinc, lead, and cadmium may approach or slightly exceed screening levels, but the potential toxicity is reduced by the naturally occurring higher alkalinity of the water in Segment NMSeg03. Because toxic effects can be impacted by hardness or the alkalinity, increased alkalinity results in decreased toxicity.

5.2.2.4 Segment NMSeg04

Segment NMSeg04 is Ninemile Creek below its confluence with the East Fork to its confluence with the South Fork Coeur d'Alene River. Aquatic life is nearly absent from this segment and zinc, lead, and cadmium concentrations and loads continue to exceed screening levels and TMDLs.

The two reaches in Segment NMSeg04 lie between NM298 and NM303 and NM303 and NM305. As noted, NM298 is located in Segment NMSeg02 near its southern boundary where Segments NMSeg02, NMSeg03, and NMSeg04 border one another at the confluence of the East Fork and Ninemile Creek.

In the first reach in Segment NMSeg04 (between NM298 and NM303), estimated values of dissolved zinc and total lead concentrations and loads decrease in every instance (Tables 5.2-3 to 5.2-8). Estimated dissolved cadmium concentrations decrease while estimated dissolved cadmium loads increase. The estimated discharge increases in this reach. It has been hypothesized that reduced concentrations within this segment are a consequence of the high alkalinity levels entering this segment from Ninemile Creek (Segment NMSeg03). Increased discharges (Table 5.2-2) may explain some of the decreases in concentrations, but do not explain the reduced loading for zinc and lead. If potential sources in this reach are contributing zinc and lead to the system, this contribution is less than the reduction in zinc and lead concentrations and loadings.

The last reach in this segment, and on Ninemile Creek, extends from near the Northside Mine (NM303) to near the mouth of the creek (NM305). For each metal evaluated (zinc, lead, and cadmium), estimated values of dissolved and total concentrations decreased while dissolved and total loads for these same metals increased. Decreases in estimated dissolved and total concentrations and increases in loads may be partially explained by the estimated increase in discharge (9.4 cfs). Groundwater is entering Ninemile Creek as the canyon narrows near its mouth.

Modeling indicates that this segment contributes an estimated value of approximately 65.5 pounds of zinc per day to the creek. Estimated values for contributions of lead and cadmium to the creek from Segment NMSeg04 are approximately 4.5 pounds/day and 0.3 pounds/day, respectively. Most of the zinc and cadmium and less than one-half of the lead are estimated to exist in the dissolved phase. The estimated contributions from Segment 4 are based on expected values at NM298 and NM305 while estimations of the percentage load in the dissolved phase are based on values at NM305. Screening levels for total and dissolved concentration and TMDLs for loading capacity are surpassed by zinc, lead, and cadmium at the mouth of Ninemile Creek.

5.2.2.5 Concentrations Versus Discharge

The following discussion is based on evaluation of data at the mouth of Ninemile Creek (NM305) (Appendix C). There is a decrease in zinc concentrations with increased discharge which is significant at $\alpha = < 0.0001$ (α is the probability the correlation is due to chance). Total lead concentrations increased with increasing discharge ($\alpha < 0.0001$). Similarly to zinc, estimated values of dissolved ($\alpha < 0.0001$) cadmium concentrations also exhibited decreased concentrations with increased discharge at the mouth of Ninemile Creek.

The regressions permit estimation of dissolved cadmium and zinc, and total lead concentrations at various discharge rates. Similar regressions were developed at the other sampling locations. At all seven sampling locations, there was a general decrease in dissolved zinc and cadmium concentrations with increasing discharge rates (Appendix C). Total lead concentrations decreased with increasing discharge at every location except the first (NM291) and last (NM305) sampling stations.

Ion speciation solubility calculations with the MINTEQA2 geochemical computer code indicated there were no solid phases controlling zinc concentrations in surface waters in the Coeur d'Alene basin and at the mouth of Ninemile Creek. Decreasing zinc, lead, and cadmium concentrations with increased discharge rates support this hypothesis by indicating that no solid is dissolving rapidly enough to achieve equilibrium with these surface waters. Otherwise, the concentrations would remain relatively constant at different discharge rates. As indicated in the solubility and adsorption modeling, adsorption is the most likely control on zinc concentrations. Accordingly, mechanistic modeling supports conclusions inferred from the regression analyses developed here.

5.3 SEDIMENT FATE AND TRANSPORT

Sediment transport processes were discussed in detail in Section 3. Brief summaries of sediment transport processes active in the watershed are presented in this section, followed by descriptions of sediment sources and transport processes observed in each segment.

5.3.1 Sediment Transport Processes

Sediment derived in Ninemile Creek is transported through the system and into the South Fork. Sediment sources in Ninemile Creek are rock debris situated adjacent to channels, channel bed sediment, bank erosion, and road drainage. Mining activities have increased the sediment load in Ninemile Creek. Based on USGS sediment transport and stream discharge data, approximately 1,350 tons of sediment were transported out of Ninemile Creek in water year 1999 (USGS 2000): approximately 60 percent as fines, 37 percent as sand, and 3 percent as bedload. Based on estimates of historical surface water and sediment discharge, this was below average for the period 1990 to 1999.

Suspended sediment and bedload samples were not analyzed for total metals; therefore, mass loading was estimated from total and dissolved surface water data as described in Section 5.2.

5.3.2 Segment Descriptions

Segment NMSeg01 has approximately 5,700 linear feet (1.1 miles) of mapped channel. The slope of the channel ranges from 10 to 19 percent and the profile appears relatively uniform. The valley bottom is vegetated with conifers that obscure view of the channel. Little disturbance was observed in the limited review, except where unstructured piles of rocky debris have been placed. The high slope of this reach provides very efficient transport of sediment supplied to the stream. Likely sources of sediment other than the rocky debris are mobilization of channel bed sediment, minor bank erosion and sediment from road drainage. Data were not available on soil and sediment metals concentrations.

Segment NMSeg02 has approximately 17,500 linear feet (3.3 miles) of mapped channel. The slope of the East Fork in this segment ranges from about 5.5 to 13.5 percent, and the profile appears to be relatively uniform. The channel form in this segment varies from a meandering braided channel to confined and channelized. Rockfalls, rock debris piles, mobilization of the channel bed material, lateral migration, and road drainage are all sediment sources in this segment. Of the four segments in the Ninemile Creek watershed, this segment appears to contain the majority of sediment sources. Soil and sediment metals concentrations exceeded screening levels, especially cadmium, lead, and zinc.

Segment NMSeg03 has approximately 9,500 linear feet (1.8 miles) of mapped channel. The channel slope varies from about 2 percent in the lower reaches to 22 percent at the headwaters. Man made disruption of the stream channel appears to be minor as compared to other segments within the watershed. Likely sources of sediment include mobilization of channel bed material, minor bank erosion, and road drainage. Sediment transport is likely very efficient in the upper reaches of the channel where the channel slope is very high. Data were not available on sediment metals concentrations. Only three surface soil samples were collected from this segment. Metals concentrations were only slightly greater than screening levels for arsenic, cadmium, lead, and zinc.

Segment NMSeg04 has approximately 26,000 linear feet (4.9 miles) of mapped channel, including one major tributary, Blackcloud Creek. The slope of the mainstem of Ninemile Creek through this segment varies from less than 1 percent to about 7 percent. Most of the channel length is constrained in the current position by old railroad grades, roads, bedrock hillslopes and recent channel remedial projects; however, there are reaches that show indications of lateral movement. Blackcloud Creek is a high-gradient stream with slopes ranging from 4 to 29 percent. Primary sources of sediment in this segment include mobilization of channel bed material, local scour, small-scale bank erosion, lateral migration, and drainage from roads. Soil

and sediment metals concentrations exceeded screening levels, especially antimony, cadmium, lead, and zinc.

5.3.3 Summary of Sediment Transport

Approximately 400 tons, or 34 tons per square mile, of sediment was transported from Ninemile Creek to the South Fork Coeur d'Alene River in water year 1999. Sediment sources (including mining waste) occur in all four segments. Based on interpretation of aerial photographs from 1984, 1991, and 1998, the majority of the sediment supplied to the creek appears to originate in Segment 2. Large piles of rock debris and rockfall are positioned adjacent to the stream channel in this segment. The moderately steep slope and braided nature of the channel in this segment provides energy and material for effective movement of sediment. Channelization, bed controls, deposition pools, and structured debris piles have previously been used in this segment to reduce the sediment yield of the basin. These efforts have likely reduced the sediment load by some undetermined quantity. The sediment yield has also presumably been reduced through time since the practice of discharging mining-related debris directly into the channel has been discontinued.

Suspended sediment and bedload samples were not analyzed for total metals; therefore mass loading was estimated from total and dissolved surface water data, as described in Section 5.2. Floodplain soil and sediment samples, representative of suspended sediment deposited during low-flow events, were analyzed for total metals. Metals concentrations in floodplain soil and sediment samples exceeded screening levels in Segments 2 and 4. Metals in depositional floodplain sediments will be remobilized into the water column, moved downstream, and eventually enter the South Fork during high-flow discharge events as both suspended sediment and dissolved metals in surface water.

5.4 SUMMARY OF FATE AND TRANSPORT

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading to Ninemile Creek. Sediment transport was evaluated using USGS suspended and bedload sediment discharge data and measured floodplain soil and sediment data. Results are summarized in this section.

Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal probability density functions at seven separate sampling locations in Ninemile Creek. Only results for cadmium, lead, and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends

in concentrations and mass loading with changing discharge rates. The percentages of dissolved and particulate forms of metals were computed from the estimated expected values predicted by the model.

Results of the probabilistic modeling indicate:

- Estimated values of dissolved zinc and cadmium concentrations exceeded screening levels at the first sampling station (NM291).

- Estimated values of total lead and dissolved cadmium and zinc loads surpassed their respective TMDLs. To illustrate the observed trends of estimated expected values throughout the watershed, estimated expected values for cadmium, lead, and zinc concentrations and mass loading are shown in Figures 5.4-1 through 5.4-6.

- Dissolved concentrations tend to be inversely related to increased discharges. Increased discharges do not always result in increased total loads because of decreases in concentrations. To illustrate the relationship between discharge, concentration, and mass loading, estimated expected values for these variables at each sampling location are plotted together for cadmium, lead, and zinc in Figures 5.4-7 through 5.4-9, respectively.

- Potential major source areas identified in each reach are listed in Table 5.4-1. Identification of major source areas was primarily based on the estimated contributions of sites to dissolved zinc loading in surface water of the Coeur d'Alene River basin. The identification process and backup documentation is presented in Draft Technical Memorandum No. 1: Candidate Alternatives and Typical Conceptual Designs, Coeur d'Alene Basin Feasibility Study (URSG and CH2M HILL 2000).

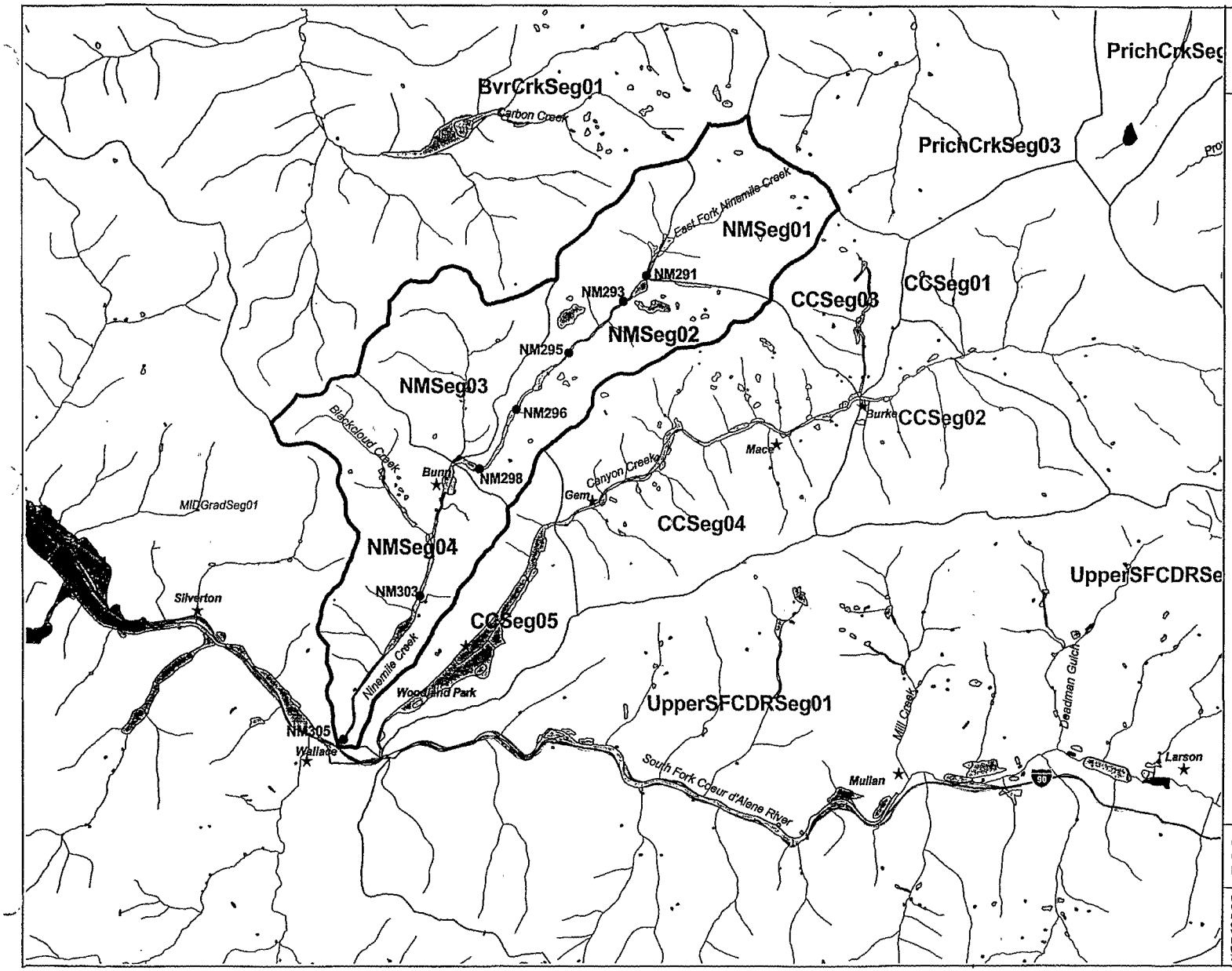


Figure 5.2-1
Ninemile Creek Watershed
Sampling Locations Evaluated in Probablistic Modeling

LEGEND

- CC2 Sampling Location
- Stream
- Road
- Interstate 90
- City
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Lake/River
- Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

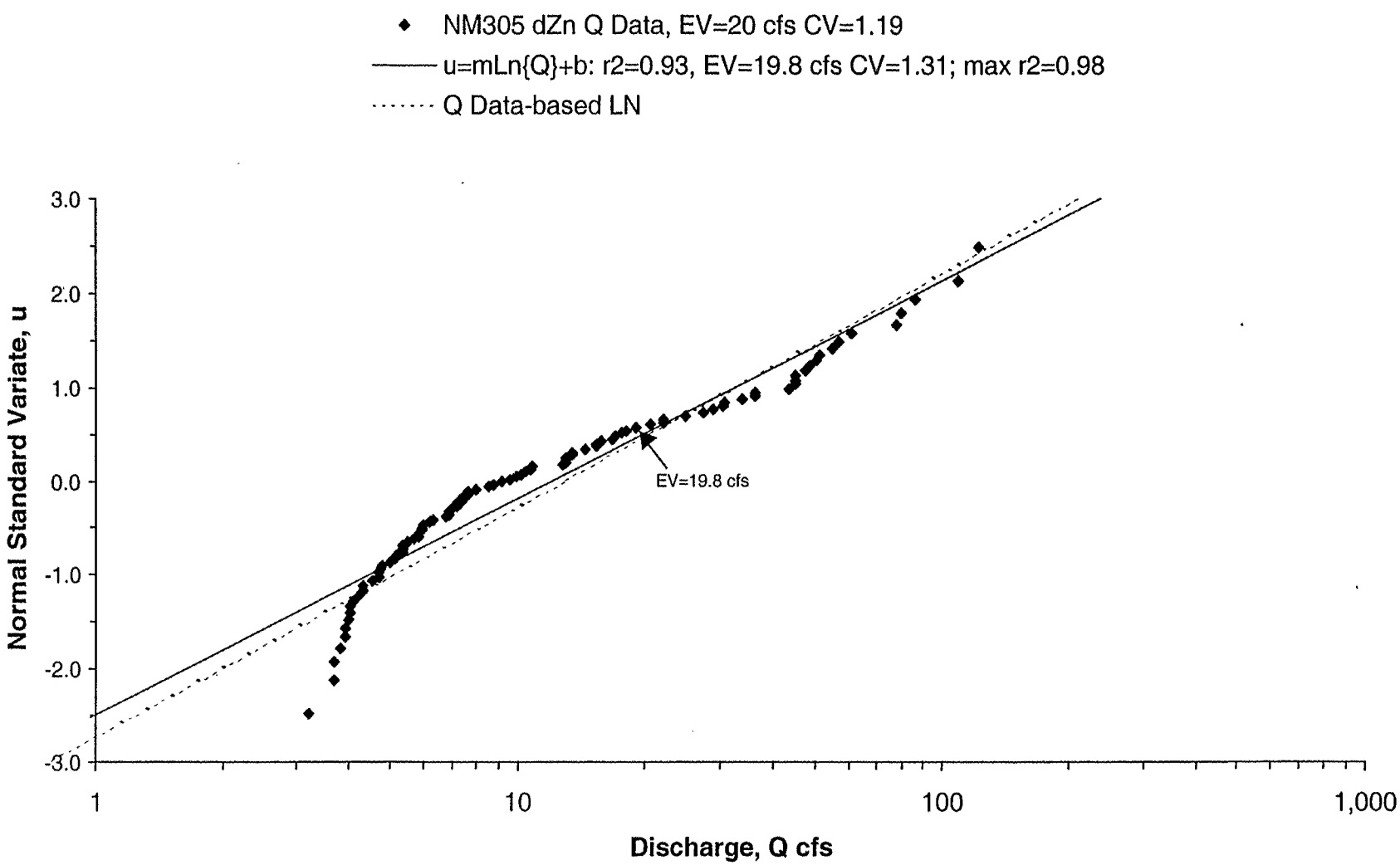
EPA REGION 10

Document Control 4162500.8615.05.a
Generation 1
n:\Projects\watershed\ninemile-canyon creek\
cc-loading date-7-10-00.apr
V: NM ev Sampling Locations
E: Watershed
L: Final RI NM ev Sampling Locations
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

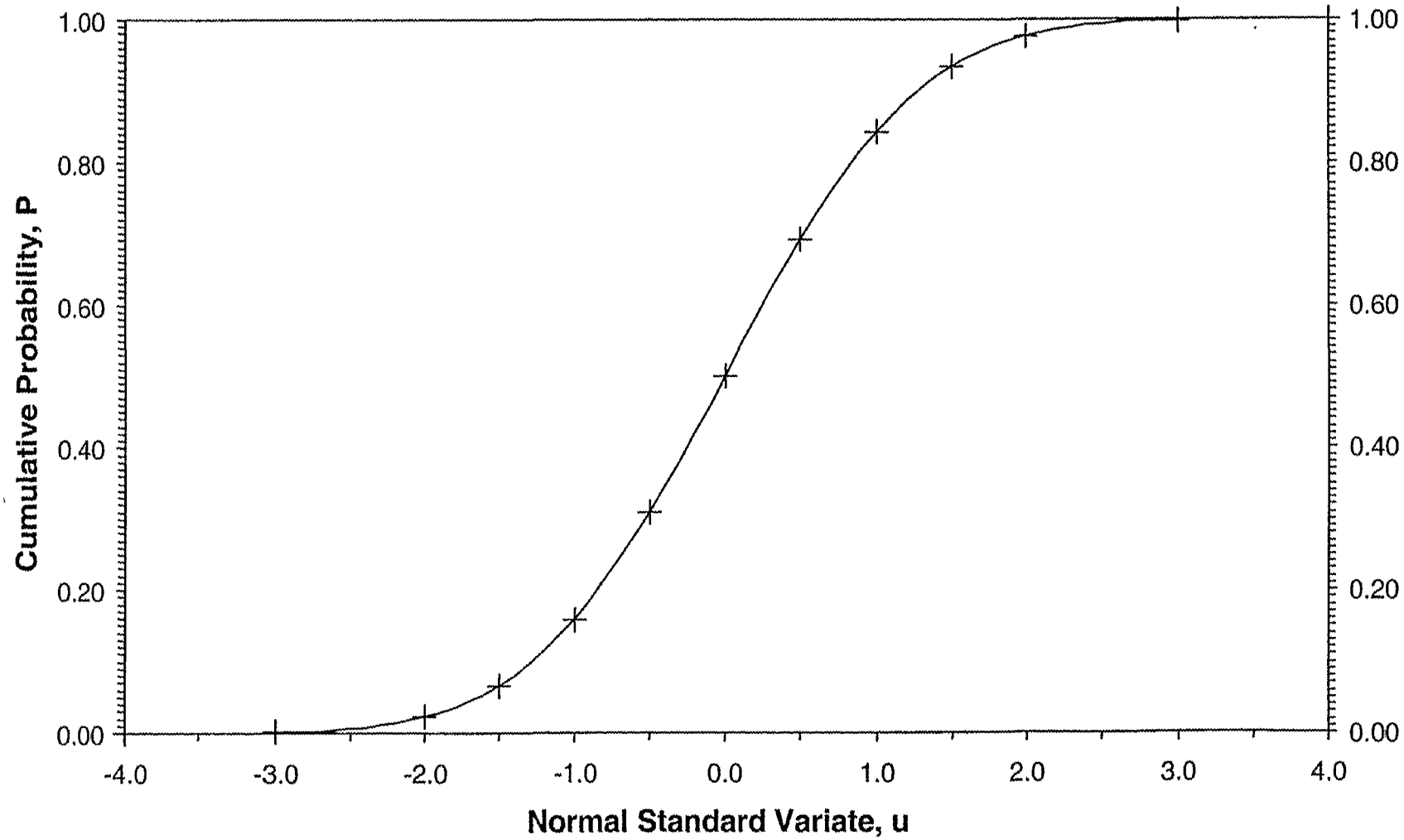
Date of Plot: July 17, 2001

Probabilistic Modeling Results for Discharge at NM305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-2

Cumulative Probability Values Corresponding to Normal Standard Variate Values



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RI REPORT

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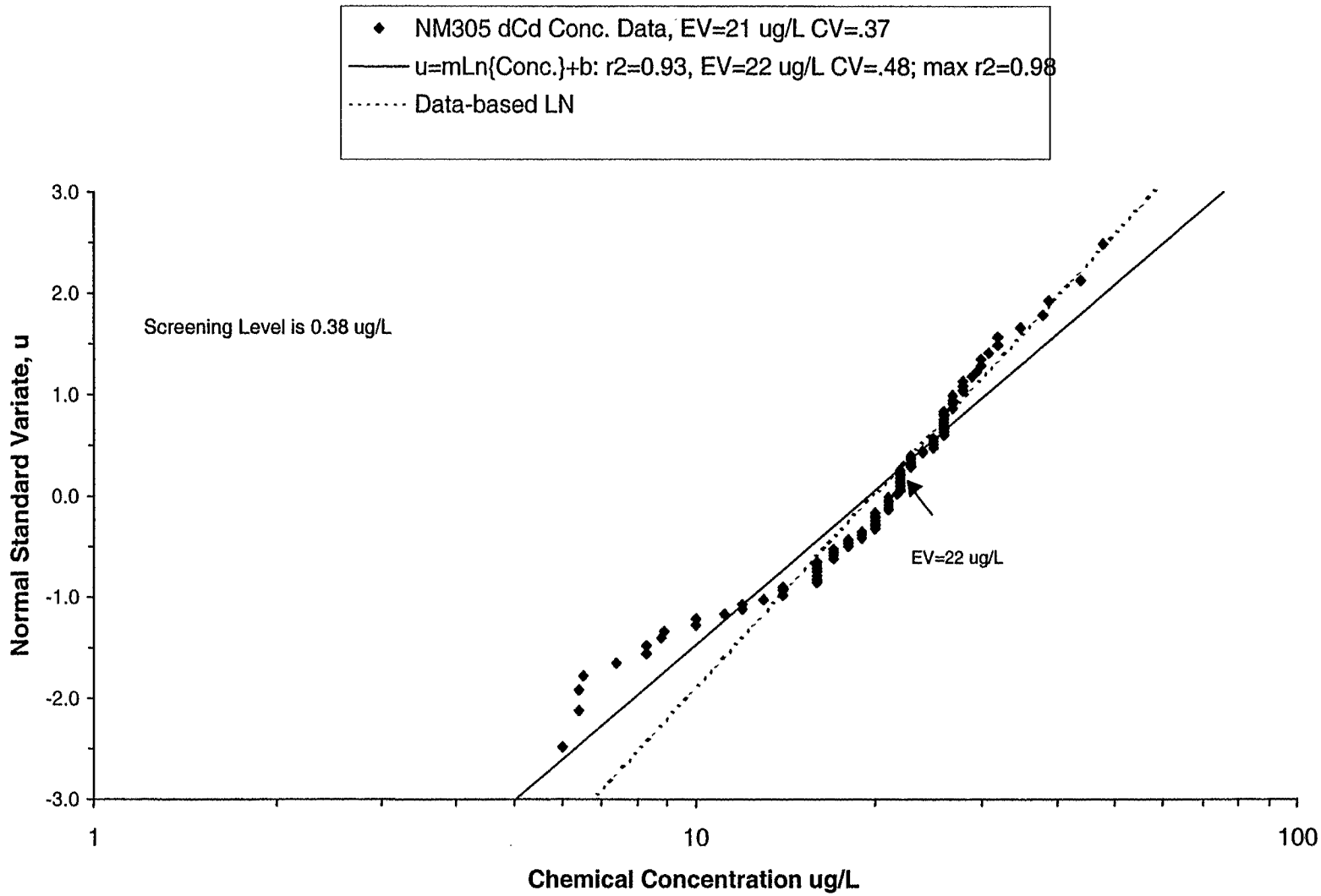
Ninemile Creek Series
07/13/01

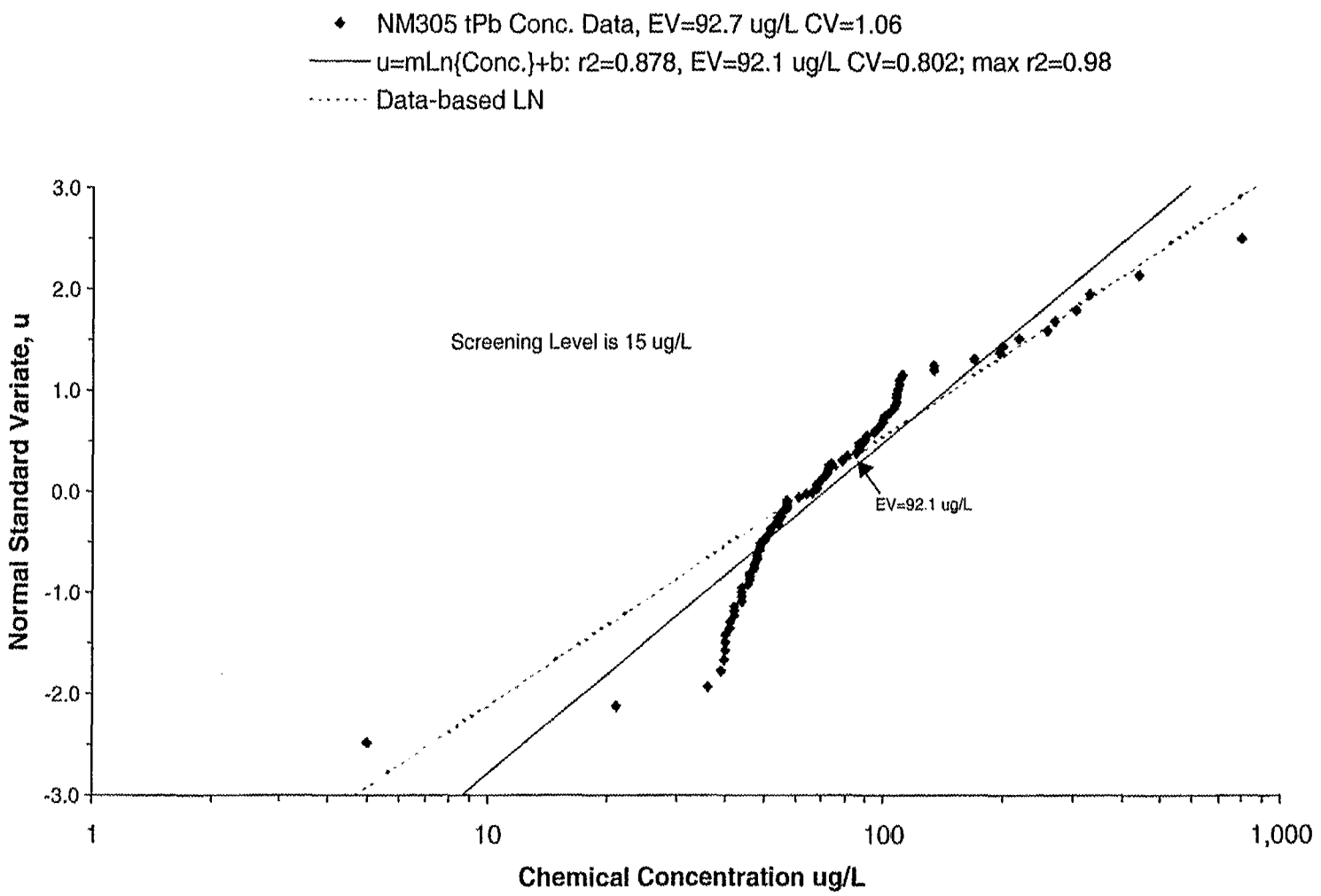
Figure 5.2-3

Probabilistic Modeling Results for Dissolved Cadmium Concentrations at NM305



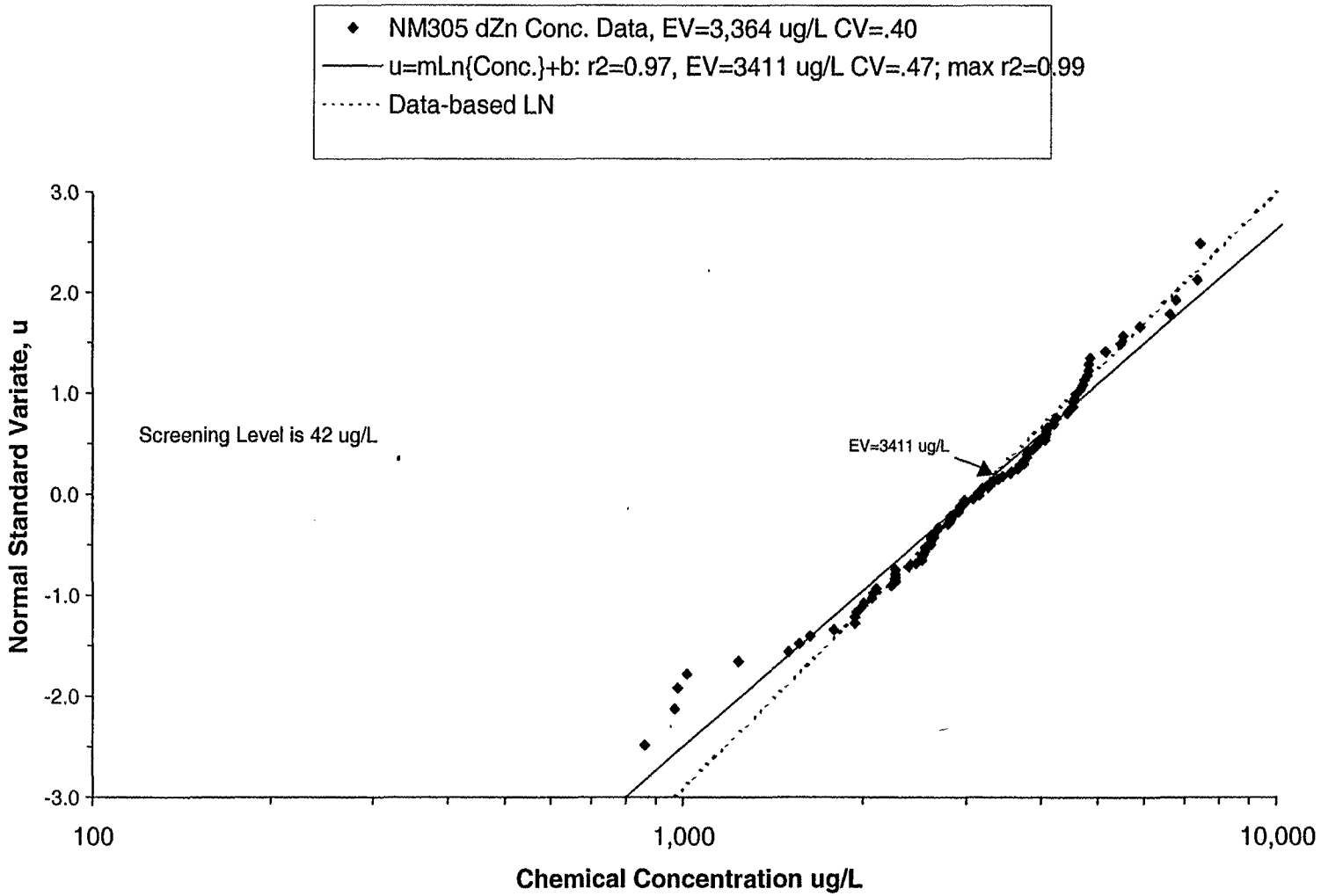
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-4

Probabilistic Modeling Results for Total Lead Concentrations at NM305



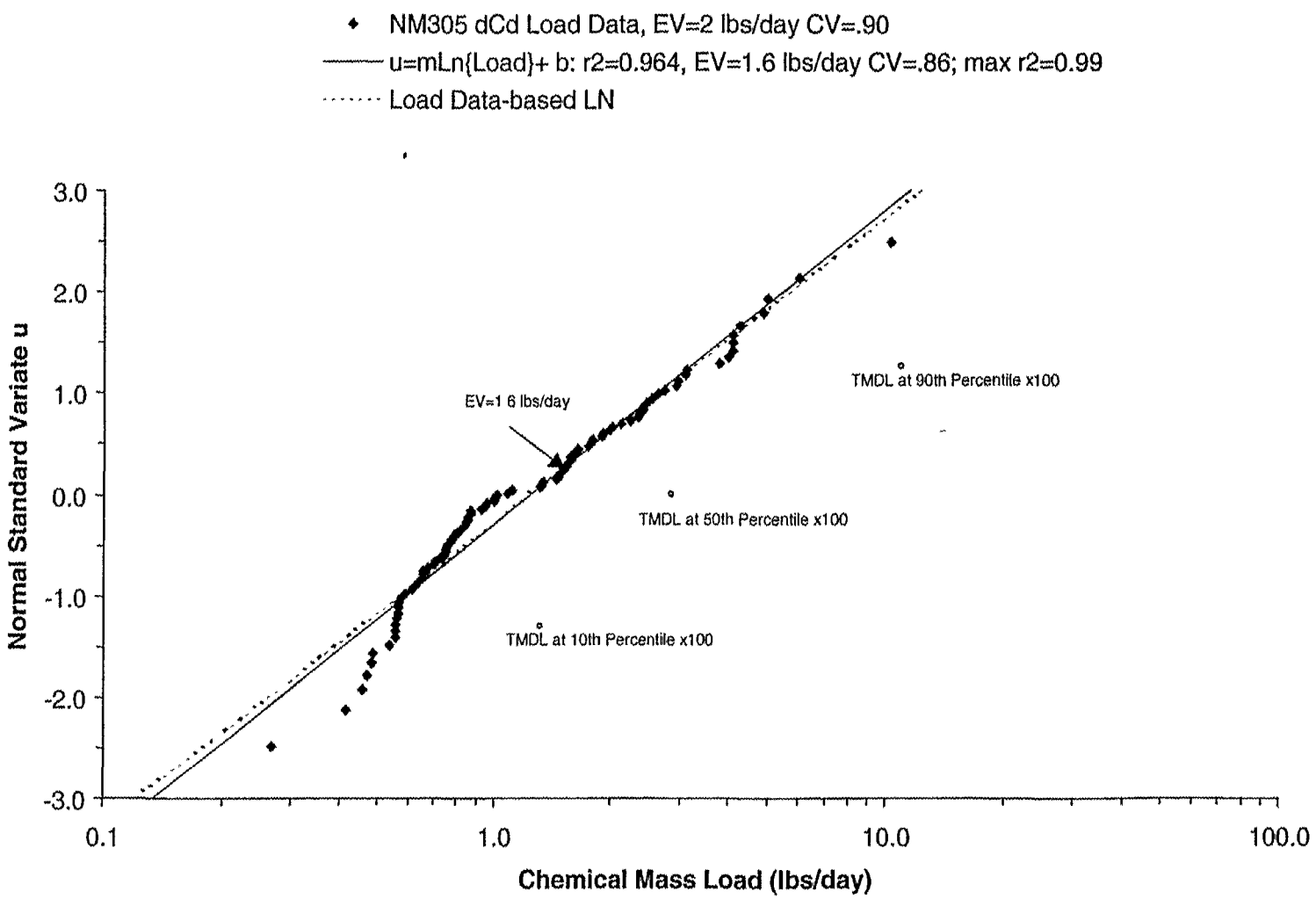
EPA REGION	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-5

Probabilistic Modeling Results for Dissolved Zinc Concentrations at NM305



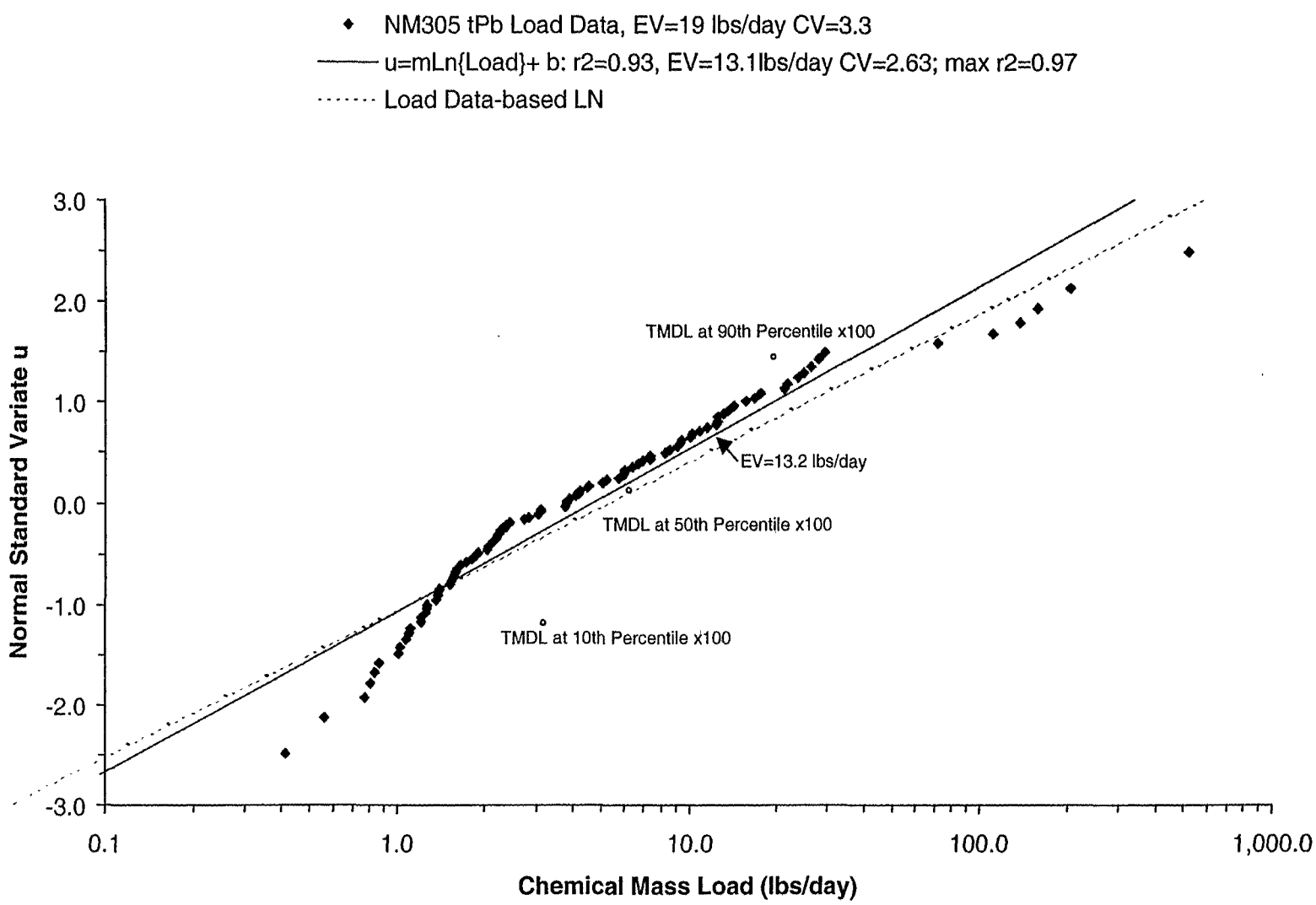
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-6

Probabilistic Modeling Results for Dissolved Cadmium Mass Loading at NM305



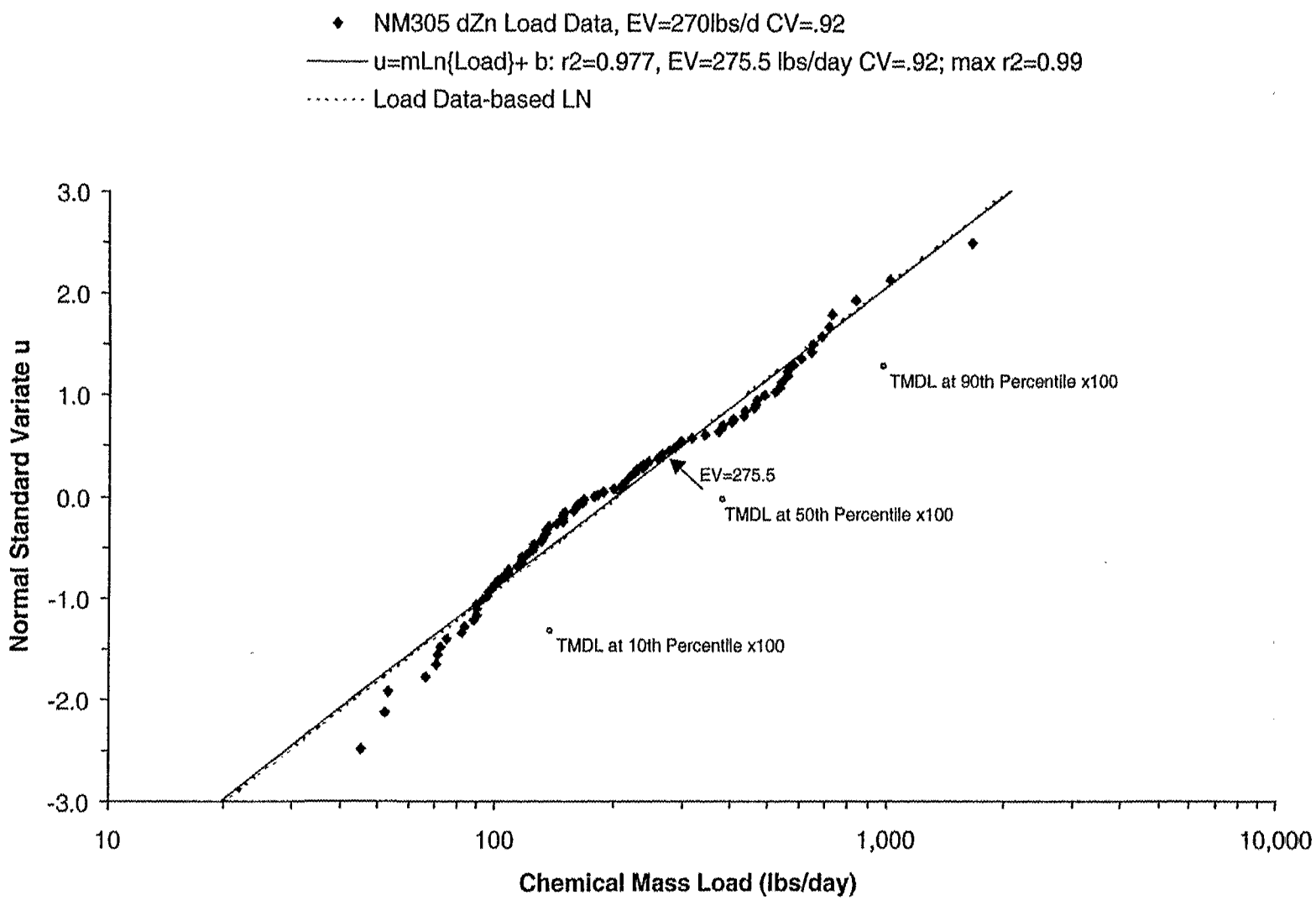
EPA REGION	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-7

Probabilistic Modeling Results for Total Lead Mass Loading at NM305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-8

Probabilistic Modeling Results for Dissolved Zinc Mass Loading at NM305



EPA REGION 8	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.2-9

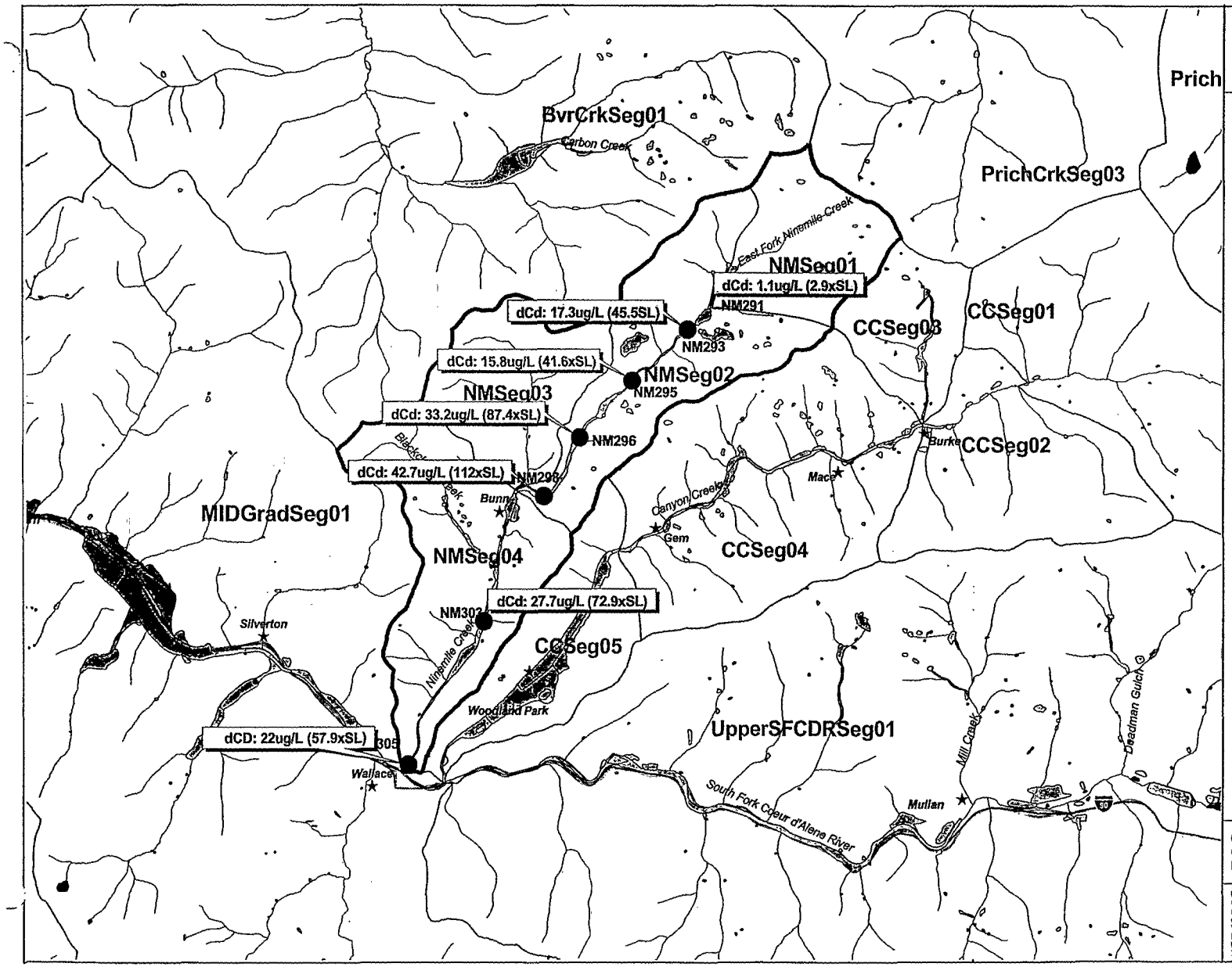


Figure 5.4-1
Ninemile Creek Watershed
Estimated Expected Values of Dissolved Cadmium Concentrations

LEGEND

Sample Location

dCd: 1.1ug/L (2.9xSL)

SL - 0.38ug/L
dCd - Dissolved Cadmium Concentration

Range of Dissolved Cadmium Concentrations in ug/L

- Range: 0 - 2.5
- Range: 2.5 - 5.0
- Range: 5.0 - 10.0
- Range: 10.0 - 15.0
- Range: > 15
- Stream
- Road
- Interstate 90
- City
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182933.6615.05.a
Generation 1
n:\Projects\watersheds\rinerl_canyn co-loading data-7-10-00.apr
V:\Ninemile Creek dCd
E: Watershed
L: Final RI Ninemile Creek dCd fig 5.4-1
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

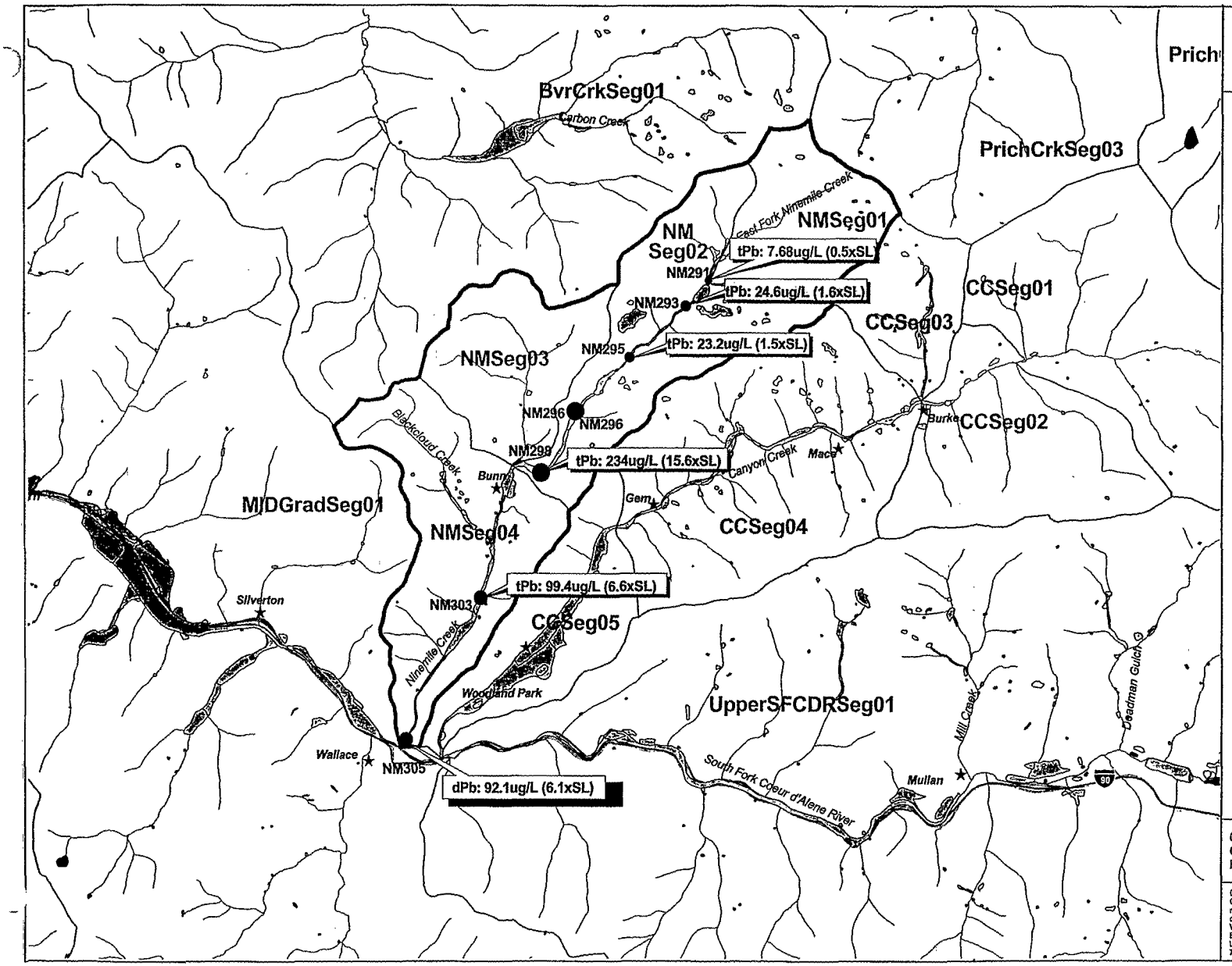


Figure 5.4-2
Ninemile Creek Watershed
Estimated Expected Values of
Total Lead Concentrations

LEGEND

Sample Location
tPb: 7.68ug/L (0.5xSL)
SL - 15ug/L
tPb - Total Lead Concentration

Range of Total Lead Concentrations in ug/L
- Range: 0 - 5.0
- Range: 5.0 - 10.0
- Range: 10.0 - 50.0
- Range: 50.0 - 100.0
- Range: > 100

Stream
Road
Interstate 90
City
Ninemile Creek Watershed
Ninemile Creek Segment
River Segment
Lake/River
Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.8615.05.a
Generation 1
n:\Projects\watersheds\ninemile_canyon\loading data-7-10-00.apr
V-Ninemile Creek tPb
E: Watershed
L: Final RI Ninemile Creek tPb Fig 5.4-2
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone; North American Datum 1983.

Date of Plot: July 17, 2001

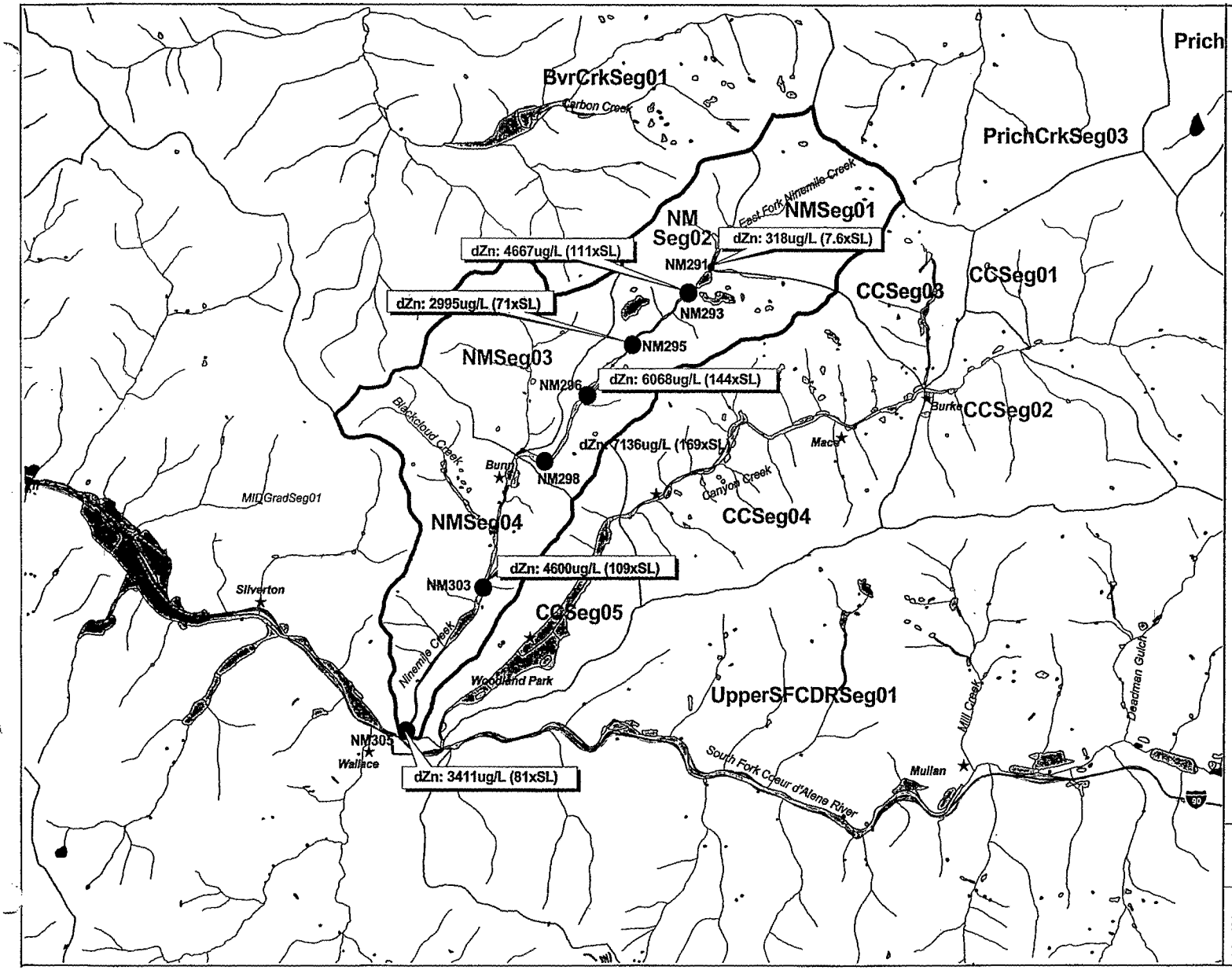


Figure 5.4-3
Ninemile Creek Watershed
Estimated Expected Values of
Dissolved Zinc Concentrations

Sample Location
dZn: 318ug/L (7.6xSL)
SL - 42ug/L
dZn - Dissolved Zinc Concentration

Range of Dissolved Zinc Concentrations in ug/L
- Range: 0 - 100
- Range: 100 - 500
- Range: 500 - 1000
- Range: 1000 - 1500
- Range: > 1500
- Stream
- Road
- Interstate 90
- City
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.8615.05a
Generation 1
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co-loading data-7-10-00.apr
V:Ninemile Creek-dZn
E: Watershed
L: Final RI Ninemile Creek dZn fig 5.4-3
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

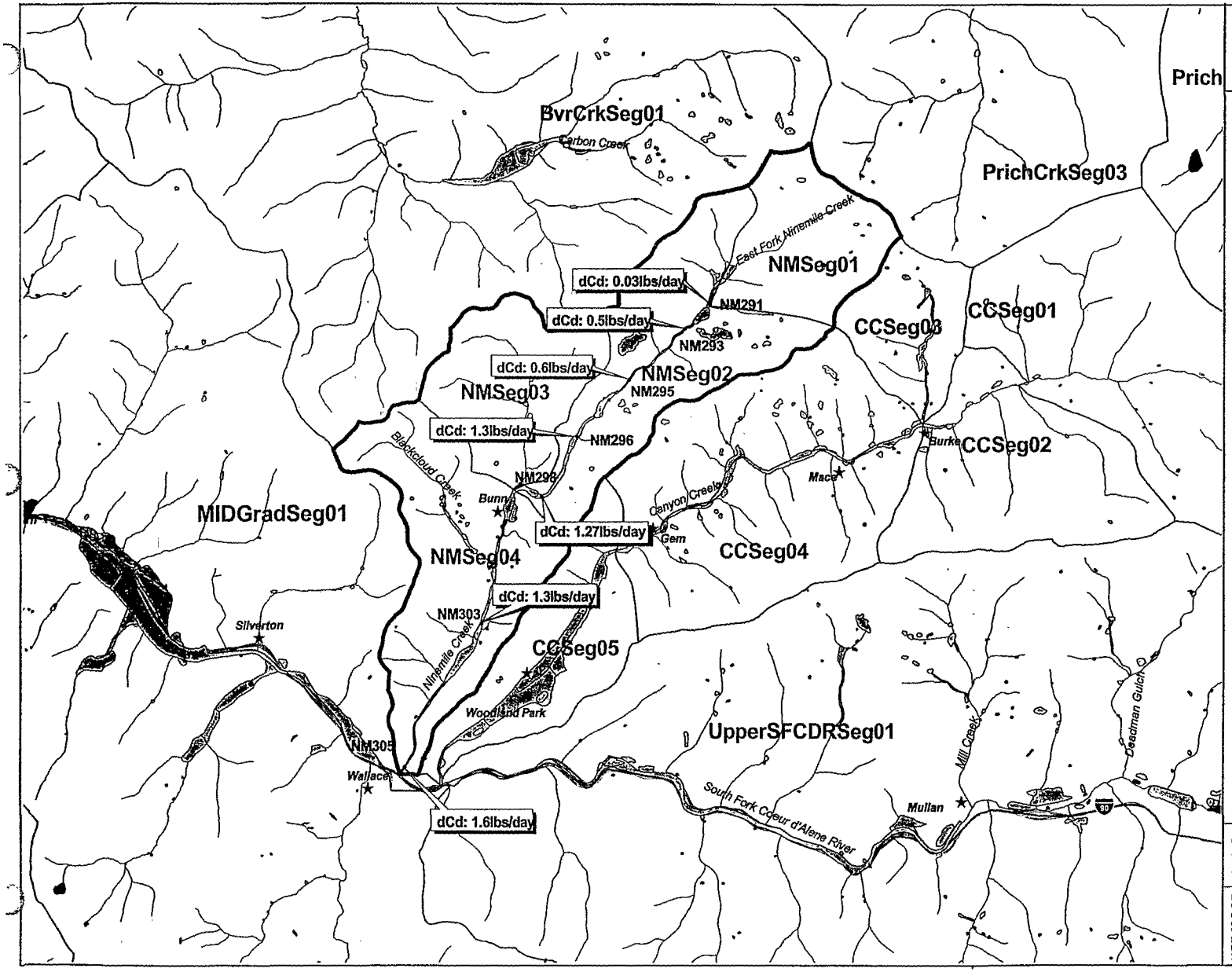
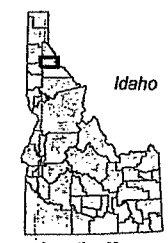


Figure 5.4-4
Ninemile Creek Watershed
Estimated Expected Values for
Dissolved Cadmium Mass Loading

LEGEND

Range of Total Cadmium (tCd) Concentrations in lbs/day
- Range: 0 - 2.5
- Range: 2.5 - 5.0
- Range: 5.0 - 10.0
- Range: 10.0 - 15.0
- Range: > 15
- NA No Data Available
- Stream
- Road
- Interstate 90
- City
- Canyon Creek Watershed
- Canyon Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615.05.a
Generation 1
n:\Projects\watersheds\ninemil_canyn
cc-loading data-7-10-00.apr
V:Canyon Creek dCd
E: Watershed
L: Final RI Ninemile fig 5.4-4 dCd
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

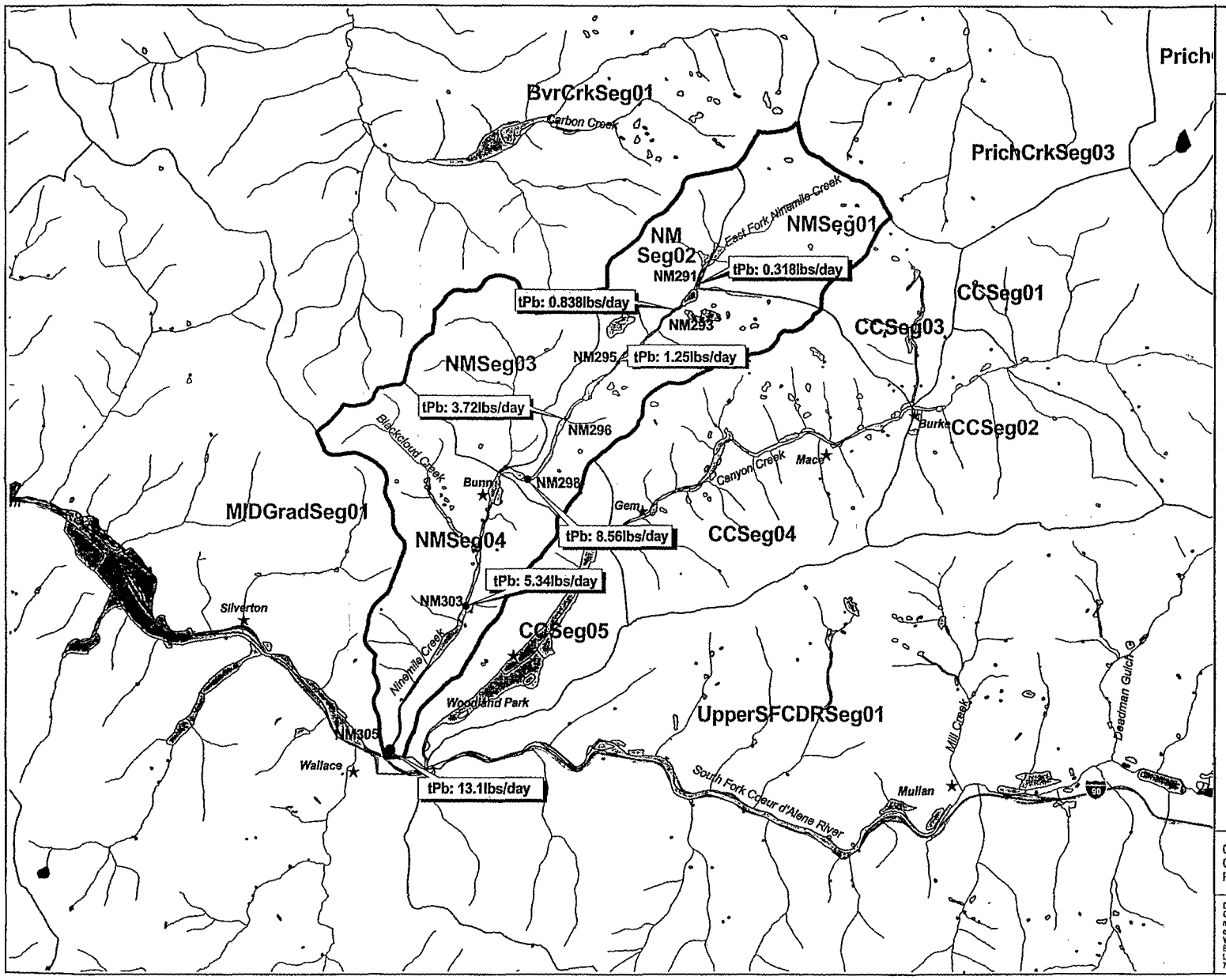


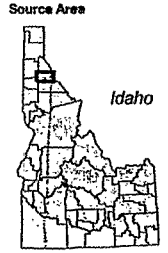
Figure 5.4-5
Ninemile Creek Watershed
Estimated Expected Values for
Total Lead Mass Loading

LEGEND

Sample Location
tPb: 3.72lbs/day
Mass Load
Total Lead Concentration

Range of Total Lead (tPb) Mass Loading in lbs/day
- Range: 0 - 5.0
- Range: 5.0 - 10.0
- Range: 10.0 - 50.0
- Range: 50.0 - 100.0
- Range: > 100

Stream
Road
Interstate 90
City
Ninemile Creek Watershed
Ninemile Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
n:\Projects\watersheds\ninemil_canyn
cc-loading date-7-10-00.apr
V:Ninemile tPb
E: Watershed
L: Final RI Ninemile tPb fig 5.4-5
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

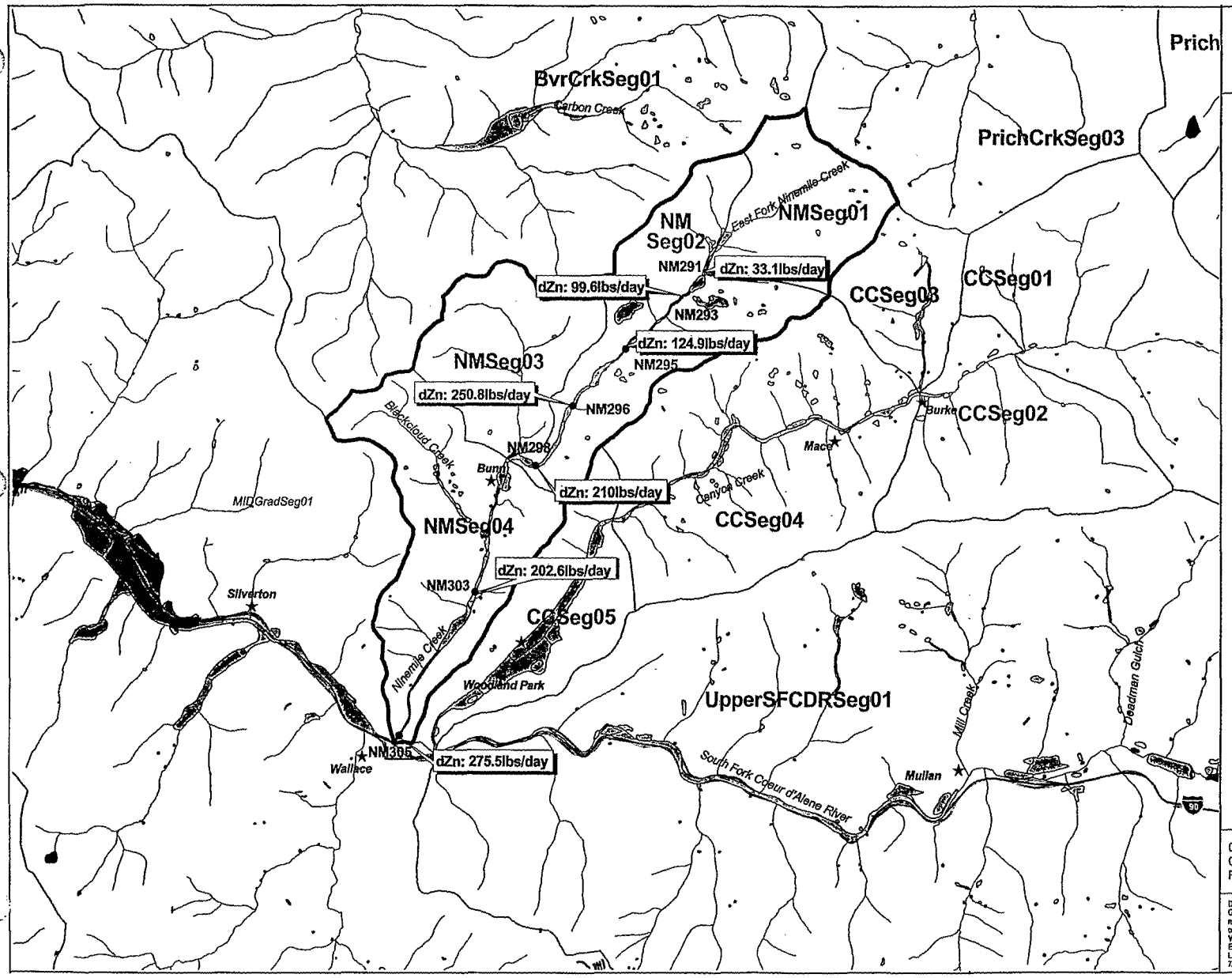


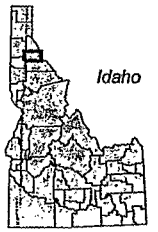
Figure 5.4-6
Ninemile Creek Watershed
Estimated Expected Values for
Dissolved Zinc Mass Loading

LEGEND

Sample Location
dZn: 210lbs/day — Mass Load
Dissolved Zinc Concentration

Range of Total Zinc (tZn) Mass Loading in lbs/day
- Range: 0 - 100
- Range: 100 - 500
- Range: 500 - 1000
- Range: 1000 - 1500
- Range: > 1500

- Stream
- Road
- Interstate 90
- City
- Ninemile Creek Watershed
- Ninemile Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

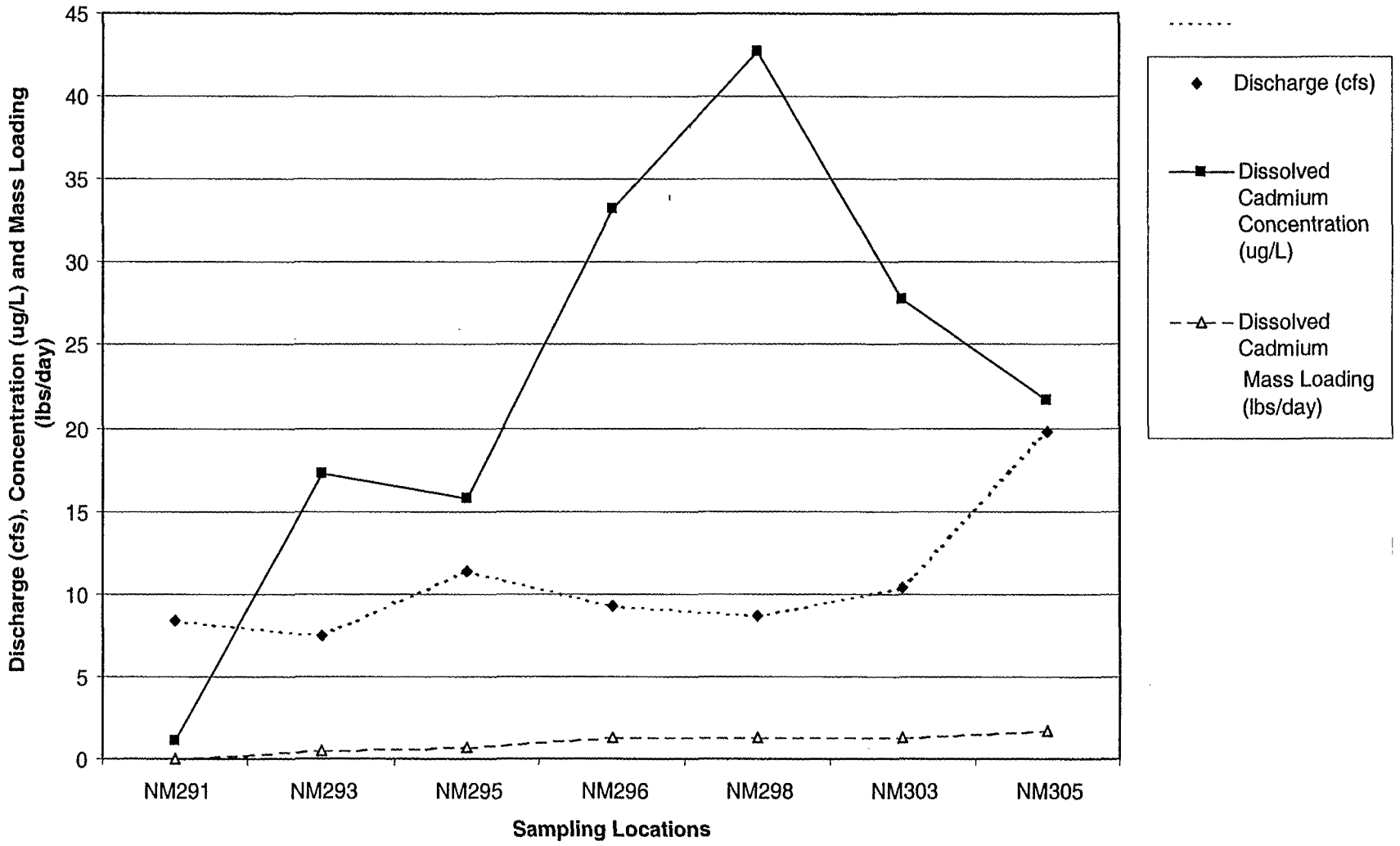
EPA REGION 10

Document Control 4162500.6515.05.a
Generation 1
n:\Projects\watershed\ninemil_canyon co-loading data-7-10-00.apr
Y:\Ninemile -Zn
E: Watershed
L: Final RI Ninemile Creek dZn fig 5.4-6
7/17/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

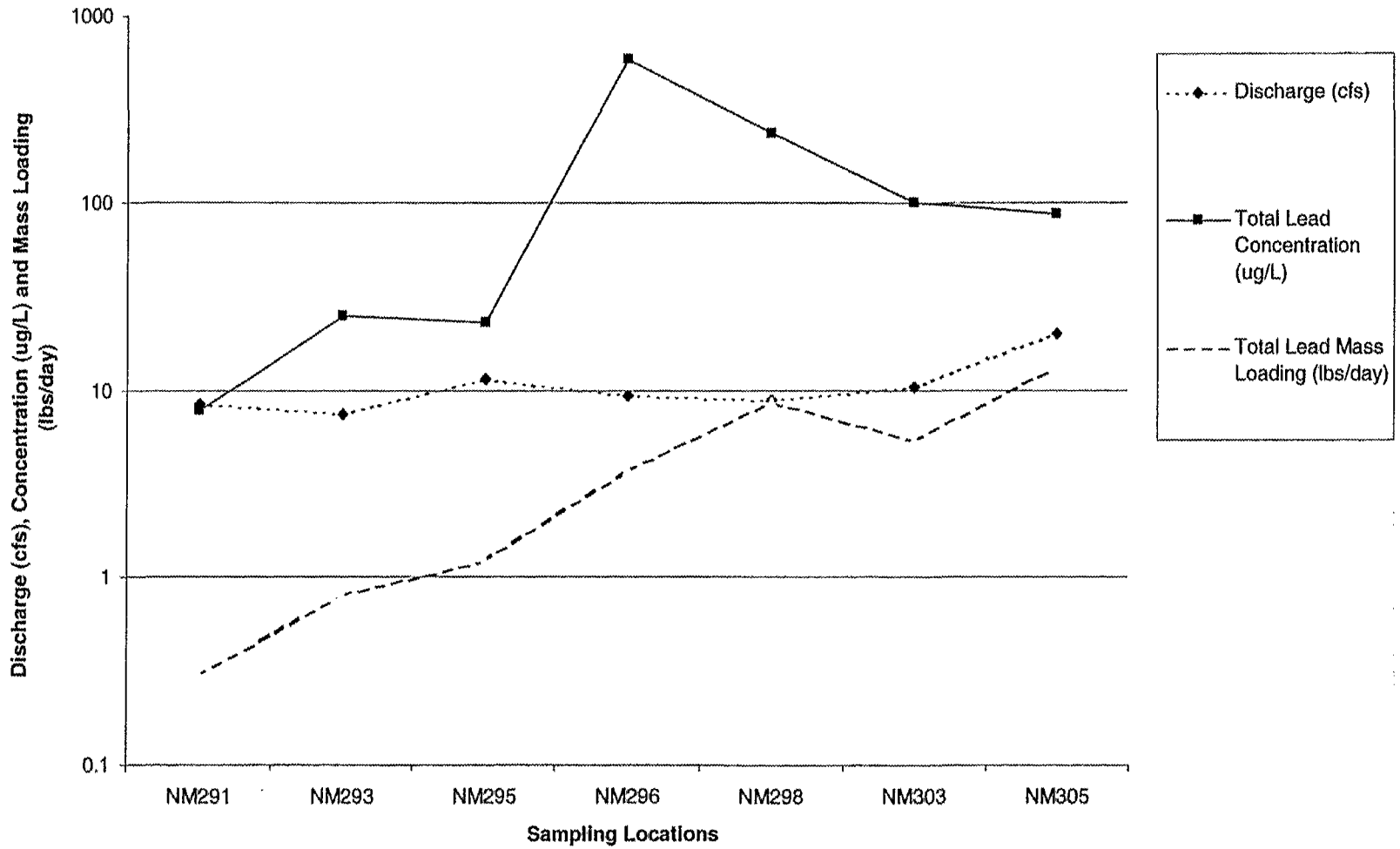
Date of Plot: July 17, 2001

Estimated Expected Values for Discharge, Dissolved Cadmium Concentrations and Total Cadmium Mass Loading



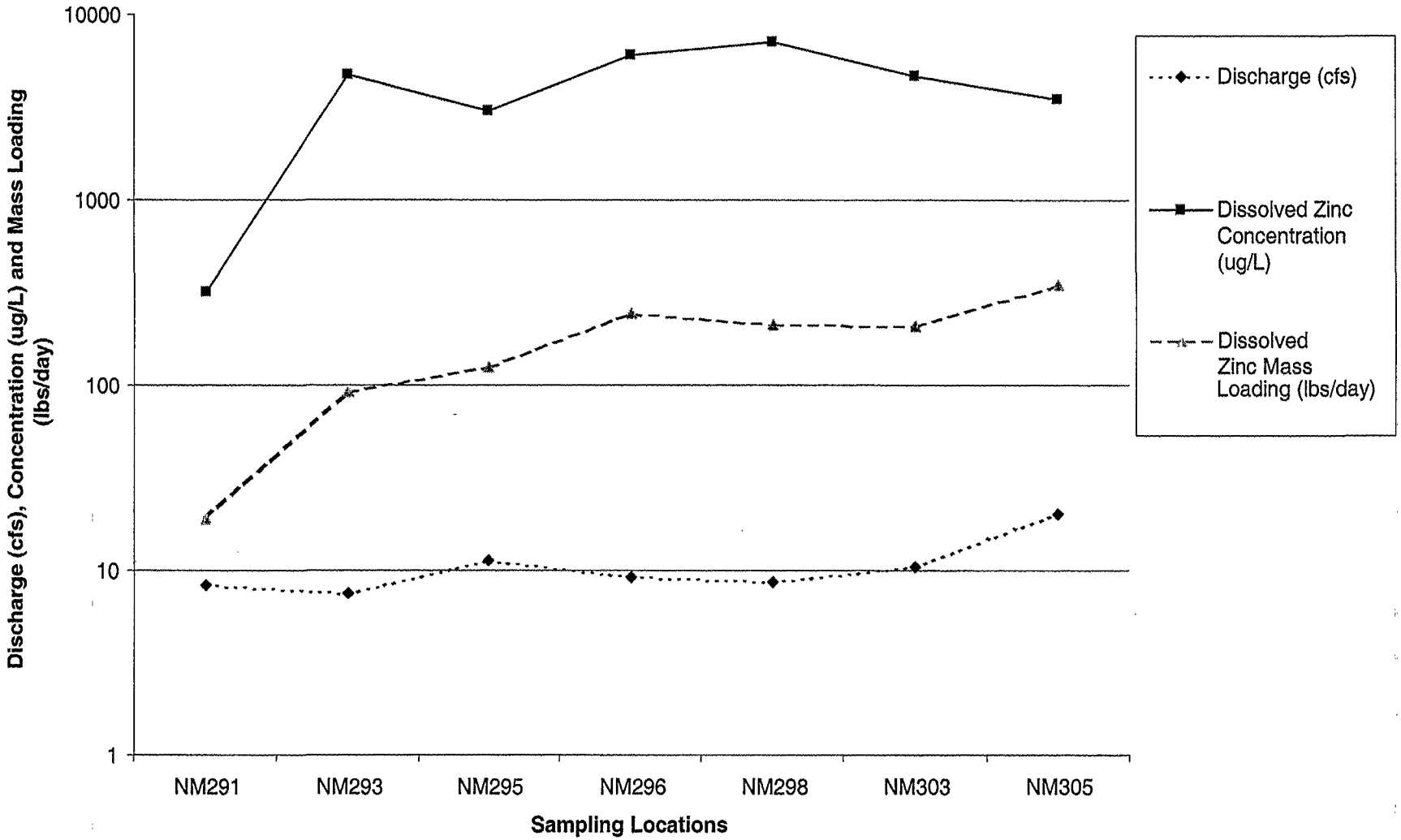
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.4-7

Estimated Expected Values for Discharge, Total Lead Concentration and Total Lead Mass Loading



EPA REGION	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.4-8

Estimated Expected Values for Discharge, Dissolved Zinc Concentration and Dissolved Zinc Mass Loading



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Ninemile Creek Series 07/13/01	Figure 5.4-9

Table 5.1-1
Instantaneous Low and High Metal Loading Values
For Six Sampling Events From May 1991 to May 1999

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.0002	10.3
Total Lead	0.006	534
Dissolved Lead	0.001	22.5
Dissolved Zinc	0.07	1,780

Table 5.2-1
Summary of Estimated Expected Values for Metals Concentrations and Mass Loading in Ninemile Creek[a]

Sampling Location	Concentration (µg/L)			Mass Loading (pounds/day)			Discharge (cfs)
	Dissolved Cadmium	Total Lead	Dissolved Zinc	Dissolved Cadmium	Total Lead	Dissolved Zinc	
Screening Level or TMDL[b]	0.38	15	42	0.107	0.20[c]	9.72	NA
NM291	**1.1** (0.48)	7.68 (1.36)	**318** (1.56)	0.03 (1.34)	**0.318** (4.2)	**33.1** (0.84)	8.4 (2.31)
NM293	**17.3** (0.76)	**24.6** (0.687)	**4,667** (2.16)	**0.5** (1.06)	**0.838** (1.37)	**99.6** (11.86)	7.5 (1.25)
NM295	**15.8** (0.68)	**23.2** (0.503)	**2,995** (0.61)	**0.6** (0.91)	**1.25** (1.3)	**124.9** (1.74)	11.4 (1.34)
NM296	**33.2** (0.55)	**587** (7.2)	**6,068** (0.53)	**1.3** (0.7)	**3.72** (0.686)	**250.8** (0.88)	9.3 (0.85)
NM298	**42.7** (0.663)	**234** (0.875)	**7,140** (0.694)	**1.27** (0.774)	**8.56** (1.41)	**210** (0.72)	8.7 (1.33)
NM303	**27.7** (0.42)	**99.4** (0.43)	**4,600** (0.8)	**1.3** (0.74)	**5.34** (1.07)	**202.6** (0.787)	10.4 (0.98)
NM305	**22** (0.48)	**92.1** (0.802)	**3,411** (0.47)	**1.6** (0.86)	**13.1** (2.63)	**275.5** (0.92)	19.8 (1.31)

[a]Summary tables with all modeling results are included in Appendix C.
[b]TMDLs are based on the 90th percentile.
[c]The TMDL for total lead was obtained by multiplying by a translator as explained in text.

Notes:
Values in parentheses are coefficients of variation.
Bold indicates exceedance of screening level or TMDL.

Table 5.2-2
Estimated Gains or Losses (EV[X]) in Discharge in Reaches in Ninemile Creek

Reach – Between Location Xi and Xj (# of Samples)	Estimated Expected Value of Gain or Loss (EV[X]) in Discharge, cfs	Coefficient of Variation (CV) for Reach ($p_{xi,xj}$ = 0.9)
NM291 (32) to NM293	-0.9	13.0
NM293 (23) to NM295	3.9	2.0
NM295 (18) to NM296	-2.1	4.2
NM296 (54) to NM298	-0.6	9.4
NM298 (50) to NM303	1.7	3.0
NM303 (42) to NM305 (96)	9.4	1.8

Table 5.2-3
Estimated Gains or Losses (EV[X]) for Dissolved Zinc Concentrations (µg/L) and Dissolved Load (pounds/day)

Reach – Between Location Xi and Xj (# of samples)	Estimated Expected Value of Increase or Decrease in the Concentration of Dissolved Zinc (µg/L)	Estimated Coefficient of Variation (CV) for the Dissolved Zinc ($p_{xi,xj}$ = 0.9)	Estimated Expected Value of Gain or Loss in the Dissolved Zinc Load (pounds/day)	Estimated Coefficient of Variation (CV) for the Dissolved Zinc Load ($p_{xi,xj}$ = 0.9)
NM291 (32) to NM293	4,349	2.2	66.5	17.4
NM293 (23) to NM295	-1,672	5.1	25.3	39.1
NM295 (18) to NM296	3,073	0.6	125.9	0.8
NM296 (54) to NM298	1,072	2.3	-40.8	2.6
NM298 (50) to NM303	-2,540	0.9	-7.4	9.4
NM303 (42) to NM305 (96)	-1,189	2.0	72.9	1.8

Table 5.4-1
Potential Major Source Areas in Ninemile Creek Watershed

Reach	Location Description	Associated Source Areas
NM291 to NM293	Wilson Creek to Tamarack 400 Level Mine	Tamarack Rock Dumps, Millsite, 400 Level, and Tamarack No. 5
NM293 to NM295	Tamarack 400 Level Mine to ¼ mile upstream from Success No. 3	Rex No.2/ Sixteen-to-One Mine
NM295 to NM298	¼ mile upstream from Success No. 3 to ½ mile upstream from Bunn	Success Mine Rock Dump, Success No. 3 and Alameda Mine
NM298 to NM303	½ mile upstream from Bunn to Northside Mine	Dayrock Mine and Tailings Repository

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ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
7	IDEQ Historical Data	IDEQ Water Quality Data	Idaho Department of Environmental Quality. 1998. Assortment of files from Glen Pettit for water years 1993 through 1996
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
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			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: PCSDATA.WK4
10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. I, Prichard Creek and Eagle Creek Drainages
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
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13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
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14	Historical Sediment Core Data: University of Idaho (Thesis papers)	Historical Lateral Lakes Sediment Data from F. Rabbi and M.L. Hoffman	Characterization of Heavy Metal Contamination in Two Lateral Lakes of the Lower Coeur d'Alene River Valley, A thesis by M.L. Hoffmann, May 1995
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16	Historical Sediment Data	Electronic Data compiled by USGS	U.S. Geological Survey. 1992. Effect of Mining-Related Activities on the Sediment-Trace Element Geochemistry of Lake Coeue d'Alene, Idaho, USA--Part 1: Surface Sediments, USGS Open-File Report 92-109, Prepared by A.J. Horowitz, K.A. Elrick, and R.B. Cook
			US Geological Survey. 2000. Chemical Analyses of Metal-Enriched Sediments, Coeur d'Alene Drainage Basin, Idaho: Sampling, Analytical Methods, and Results. Draft. October 13, 2000. Prepared by S.E. Box, A.A. Bookstrom, M. Ikramuddin, and J. Lindsey. Samples collected from 1993 to 1998.

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
17	USGS Spokane River Basin Sediment Samples	Surface Sediment Samples Collected by USGS in the Spokane River Basin	Environmental Protection Agency. 1999. Data Validation Memorandum and Attached Table from Laura Castrilli to Mary Jane Nearman dated June 9, 1999. Subject: Coeur d'Alene (Bunker Hill) Spokane River Basin Surface Sample Samples, USGS Metals Analysis, <63 um fraction, Data Validation, Samples SRH7-SRH30
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
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22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
28	USGS National Water Quality Assessment database	Surface water data for sampling location NF50 at Enaville, Idaho.	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur d'Alene River at Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are shown in the data summary tables in the "Ref" column.

Data Summary Table
Nine Mile Creek - segment NmSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM289	RV	2	11/13/1997		0.05 U	0.16 U	0.069 U	0.17 J	8.6 U	0.11 J	1.1 J	0.1 U	0.22 U	12.2 U
NM289	RV	4	05/16/1991				0.2 U			3 U				20 U
NM289	RV	5	10/04/1991				0.2 U			1				12 U
NM289	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	21	1	5 U	0.2 U	0.2 U	12
NM290	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	51	2.6	5 U	0.2 U	0.2 U	19
NM365	AD	2	11/14/1997		4.8 J	3.8	155	* 156	6690	* 2010	1590	0.25 U	2.8	* 28400 J
Surface Water - Dissolved Metals (ug/l)														
NM289	RV	2	11/13/1997		0.5 U	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	4.7
NM289	RV	4	05/16/1991				0.2 U			3 UJ				20 U
NM289	RV	5	10/04/1991				0.2 U			0.1 U				12 U
NM289	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.6	5 U	0.2 U	0.2 U	11
NM290	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.8	5 U	0.2 U	0.2 U	16
NM365	AD	2	11/14/1997		0.5 U	0.36	* 150	14.9	10 U	93.1	789	0.2 U	0.03 U	* 24300

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
NM11243	FP	16	—			58.1	8.9	156	38500	14500	1430			2670
NM11244	FP	16	—			23.9	11.7	265	58600	* 20400	1640			2290
NM11245	FP	16	—			26.2	3 U	421	74100	* 59600	741			1540
NM11246	FP	16	—			50	10.3	192	43200	* 22300	757			3720
NM11247	FP	16	—			12.6	12.7	143	39800	* 19600	878			2680
NM1126	GS	15	10/02/1998				2.49		62700	26.6				223
NM1127	GS	15	10/02/1998				6.88	154	271000	1510				653
NM1127	GS	15	10/05/1998				9.79		3480	138				938
NM1128	GS	15	10/02/1998				24.3	233	260000	* 54100				2370
NM1128	GS	15	10/05/1998				4.43			200				413
NM1129	GS	15	10/05/1998				21.4		296000	437				2080
NM1589	GS	15	10/05/1998					276	70400	12300				27600
NM1591	GS	15	10/05/1998				50.4		19300	384				10500
NM1596	GS	15	10/05/1998				1.51	144	79200	7530				126
NM1597	GS	15	10/05/1998				3.48	56.6	34800	3950				320
NM1599	GS	15	10/05/1998				17.5	113	73600	5360				1700
NM1600	GS	15	10/05/1998				19.9	115	63100	8320				1930
NM1601	GS	15	10/02/1998				1.3			109				106
NM1603	GS	15	10/02/1998				31.3	87.9	29000	1280				3050
NM1604	GS	15	10/02/1998				14.8		40400	4400				1430
NM1605	GS	15	10/02/1998				211	4190	117000	* 35400				* 127000
NM1606	GS	15	10/02/1998						120000	* 46600				20900
NM1606	GS	15	10/12/1998	0			1.48	1160	128000	300				123
NM1607	GS	15	10/02/1998				18.9	224	129000	* 19800				1830
NM1608	GS	15	10/02/1998				1.51		13900	333				126
NM1609	GS	15	10/02/1998				2.48	44.9	39100	663				221
NM1610	GS	15	10/02/1998				1.8		17700	157				155
NM1611	GS	15	10/02/1998				3.02	113	20600	640				274
NM1612	GS	15	10/06/1998					50	314000	1630				16300
NM1630	GS	15	10/05/1998				18	103	38100	1060				1750
NM1631	GS	15	10/05/1998				4		15400	10.7				370
NM1632	GS	15	10/05/1998				1.29		18400					105
NM1633	GS	15	10/05/1998				0.786		17500					55.1
NM1634	GS	15	10/05/1998				0.972		17900					73.4
NM1636	GS	15	10/02/1998				298		26800	10400				* 166000
NM1641	GS	15	10/05/1998				13.6	12.8	27300	5860				1310
NM1643	GS	15	10/05/1998				1.9		18100					164

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
NM1644	GS	15	10/05/1998				6.68		23100	404				633
NM1645	GS	15	10/05/1998				3.79		18058.56198	42.5				350
NM1648	GS	15	10/02/1998				16.3	41.5	76000	8980				1580
NM1648	GS	15	10/13/1998				16	109	77900	10700				1550
NM1651	GS	15	10/05/1998				4.72		55000	* 58700				441
NM1661	GS	15	10/05/1998				530							* 269000
NM1661	GS	15	10/05/1998					* 24300	43600	1370				
NM1663	GS	15	10/05/1998				12.3		33900	1220				1180
NM1664	GS	15	10/05/1998				0.989		14600	89.5				75
NM1665	GS	15	10/05/1998				1.43		7020	1220				118
NM1666	GS	15	10/05/1998				0.181	54.3	13800	3300				
NM1667	GS	15	10/05/1998				6.72		18400	420				637
NM1668	GS	15	10/02/1998				6.2	381	95100	1840				586
NM1676	GS	15	10/06/1998					144	42000	6480				18700
NM2001	GS	15	10/02/1998				6.47			1470				613
NM2004	GS	15	10/12/1998				2.64		14600	65.4				237
NM413	GS	11	10/25/1998	0	3.2 J	14.1	6.4	63.3	32700	4200	1270	0.2 J	4	2440
NM414	GS	11	10/25/1998	0	2.3 J	12.8	10.9	127	31800	2350	1250	0.11 J	2.4	2560
NM415	GS	11	10/25/1998	0	1.8 J	75.3	19.3	174	36000	2050	810	0.15 J	2.3	5840
NM416	GS	11	10/25/1998	0	2.6 J	20.1	13.5	191	34900	4500	1360	0.82	7.4	5050
NM417	GS	11	10/25/1998	0	3.7 J	49.8	3.3	40	35300	3870	910	0.09 J	5.1	1110
NM429	GS	11	11/10/1998	0	0.42 UJ	1.6 J	0.24 U	70	18500	83.4	2570	9	0.14 U	109
NM430	GS	11	11/10/1998	0	2.8 J	10	16.4	81.1	27900	3230	798	2.2	5.3	3160
NM431	GS	11	11/10/1998	0	9.3 J	23.8	19.9	136	49500	4530	327	9.5	20.3	3980
NM432	GS	11	11/10/1998	0	6.6 J	7.5	3.1	122	37700	6210	351	6.2	14.9	1090
NM433	GS	11	11/10/1998	0	4.2 J	5.4	40.1	70.3	28400	4070	1560	2.5	8.8	9300
NM461	GS	11	11/10/1998	0	10.5 J	43.6	14.5	288	64400	16100	1340	1.3	24.4	4120
NM462	GS	11	11/10/1998	0	3.1 J	14.5	8.5	67.1	29300	4610	1080	0.63	5.1	2970
Subsurface Soil (mg/kg)														
NM421	MW	11	10/23/1998	5	10.6 UJ	0.21 U	0.42 UJ	9.7	11500	6.9	526	0.05 U	0.64 U	268
NM421	MW	11	10/23/1998	10	10.4 UJ	0.2 U	0.42 UJ	9.4	10000	6.5	310	0.05 U	0.63 U	41.1
NM422	MW	11	10/23/1998	10	11.7 UJ	3.4	2.9 J	20.1	22800	206	353	0.06 U	0.7 U	1050
NM422	MW	11	10/23/1998	15	10.9 UJ	1.1	0.45 J	13.2	12800	26	846	0.05 U	0.65 U	74.1
NM423	MW	11	10/23/1998	5	466 J	148	78.4 J	228	43000	* 25700	3210	21	77.7	10900
NM444	MW	11	10/23/1998	7	11.6 UJ	34.5	39 J	45.6	43200	4180 J	2190	0.36	4.9	7070
NM444	[illegible]	11	10/23/1998	35	12.1 UJ	37.7	26.6 J	[illegible]	51500	4070	3040	0.31	3.8	4840

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Subsurface Soil (mg/kg)														
NM444	MW	11	10/23/1998	55	12.2 UJ	27.7	12.6 J	91.5	42200	4360	2450	0.11 J	4.1	2340
Sediment (mg/kg)														
NM765	TP	2	12/15/1997	1.5	0.984 J	1.62 J	3.33 J	14.8 J	7660 J	258 J	529	0.0835 J	0.344 J	265 J
NM766	TP	2	12/15/1997	0	3.06 UJ	1.91 J	34.7 J	22.2 J	14300 J	723 J	575	0.0499 U	1.68 J	6940 J
NM767	TP	2	12/15/1997	1	3.76 UJ						1620			
NM767	TP	2	12/15/1997	1		11.5 J	19.3 J	90.4 J	25800 J	4040 J		1.46	4.6 J	3190 J
NM767	TP	2	12/15/1997	2.5	5.25 UJ	9.1 J	* 199 J	77.3 J	22500 J	1580 J	480	0.183	9.08 J	* 21900 J
NM770	TP	2	01/17/1998	0	1.1 J	8.9	13.3	280	98700	1760	6810	0.41	4.5	12200
NM771	TP	2	01/17/1998	0	5.7 J	13.2	55	93.6	29200	* 5540	2700	1.3	7.9 J	7310
Groundwater - Total Metals (ug/l)														
NM422	MW	11	12/01/1998	16	1.8 J	1 U	5.1	5 U	216	1.6 J	61.2	0.2 U	5 U	817
NM422	MW	23	12/01/1999	16	2 U	1 U	6.5	5 U	210	2.8	54.8	0.2 U	5 U	1070
NM444	MW	11	12/01/1998	78	2 J	1 U	6.7	5 U	1410	20.5	2730	0.2 U	5 U	* 4600
NM444	MW	23	12/01/1999	78	2 U	1 U	7.3	5 U	1320	30.6	255	0.2 U	5 U	2540
Groundwater - Dissolved Metals (ug/l)														
NM422	MW	11	12/01/1998	16	1 U	1 U	5.3	5 U	50 U	1 U	61.3	0.2 U	5 U	765
NM422	MW	23	12/01/1999	16	2 U	1 U	7.8	5 U	164	2 J	11	0.2 U	5 U	1180
NM444	MW	11	12/01/1998	78	2.1 J	1 U	6.8	5 U	407	2	* 3010	0.2 U	5 U	* 4440
NM444	MW	23	12/01/1999	78	2 U	1 U	9.7	5 U	69.4 J	0.54 J	775	0.2 U	5 U	3620
Surface Water - Total Metals (ug/l)														
NM100	RV	18	05/23/1999				10		1600 U	620	180			1700
NM291	RV	2	11/13/1997		0.12 U	0.19	1.1	0.22 J	63.1 J	1.5	2.8 J	0.1 U	0.22 U	328
NM291	RV	4	05/16/1991				0.6			3				145
NM291	RV	5	10/04/1991				1			4				260
NM291	RV	7	10/27/1993				1.5			2.5 U				314
NM291	RV	7	12/02/1993				1.5			28				328
NM291	RV	7	12/16/1993				1.2			7				300
NM291	RV	7	01/24/1994				1.3			8				300
NM291	RV	7	04/08/1994				1.4			6				315
NM291	RV	7	04/19/1994				2.1			18				410
NM291	RV	7	05/04/1994				1			2.5 U				167

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM291	RV	7	05/19/1994				0.6			5				102
NM291	RV	7	06/07/1994				1.2			2.5 U				145
NM291	RV	7	06/23/1994				1			5				161
NM291	RV	7	07/20/1994				1.1			2.5 U				198
NM291	RV	7	08/15/1994				1.4			5				257
NM291	RV	7	09/08/1994				1.2			5				251
NM291	RV	7	10/04/1994				1.4			8				308
NM291	RV	7	04/13/1995				1.2			8				279
NM291	RV	7	04/25/1995				1.3			8				316
NM291	RV	7	05/09/1995				1.4			12				151
NM291	RV	7	05/23/1995				0.7			5				74
NM291	RV	7	06/12/1995				0.5			9				75
NM291	RV	7	06/27/1995				0.6			2.5 U				97
NM291	RV	7	07/11/1995				0.8			5				142
NM291	RV	7	07/25/1995				0.8			7				160
NM291	RV	7	08/14/1995				1.1			8				216
NM291	RV	7	09/13/1995				1.3			14				261
NM291	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	22	0.3	5 U	0.2 U	0.2 U	10 U
NM291	RV	11	11/15/1998		1 U	1 U	1 U	5 U	50 U	2	5 U	0.2 U	5 U	15.5
NM292	RV	2	11/13/1997		0.05 U	0.16 U	0.069 U	0.06 U	145	1.7	7.4 J	0.1 U	0.22 UJ	13.6 U
NM292	RV	3	05/14/1998		0.2 U	2 U	0.2	2 U	42	1.9	5 U	0.2 U	0.2 U	34
NM292	RV	11	11/15/1998		1 U	1 U	1.3	5 U	50 U	3.1	5 U	0.2 U	5 U	374
NM293	RV	2	11/12/1997		0.28 U	0.16 U	15.8	0.72 J	370	15.6	94.1	0.1 U	0.22 U	* 4450
NM293	RV	4	05/16/1991				3.7			15				1250
NM293	RV	5	10/04/1991				9			19				2330
NM293	RV	7	04/19/1994				28.7			102				* 3870
NM293	RV	7	05/04/1994				21			16.6				2630
NM293	RV	7	05/19/1994				11			13				1430
NM293	RV	7	06/07/1994				13			12				1960
NM293	RV	7	06/23/1994				12			18				2100
NM293	RV	7	07/20/1994				13			18				2420
NM293	RV	7	08/15/1994				16			23				2990
NM293	RV	7	09/08/1994				13			20				2890
NM293	RV	7	10/04/1994				14			27				* 3330
NM293	RV	7	05/09/1995				12			57				2460
NM293	RV	7	05/13/1995				46			23				* 9110
NM293	RV	7	05/23/1995				9.8			14				1550

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM293	RV	7	06/12/1995				8.9			14				1610
NM293	RV	7	06/27/1995				11			11				1870
NM293	RV	7	07/11/1995				12			15				2260
NM293	RV	7	07/25/1995				13			16				2530
NM293	RV	7	08/14/1995				16			20				* 3280
NM293	RV	7	09/13/1995				18			37				* 3920
NM293	RV	3	05/14/1998		0.2 U	2 U	5.4	2 U	78	19.7	61	0.2 U	0.2 U	1340
NM293	RV	11	11/15/1998		1 U	1 U		5 U				0.2 U	5 U	
NM293	RV	11	11/15/1998				79.3		234	126	990			* 15100
NM294	RV	2	11/13/1997		0.36 U	0.25	16	2.8 J	324	75	126	0.1 U	0.22 U	* 6360
NM294	RV	3	05/14/1998		0.2 U	2 U		2 U	166			0.2 U	0.2 U	
NM294	RV	3	05/14/1998				13.2			19.1	141			* 4810
NM294	RV	11	11/15/1998		1 U	1 U	1 U	5 U	52.3 J	1 UJ	5 U	0.2 U	5 U	69.3
NM295	RV	2	11/12/1997		0.27 U	0.16 U	16.4	0.58 J	268	15.8	37.4	0.1 U	0.22 U	* 4280
NM295	RV	4	05/16/1991				4			16				1330
NM295	RV	5	10/04/1991				10.1			19				2760
NM295	RV	7	04/19/1994				26			22				* 3910
NM295	RV	7	05/03/1994				18.3			22.3				2610
NM295	RV	7	05/19/1994				12			24				1550
NM295	RV	7	06/07/1994				14			15				2050
NM295	RV	7	07/20/1994				15			20				2650
NM295	RV	7	08/15/1994				18			24				* 3230
NM295	RV	7	09/08/1994				16			20				* 3170
NM295	RV	7	10/04/1994				17			24				* 3920
NM295	RV	7	05/09/1995				13			37				2720
NM295	RV	7	05/23/1995				10.3			23				1580
NM295	RV	7	06/12/1995				8.5			14				1750
NM295	RV	7	06/27/1995				11			13				1990
NM295	RV	7	07/11/1995				12			20				2390
NM295	RV	7	07/25/1995				14			18				2610
NM295	RV	7	08/14/1995				17			21				* 3390
NM295	RV	7	09/13/1995				20			20				* 4010
NM295	RV	3	05/15/1998		0.5 U	1 U	6.5	3 U	29.6 U	13.9	51.5	0.2 UJ	0.3 U	1570
NM295	RV	11	11/15/1998		1 U	1 U	59.4	5 U	140	74.4	527	0.2 U	5 U	* 12100
NM296	RV	2	11/12/1997		0.41 U	0.1	38	7	15.1 U	80.5	51.3	0.1 U	0.22 U	* 8080
NM296	RV	4	05/16/1991				7.5			24				2090
NM296	RV	5	10/04/1991				31.2			106				* 6100

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM296	RV	7	04/06/1994				36			120				* 6450
NM296	RV	7	04/19/1994				32			382				* 4560
NM296	RV	7	05/03/1994				27.3			78.3				* 3830
NM296	RV	7	05/19/1994				19			63				2600
NM296	RV	7	06/07/1994				24			88				* 3420
NM296	RV	7	06/23/1994				27			94				* 4210
NM296	RV	7	07/20/1994				33			143				* 5000
NM296	RV	7	08/15/1994				38			153				* 5880
NM296	RV	7	09/08/1994				38			158				* 5830
NM296	RV	7	10/04/1994				38			158				* 6730
NM296	RV	7	11/15/1994				50			193				* 9660
NM296	RV	7	12/13/1994				55			187				* 11100
NM296	RV	7	02/09/1995				55			137				* 10800
NM296	RV	7	03/22/1995				48			118				* 9820
NM296	RV	7	04/13/1995				47			100				* 8870
NM296	RV	7	04/25/1995				44			77				* 9750
NM296	RV	7	05/09/1995				19			82				* 3510
NM296	RV	7	05/23/1995				14			46				2280
NM296	RV	7	06/12/1995				14			46				2810
NM296	RV	7	06/27/1995				22			70				* 3670
NM296	RV	7	07/11/1995				22			74				* 4230
NM296	RV	7	07/25/1995				28			85				* 5050
NM296	RV	7	08/14/1995				29			110				* 5570
NM296	RV	7	09/13/1995				38			132				* 6460
NM296	RV	7	10/18/1995				45			108				* 7970
NM296	RV	7	11/21/1995				28			66				* 5200
NM296	RV	7	12/27/1995				38			69				* 6070
NM296	RV	7	01/17/1996				40			93				* 6860
NM296	RV	7	03/28/1996				27			59				* 5070
NM296	RV	7	04/17/1996				29			54				* 5140
NM296	RV	7	05/08/1996				26			50				* 4560
NM296	RV	7	06/19/1996				12			33				1930
NM296	RV	7	07/24/1996				23			70				* 3530
NM296	RV	7	08/21/1996				29			92				* 4640
NM296	RV	7	09/26/1996				33			135				* 5640
NM296	RV	7	10/29/1996				33			150				* 5940
NM296	RV	7	11/27/1996				42			152				* 8610

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM296	RV	7	12/13/1996				41			134				* 8260
NM296	RV	7	01/30/1997				42			94				* 7500
NM296	RV	7	02/19/1997				37			75				* 7130
NM296	RV	7	03/26/1997				40			84				* 7130
NM296	RV	7	04/16/1997				33			74				* 6090
NM296	RV	7	05/15/1997				22			* 4260				* 3650
NM296	RV	7	06/24/1997				8.5			30				1540
NM296	RV	7	07/23/1997				15			42				2950
NM296	RV	7	08/14/1997				20			52				* 4170
NM296	RV	7	09/04/1997				25			48				* 4860
NM296	RV	7	10/16/1997				35			71				* 6290
NM296	RV	7	11/26/1997				34			63				* 6820
NM296	RV	7	12/17/1997				36			70				* 6930
NM296	RV	7	01/21/1998				39			56				* 6700
NM296	RV	7	02/25/1998				33			66				* 6470
NM296	RV	7	03/20/1998				32			101				* 5410
NM296	RV	7	04/23/1998				24			223				* 5110
NM296	RV	7	05/07/1998				8.7			59				1630
NM296	RV	7	05/28/1998				11			50				2220
NM296	RV	7	06/26/1998				19			44				* 3400
NM296	RV	7	06/26/1998				19			41				* 3510
NM296	RV	7	07/28/1998				27			80				* 4650
NM296	RV	7	08/26/1998				32			68				* 5550
NM296	RV	7	09/24/1998				29			62				* 5800
NM296	RV	7	10/08/1998				34			67				* 6290
NM296	RV	7	10/26/1998				38			64				* 6960
NM296	RV	7	11/25/1998				72			227				* 13100
NM296	RV	3	05/16/1998		0.7 U	0.2 U	10 J	2.7	45.7 J	26.8		0.2 U		
NM296	RV	11	12/06/1998		1 U	1 U	91.1	18.6	77.7 J	160	290	0.2 U	5 U	* 17200
NM297	RV	2	11/12/1997		0.52 U	0.12	40.4	4.9	29.4 U	129	42.2	0.1 U	0.22 U	* 8240
NM297	RV	5	10/04/1991				32.8			182				* 6100
NM297	RV	3	05/15/1998		0.5 U	1 U	11.4	3.6	48.2 U	46.4	47.3	0.2 U	0.3 U	2290
NM297	RV	11	12/06/1998		1 U	1 U	87.8	13.3	64 J	235	234	0.2 U	5 U	* 16500
NM298	RV	2	11/12/1997			0.18		4.6		138	45.1	0.15 J	0.22 U	* 8450
NM298	RV	2	11/12/1997		0.52 U		42.7		19.1 U					
NM298	RV	7	10/27/1993				31			268				* 5550
NM298	RV	7	12/02/1993				30			114				* 6361

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM298	RV	7	12/16/1993				43			280				* 7350
NM298	RV	7	01/24/1994				38			290				* 8640
NM298	RV	7	02/18/1994				51			224				* 7670
NM298	RV	7	03/08/1994				48			362				* 7360
NM298	RV	7	03/24/1994				48			252				* 7920
NM298	RV	7	04/07/1994				39			159				* 6930
NM298	RV	7	04/18/1994				32			504				* 4730
NM298	RV	7	05/04/1994				28			103				* 3900
NM298	RV	7	05/19/1994				19			70				2680
NM298	RV	7	06/07/1994				27			106				* 3750
NM298	RV	7	06/23/1994				29			128				* 4400
NM298	RV	7	07/20/1994				36			166				* 5160
NM298	RV	7	08/15/1994				42			158				* 5890
NM298	RV	7	09/08/1994				40			153				* 6140
NM298	RV	7	10/04/1994				46			239				* 7720
NM298	RV	7	11/15/1994				92			* 4000				* 11100
NM298	RV	7	12/13/1994				78			352				* 12200
NM298	RV	7	01/10/1995				60			375				* 9150
NM298	RV	7	02/09/1995				58			234				* 10300
NM298	RV	7	03/07/1995				48			206				* 8450
NM298	RV	7	03/22/1995				54			180				* 9780
NM298	RV	7	04/13/1995				48			190				* 9390
NM298	RV	7	04/25/1995				46			164				* 9730
NM298	RV	7	05/09/1995				20			178				* 3800
NM298	RV	7	05/23/1995				15			108				2310
NM298	RV	7	06/12/1995				16			102				2810
NM298	RV	7	06/27/1995				26			134				* 3720
NM298	RV	7	07/11/1995				26			178				* 4380
NM298	RV	7	07/25/1995				32			338				* 5460
NM298	RV	7	08/14/1995				37			272				* 5830
NM298	RV	7	09/13/1995				46			274				* 6630
NM298	RV	18	10/27/1998				42			110				* 7300
NM298	RV	18	11/19/1998							150				* 12000
NM298	RV	18	12/10/1998				80			200				* 15000
NM298	RV	18	01/21/1999				49			140				* 9500
NM298	RV	18	03/22/1999				43			220				* 6800
NM298	RV	18	04/20/1999				39			400				* 6200

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM298	RV	18	05/05/1999				27			85				* 4500
NM298	RV	18	05/23/1999				12		1200 U	450	110			1900
NM298	RV	18	06/15/1999				6			93				850
NM298	RV	18	07/07/1999				10.7			50.4				1820
NM298	RV	18	08/04/1999				20.8			82.5				2910
NM298	RV	18	09/01/1999				29.2			95.5				* 5060
NM298	RV	7	10/01/1998				32			74				* 6040
NM298	RV	7	01/15/1999				52			140				* 9460
NM298	RV	7	02/23/1999				50			132				* 8490
NM298	RV	7	03/08/1999				47			114				* 8490
NM298	RV	3	05/14/1998		0.2 U	2 U	10.5	2	37	48.2	42	0.2 U	0.2 U	2050
NM359	AD	3	05/17/1998		0.3 U	1.3 U	* 377 J	28.1		30.9		0.2 U		
NM360	AD	2	11/13/1997		0.34 U	0.16 U	0.12 J	0.06 U	71 J	0.28 J	14.7	0.1 U	0.22 U	54.9
NM360	AD	3	05/13/1998		0.29 J	0.79 J	0.12 J	1.3 J	775	6.8	34.1	0.16 U	0.043 J	47.9
NM361	AD	2	11/14/1997		0.39 U	1.9 J	5.6	1.6 J	88.3 J	91.7	21.9	0.1 U	0.22 U	1410 J
NM361	AD	8	04/04/1996		5 U	5 U	14	5 U		148	33.5	0.2 U	1 U	2950
NM361	AD	3	05/13/1998		0.032 U	2.3 J	13.2	2.2 J	106	148	26.3	0.16 U	0.042 U	2820
NM362	SP	2	11/14/1997		0.15 U	0.26 J	0.87	0.43 U	11.9 U	1.9	1 U	0.1 U	0.22 U	262 J
NM362	SP	4	05/15/1991				0.2 U			3 U				20 U
NM362	SP	5	10/04/1991				0.7			1				169
NM362	SP	3	05/13/1998		0.032 U	0.23 U	0.41 J	0.44 U	14.4 J	1.1 J	0.4 J	0.16 U	0.042 U	115
NM363	SP	2	11/14/1997		9.4	10.9	* 1520	* 211	16600	* 1650	* 26800	0.35 U	3	* 430000 J
NM363	SP	3	05/16/1998		0.2 U	8.1 J	* 1810 J	* 340		270		0.2 U	0.2 U	
NM364	AD	2	11/14/1997		0.41 U	0.96 J	0.41	0.89 U	47.1 U	13.2	7.7 J	0.1 U	0.22 U	93.6 J
NM364	AD	3	05/16/1998		0.8 U	1.1 J	0.6 J	1 J	202	13.9	7.1 J	0.2 U		129
NM366	AD	2	11/14/1997		0.91 U	0.15 J	1.5	2.3 J	95.4 J	35.6	274	0.1 U	0.22 U	357 J
NM366	AD	3	05/16/1998		0.8 U	0.2 U	0.3 J	0.4 U	75 J	17.4	10 J	0.2 U		97.7
NM368	SP	2	11/15/1997		0.38 U	0.28 J	13.1	2 J	2320	21.2	1090	0.1 U	0.22 U	* 8530 J
NM368	SP	3	05/13/1998		0.032 U	0.42 J	15.9	3.5 J	94.4 J	113	8.6 J	0.16 U	0.042 U	2900
NM374	SP	3	05/17/1998		0.45 U	0.96 J	156 J	51.4 J	314 J	1300 J	216 J	0.16 U	0.35 U	
NM411	RV	11	11/15/1998		1.1 J	1 J	23.2	5 U	2550	16	1020	0.2 U	5 U	* 10100
NM412	RV	11	11/15/1998		1 U	1 U	59.8	5 U	143	75.7	543	0.2 U	5 U	* 12200
NM435	RV	11	12/06/1998		1 U	1 U	45.6	5 U	50 U	28.6	273	0.2 U	5 U	* 9680
NM435	RV	11	11/15/1998		1 U	1 U	57.3	5 U	118	72.3	486	0.2 U	5 U	* 11800
NM435	RV	11	11/17/1998		0.63 U	0.23 J	62.5	2.8 U	240	131	610	0.2 U	4.5 U	* 11900
NM436	RV	11	12/06/1998		1 U	1 U	50	5 U	177	80.6	242	0.2 U	5 U	
NM437	RV	11	12/06/1998		1 U	1 U	49.1	5 U	50 U	37.1	226	0.2 U	5 U	

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM438	RV	11	12/06/1998		1 U	1 U	55.4	5 U	50 U	53.6	230	0.2 U	5 U	
NM439	RV	11	12/06/1998		1.3 J	1 U	90.7	15.2	50 U	115	314	0.2 U	5 U	
NM440	RV	11	12/06/1998		1 U	1 U		23.8	111	243	299	0.2 U	5 U	* 18000
NM440	RV	11	12/06/1998				92.3							
NM8	RV	4	05/16/1991											2270
NM8	RV	4	05/16/1991				8.6			46				
NM8	RV	5	10/04/1991				32.6			130				* 6380
NM8	RV	11	12/06/1998		1 U	1 U		9.2	50 U	196		0.2 U	5 U	
NM8	RV	11	12/06/1998				91.3				218			
Surface Water - Dissolved Metals (ug/l)														
NM100	RV	18	05/23/1999				8.2		10	25	32			1380
NM291	RV	2	11/13/1997		0.5 U	0.14	1.34	0.5 U	10 U	1.42	1 U	0.2 U	0.03 U	311
NM291	RV	4	05/16/1991				0.4			3 UJ				137
NM291	RV	5	10/04/1991				1			1 U				249
NM291	RV	7	10/27/1993				1.6			1.5 U				331
NM291	RV	7	12/02/1993				1.4			1.5 U				299
NM291	RV	7	12/16/1993				1.2			1.5 U				276
NM291	RV	7	01/24/1994				1.2			1.5 U				303
NM291	RV	7	04/08/1994				1.6			1.5 U				331
NM291	RV	7	04/19/1994				2.9			3.7				397
NM291	RV	7	05/04/1994				1			2 J				161
NM291	RV	7	05/19/1994				0.6			3				106
NM291	RV	7	06/07/1994				1			3				161
NM291	RV	7	06/23/1994				1			1.5 U				158
NM291	RV	7	07/20/1994				1.2			1.5 U				203
NM291	RV	7	08/15/1994				1.3			2.5 J				256
NM291	RV	7	09/08/1994				1.4			1.5 U				259
NM291	RV	7	10/04/1994				1.4			1.5 U				305
NM291	RV	7	04/13/1995				1.3			3				282
NM291	RV	7	04/25/1995				1.3			1.5 U				277
NM291	RV	7	05/09/1995				1			4				136
NM291	RV	7	05/23/1995				0.7			3				71
NM291	RV	7	06/12/1995				0.5			3				74
NM291	RV	7	06/27/1995				0.7			1.5 U				108
NM291	RV	7	07/11/1995				0.9			4				151
NM291	RV	7	07/25/1995				0.8			1.5 U				160

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM291	RV	7	08/14/1995				1			3				209
NM291	RV	7	09/13/1995				1.3			4				241
NM291	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
NM291	RV	11	11/15/1998		1 U	1 U	1 U	5 U	50 U	1 U	5 U	0.2 U	5 U	5.5
NM292	RV	2	11/13/1997		0.5 U	0.1 U	0.04 U	1.1	10 U	0.24	1 U	0.2 U	0.03 U	6.42
NM292	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	1.3	5 U	0.2 U	0.2 U	31
NM292	RV	11	11/15/1998		1 U	1 U	1.4	5 U	50 U	2.5	5 U	0.2 U	5 U	354
NM293	RV	2	11/12/1997		0.5 U	0.13	17.5	0.84	10 U	14.1	89.7	0.2 U	0.03 U	* 4380
NM293	RV	4	05/16/1991				3.8			3 J				1310
NM293	RV	5	10/04/1991				8.3			7				2410
NM293	RV	7	04/19/1994				28			21				3840
NM293	RV	7	05/04/1994				20.3			12.6				2710
NM293	RV	7	05/19/1994				11			9				1500
NM293	RV	7	06/07/1994				13			10				1990
NM293	RV	7	06/23/1994				14			19				2160
NM293	RV	7	07/20/1994				14			13				2490
NM293	RV	7	08/15/1994				16			15				3010
NM293	RV	7	09/08/1994				14			15				2990
NM293	RV	7	10/04/1994				14			12				3480
NM293	RV	7	05/09/1995				13			12				2290
NM293	RV	7	05/13/1995				* 46			12.6				37
NM293	RV	7	05/23/1995				9.3			9				1490
NM293	RV	7	06/12/1995				9			8				1600
NM293	RV	7	06/27/1995				12			9				1900
NM293	RV	7	07/11/1995				12			11				2330
NM293	RV	7	07/25/1995				13			11				2550
NM293	RV	7	08/14/1995				16			14				3360
NM293	RV	7	09/13/1995				18			17				3960
NM293	RV	3	05/14/1998		0.2 U	2 U	4.6	2 U	20 U	7.5	53	0.2 U	0.2 U	1230
NM293	RV	11	11/15/1998		1 U	1 U		5 U				0.2 U	5 U	
NM293	RV	11	11/15/1998				* 78.5		116	95.9	978			
NM294	RV	2	11/13/1997		0.5 U	0.15	17.3	1	10 U	5.67	90.9	0.2 U	0.03 U	* 6230
NM294	RV	3	05/14/1998		0.2 U	2 U		2 U	20 U	3		0.2 U	0.2 U	
NM294	RV	3	05/14/1998				13.6				131			* 4580
NM294	RV	11	11/15/1998		1 U	1 U	1 U	5 U	50 U	1 U	5 U	0.2 U	5 U	43
NM295	RV	2	11/12/1997		0.5 U	0.11	17.5	0.67	10 U	13.9	32	0.2 U	0.03 U	* 4300
NM295	RV	4	05/16/1991				3.8			3 UJ				1390

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM295	RV	5	10/04/1991				10.5			7				2960
NM295	RV	7	04/19/1994				26			21				3740
NM295	RV	7	05/03/1994				20.6			13				2710
NM295	RV	7	05/19/1994				10			13				1660
NM295	RV	7	06/07/1994				15			12				2160
NM295	RV	7	07/20/1994				15			11				2720
NM295	RV	7	08/15/1994				17			16				3320
NM295	RV	7	09/08/1994				17			14				3290
NM295	RV	7	10/04/1994				17			15				3960
NM295	RV	7	05/09/1995				13			13				2420
NM295	RV	7	05/23/1995				9.3			11				1610
NM295	RV	7	06/12/1995				8.7			10				1740
NM295	RV	7	06/27/1995				13			10				2060
NM295	RV	7	07/11/1995				12			13				2480
NM295	RV	7	07/25/1995				14			13				2730
NM295	RV	7	08/14/1995				18			15				3470
NM295	RV	7	09/13/1995				20			17				4110
NM295	RV	3	05/15/1998		0.5 U	1 U	6.5	3 U	20 U	7.6		0.2 U	0.3 U	1390
NM295	RV	3	05/15/1998								46.2			
NM295	RV	11	11/15/1998		1 U	1 U	* 59.5	5 U	50 U	41.7	526	0.2 U	5 U	* 11800
NM296	RV	2	11/12/1997		0.5 U	0.13	* 41.4	5.34	10 U	68.3	51.8	0.2 U	0.03 U	* 8180
NM296	RV	4	05/16/1991				7.2			4 J				2190
NM296	RV	5	10/04/1991				31.6			44				* 6450
NM296	RV	7	04/06/1994				35			102				* 6680
NM296	RV	7	04/19/1994				32			61				* 4340
NM296	RV	7	05/03/1994				28.3			64.3				3970
NM296	RV	7	05/19/1994				20			53				2630
NM296	RV	7	06/07/1994				26			70				3640
NM296	RV	7	06/23/1994				28			85				* 4270
NM296	RV	7	07/20/1994				32			108				* 5060
NM296	RV	7	08/15/1994				36			* 117				* 5960
NM296	RV	7	09/08/1994				36			* 127				* 6010
NM296	RV	7	10/04/1994				37			99				* 6930
NM296	RV	7	11/15/1994				* 54			* 154				* 9620
NM296	RV	7	12/13/1994				* 57			* 156				* 11800
NM296	RV	7	02/09/1995				* 58			102				* 11100
NM296	RV	7	03/22/1995				* 51			72				* 9630

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM296	RV	7	04/13/1995				* 46			64				* 9140
NM296	RV	7	04/25/1995				* 44			64				* 9180
NM296	RV	7	05/09/1995				18			37				3250
NM296	RV	7	05/23/1995				14			30				2270
NM296	RV	7	06/12/1995				13			34				2800
NM296	RV	7	06/27/1995				18			48				3650
NM296	RV	7	07/11/1995				23			44				* 4360
NM296	RV	7	07/25/1995				28			59				* 5120
NM296	RV	7	08/14/1995				31			79				* 5560
NM296	RV	7	09/13/1995				* 39			104				* 6680
NM296	RV	7	10/18/1995				* 46			84				* 8350
NM296	RV	7	11/21/1995				26			50				* 5180
NM296	RV	7	12/27/1995				34			55				* 6180
NM296	RV	7	01/17/1996				* 42			72				* 6730
NM296	RV	7	03/28/1996				27			50				* 5250
NM296	RV	7	04/17/1996				29			41				* 5160
NM296	RV	7	05/08/1996				25			37				* 4760
NM296	RV	7	06/19/1996				12			26				1960
NM296	RV	7	07/24/1996				24			41				3570
NM296	RV	7	08/21/1996				29			60				* 4710
NM296	RV	7	09/26/1996				33			84				* 5600
NM296	RV	7	10/29/1996				34			87				* 5990
NM296	RV	7	11/27/1996				* 43			84				* 8910
NM296	RV	7	12/13/1996				* 44			85				* 8470
NM296	RV	7	01/30/1997				* 41			66				* 7600
NM296	RV	7	02/19/1997				38			58				* 7270
NM296	RV	7	03/26/1997				* 39			55				* 7200
NM296	RV	7	04/16/1997				33			46				* 6090
NM296	RV	7	06/24/1997				8			20				1500
NM296	RV	7	07/23/1997				15			32				3070
NM296	RV	7	08/14/1997				21			45				* 4320
NM296	RV	7	09/04/1997				24			47				* 5010
NM296	RV	7	10/16/1997				36			68				* 6370
NM296	RV	7	11/26/1997				34			62				* 7110
NM296	RV	7	12/17/1997				36			60				* 7220
NM296	RV	7	01/21/1998				* 39			40				* 7000
NM296	RV	7	02/25/1998				32			56				* 6480

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM296	RV	7	03/20/1998				32			58				* 5540
NM296	RV	7	04/23/1998				24			45				* 5100
NM296	RV	7	05/07/1998				7.8			17				1630
NM296	RV	7	05/28/1998				12			23				2300
NM296	RV	7	06/26/1998				19			32				3460
NM296	RV	7	06/26/1998				20			30				3490
NM296	RV	7	07/28/1998				27			35				* 4660
NM296	RV	7	08/26/1998				30			54				* 5710
NM296	RV	7	09/24/1998				29			53				* 5840
NM296	RV	7	10/08/1998				36			64				* 6870
NM296	RV	7	10/26/1998				* 39			51				* 7220
NM296	RV	3	05/16/1998		0.4 U	0.3 J	11.9 J	14.2 J		21.3		0.2 UJ	0.5 UJ	
NM296	RV	11	12/06/1998		1 U	1 U	* 91.9	10.2	50 U	89.8	286	0.2 U	5 U	* 17100
NM297	RV	2	11/12/1997		0.5 U	0.11	* 43.4	4.7	10 U	* 120	41.9	0.2 U	0.03 U	* 8330
NM297	RV	5	10/04/1991				32.6			74				* 6700
NM297	RV	3	05/15/1998		0.5 U	1 U	11.2	3 U	20 U	31.8	41.8	0.2 U	0.3 U	2050
NM297	RV	11	12/06/1998		1 U	1 U	* 89.2	8	50 U	* 142	232	0.2 U	5 U	* 16300
NM298	RV	2	11/12/1997		0.5 U				10 U	* 124		0.2 U	0.03 U	
NM298	RV	2	11/12/1997			0.12	* 48.4	3.8			47.4			* 8700
NM298	RV	7	10/27/1993				33			103				* 5650
NM298	RV	7	12/02/1993				32			92				* 6270
NM298	RV	7	12/16/1993				* 47			* 156				* 7540
NM298	RV	7	01/24/1994				38			* 198				* 8770
NM298	RV	7	02/18/1994				* 50			* 171				* 8070
NM298	RV	7	03/08/1994				* 44			* 153				* 7240
NM298	RV	7	03/24/1994				* 50			* 172				* 8030
NM298	RV	7	04/07/1994				* 39			* 132				* 6990
NM298	RV	7	04/18/1994				32			83				* 4660
NM298	RV	7	05/04/1994				30			89				4110
NM298	RV	7	05/19/1994				23			78				2820
NM298	RV	7	06/07/1994				28			100				3890
NM298	RV	7	06/23/1994				30			105				* 4470
NM298	RV	7	07/20/1994				35			* 116				* 5250
NM298	RV	7	08/15/1994				* 42			* 134				* 6040
NM298	RV	7	09/08/1994				* 41			* 138				* 6150
NM298	RV	7	10/04/1994				* 46			* 184				* 7850
NM298	RV	7	11/15/1994				* 90			* 378				* 11400

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM298	RV	7	12/13/1994				* 85			* 329				* 12400
NM298	RV	7	01/10/1995				* 67			* 169				* 9680
NM298	RV	7	02/09/1995				* 54			* 197				* 10600
NM298	RV	7	03/07/1995				* 50			* 153				* 8590
NM298	RV	7	03/22/1995				* 54			* 111				* 9140
NM298	RV	7	04/13/1995				* 48			* 155				* 9160
NM298	RV	7	04/25/1995				* 46			* 121				* 8960
NM298	RV	7	05/09/1995				20			100				3390
NM298	RV	7	05/23/1995				15			78				2350
NM298	RV	7	06/12/1995				17			90				2890
NM298	RV	7	06/27/1995				26			106				3800
NM298	RV	7	07/11/1995				23			* 160				* 4460
NM298	RV	7	07/25/1995				33			* 216				* 5470
NM298	RV	7	08/14/1995				37			* 220				* 6060
NM298	RV	7	09/13/1995				* 47			* 221				* 7160
NM298	RV	18	10/27/1998				* 40			93				* 7160
NM298	RV	18	11/19/1998				* 67			109				* 12600
NM298	RV	18	12/10/1998				* 83			* 138				* 14000
NM298	RV	18	01/21/1999				* 52			105				* 9330
NM298	RV	18	03/22/1999				* 44			85				* 6950
NM298	RV	18	04/20/1999				38			59				* 6230
NM298	RV	18	05/05/1999				27			46				* 4540
NM298	RV	18	05/23/1999				9.9		10	33	32			1600
NM298	RV	18	06/15/1999				5.7			31				867
NM298	RV	18	07/07/1999				11			37				1660
NM298	RV	18	08/04/1999				20			59				2980
NM298	RV	18	09/01/1999				28			74				* 4820
NM298	RV	7	10/01/1998				34			59				* 5990
NM298	RV	7	01/15/1999				* 51			105				* 9600
NM298	RV	7	02/23/1999				* 50			106				* 8690
NM298	RV	7	03/08/1999				* 46			105				* 8580
NM298	RV	3	05/14/1998		0.2 U	2 U	10.5	2	20 U	36.9	40	0.2 U	0.2 U	2060
NM359	AD	3	05/17/1998		0.3 U	1.3 J	* 376 J	25.8		7		0.2 UJ		
NM360	AD	2	11/13/1997		0.5 U	0.2	0.056	0.22	56.3	0.14	10.3	0.2 U	0.03 U	24.7
NM360	AD	3	05/13/1998		0.26 J	0.23 U	0.041 U	0.44 U	145	0.11 U	19	0.16 U	0.042 U	8.1 J
NM361	AD	2	11/14/1997		0.5 U	1.7	6.19	0.86	10 U	44.8	18.2	0.2 U	0.03 U	1350
NM361	AD	3	05/13/1998		0.032 U	1.9 J	12	1.5 J	73.7 J	* 110	23.1	0.16 U	0.042 U	2550

Data Summary Table
Nine Mile Creek - segment NmSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM362	SP	2	11/14/1997		0.5 U	0.35	1.09	0.23	10 U	1.01	1 U	0.2 U	0.03 U	261
NM362	SP	4	05/15/1991				0.2 U			3 UJ				20 U
NM362	SP	5	10/04/1991				0.3			0.1 U				73
NM362	SP	3	05/13/1998		0.032 U	0.25 J	0.44 J	0.44 U	20.1 J	2 J	1 J	0.16 U	0.042 U	122
NM363	SP	2	11/14/1997		1 U	4.6	* 1650	144	2970	* 810	* 28300	0.2 U	0.27	* 498000
NM363	SP	3	05/16/1998		0.2 U	8 J	* 1810 J	* 347		* 271		0.2 UJ	0.2 UJ	
NM364	AD	2	11/14/1997		0.66	1	0.36	0.41	10 U	1.1	1 U	0.2 U	0.03 U	55.1
NM364	AD	3	05/16/1998		0.6 U	0.8 J	1.2 J	0.5 J	154 J	1 J	9.9 J	0.2 UJ		311 J
NM366	AD	2	11/14/1997		0.83	0.26	0.82	0.55	10 U	1.48	28.2	0.2 U	0.03 U	311
NM366	AD	3	05/16/1998		0.5 U	0.4 J	0.3 J	0.4 U	49.9 J	0.8 J	3.9 J	0.2 UJ		120 J
NM368	SP	2	11/15/1997		0.5 U	0.47	15.3	1.2	943	1.83	1090	0.2 U	0.03 U	* 8330
NM368	SP	3	05/13/1998		0.032 U	0.34 J	17	3.3 J	41.9 J	98.9	7.7 J	0.16 U	0.042 U	3270
NM374	SP	3	05/17/1998		0.52 U	0.77 J	* 158 J	51.1 J	303 J		207 J	0.16 U	0.28 UJ	
NM411	RV	11	11/15/1998		1 J	1 U	22.8	5 U	1010	1 U	1020	0.2 U	5 U	* 10000
NM412	RV	11	11/15/1998		1 U	1 U	* 60.1	5 U	50 U	39.9	545	0.2 U	5 U	* 12100
NM435	RV	11	12/06/1998		1 U	1 U	* 45.6	5 U	50 U	28.9	271	0.2 U	5 U	* 9450
NM435	RV	11	11/15/1998		1 U	1 U	* 58.2	5 U	50 U	40	487	0.2 U	5 U	* 11000
NM435	RV	11	11/17/1998		0.34 U	0.2 U	* 60.9	0.65 U	6.9 U	38.2	548	0.2 U	4.5 U	* 11100
NM436	RV	11	12/06/1998		1 U	1 U	* 49.4	5 U	50 U	26.1	236	0.2 U	5 U	* 9750
NM437	RV	11	12/06/1998		1 U	1 U	* 48.7	5 U	50 U	26.8	223	0.2 U	5 U	* 9680
NM438	RV	11	12/06/1998		1 U	1 U	* 55.7	5 U	50 U	43.6	229	0.2 U	5 U	* 10800
NM439	RV	11	12/06/1998		1 U	1 U	* 90.4	12	50 U	76.1	313	0.2 U	5 U	* 16600
NM440	RV	11	12/06/1998		1 U	1 U			50 U			0.2 U	5 U	* 17300
NM440	RV	11	12/06/1998				* 93.7	11.2		89.8	297			
NM8	RV	4	05/16/1991				8.6			26 J				2480
NM8	RV	5	10/04/1991				31.8			87				* 6810
NM8	RV	11	12/06/1998		1 U	1 U		7.2	79.4 J	* 139		0.2 U	5 U	
NM8	RV	11	12/06/1998				* 90.6				217			* 15900

Data Summary Table
Nine Mile Creek - segment NmSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
NM11248	FP	16	---			23.2	3.7	22.8	18100	323	418			507
NM11249	FP	16	---			16	3.2	17.9	16700	118	482			224
NM11250	FP	16	---			22.7	1.8	19.6	17300	80.6	810			223
Surface Water - Total Metals (ug/l)														
NM299	RV	2	11/11/1997		0.26 U	0.31	0.069 U	0.31 U	157	0.38 J	35	0.1 U	0.22 U	16.2 U
NM299	RV	4	05/16/1991				0.4			3 U				64
NM299	RV	5	10/04/1991				0.3			4				73
NM299	RV	3	05/14/1998		0.2	2 U	0.4	2 U	81	0.9	11	0.2 U	0.2 U	13
Surface Water - Dissolved Metals (ug/l)														
NM299	RV	2	11/11/1997		0.5 U	0.1 U	0.04 U	0.5 U	150	0.1 U	38.7	0.2 U	0.03 U	4.9
NM299	RV	4	05/16/1991				0.3			3 UJ				20 U
NM299	RV	5	10/04/1991				0.2			0.1 U				12 U
NM299	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	49	0.2 U	10	0.2 U	0.2 U	30

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
NM453	GS	11	11/10/1998	0	8.6 J	16.6	6.5	99.6	16700	2780	759	1	7	1030
NM454	GS	11	11/10/1998	0	13.3 J	36.1	20.1	201	35500	6450	1510	1.4	11.4	4030
NM455	GS	11	11/10/1998	0	17.5 J	52.8	29.3	164	33800	7770	3100	7.6	26.9	5770
NM456	GS	11	11/10/1998	0	5.1 J	22.4	8.7	84.2	19000	1890	1010	0.62	4.8	1570
NM457	GS	11	11/10/1998	0	2.8 J	17.4	3.5	59.6	22000	1060	811	0.38	2.6	735
Subsurface Soil (mg/kg)														
NM441	MW	11	11/05/1998	15	11.3 UJ	0.96 J	0.45 U	20.5 J	13100	23.1	1210 J	0.05 UJ	0.68 U	38.4
NM442	MW	11	11/04/1998	5	26.6 J	18.3 J	27.4	153 J	33500	13000	648 J	5.1 J	29.4	4800
NM442	MW	11	11/04/1998	15	11.1 UJ	5.7 J	0.44 U	14.6 J	14400	599	955 J	0.05 UJ	0.67 U	74.4
NM459	MW	11	11/12/1998	25	0.63 UJ	7.2	0.04 U	9.5	8770	20.7	226 J	0.06 U	0.2 U	83.3 J
NM459	MW	11	11/12/1998	10	0.62 UJ	7.8	0.04 U	17.9	14600	40	539 J	0.06 J	0.2 U	66.6 J
NM460	MW	11	11/04/1998	5	11.2 UJ	22.3 J	1.7	29.2 J	15800	61.1	1670 J	0.05 J	0.67 U	467
NM460	MW	11	11/04/1998	10	12.2 UJ	11 J	0.49 U	17.2 J	15400	42.2	466 J	0.06 UJ	0.73 U	127
Sediment (mg/kg)														
NM751	TP	2	12/14/1997	0	37.1 J	30.3 J	40.9 J	156 J	37100 J	* 14100 J	6830	0.0545 U	18.3 J	6300 J
NM751	TP	2	12/14/1997	1.5	34.8 J	105 J	66.9 J	69.5 J	20500 J	4680 J	826 J	1.43	9.46 J	7260 J
NM753	TP	2	12/14/1997	0	4.66 UJ	3.11 J	27.3 J	19.8 J	14200 J	1730 J	759	0.0485 U	3.65 J	5130 J
NM754	TP	2	12/14/1997	0.5	53 J	9.12 J	1.26 J	113 J	15500 J	* 6930 J	1250	0.0543 U	17.7 J	405 J
NM754	TP	2	12/14/1997	2.5	6.62 UJ	5.14 J	0.945 J	28.1 J	10900 J	* 5360 J	1830	0.0587 J	2.57 J	278 J
NM756	TP	2	12/14/1997	0.5	72.3 J	112 J	85.6 J	144 J	35200 J	* 12100 J	1600	0.313	23 J	17600 J
NM756	TP	2	12/14/1997	0.5	169 J	216 J	* 194 J	211 J	47800 J	* 20100 J	2690	0.34	40.7 J	15900 J
NM757	TP	2	12/14/1997	0	9.74 J		22.1 J			5070 J				2470 J
NM758	TP	2	12/14/1997	0.5		11.5 J		74.7 J	28800 J		1920	0.201	11 J	
NM760	TP	2	12/15/1997	1.5	1.14 J	11.4 J	4.89 J	18 J	21900 J	154 J	693	0.0877 J	1.02 J	1120 J
NM760	TP	2	12/15/1997	0	8.96 UJ	13 J	6.53 J	93.8 J	28900 J	4170 J	1370	0.0555 U	8.64 J	2500 J
NM762	TP	2	12/15/1997	0	1.21 UJ	2.34 J	3.01 J	37.8 J	21600 J	527 J	529	0.0714 J	1.52 J	1170 J
NM763	TP	2	12/15/1997	1	241 J	8.5 J	6.08 J	181 J	28300 J	1820 J	911	0.111	39.5 J	1460 J
NM763	TP	2	12/15/1997	2.5	11.1 J	6.38 J	22.5 J	41.2 J	29800 J	1320 J	846	0.0604 U	3.94 J	4330 J
Groundwater - Total Metals (ug/l)														
NM441	MW	11	12/03/1998	43	0.14 U	0.25 J				5.7	136	0.2 U	4.5 U	* 4730
NM441	MW	11	12/03/1998	43			19.2 J	7.6	119 J					
NM441	MW	11	12/03/1998	18	0.12 U	0.2 U	13.7 J	0.89 J	12.6 J	1.8 J	117	0.2 U	4.5 U	* 3370

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Groundwater - Total Metals (ug/l)														
NM441	MW	11	12/03/1998	12	0.12 U	0.2 U	13.7 J	0.9 J	6.9 U	2.3	103	0.2 U	4.5 U	* 3170
NM441	MW	11	12/09/1998	18	1 U	1 U	7.3	5 U	408	2.8	87.7	0.2 U	5 U	1690
NM441	MW	23	12/01/1999	12	2 U	1 U	11.1	5 U	25 U	0.76 J	7.3 J	0.2 U	5 U	2690
NM441	MW	23	12/01/1999	43	2 U	1 U	3.2	5 U	745	9.5	1260	0.2 U	5 U	846
NM442	MW	11	12/09/1998	16	1 U	1 U	* 572 J	75.9	1060	* 3050 J	1460	0.2 U	5 U	* 82100 J
NM442	MW	11	12/03/1998	32	0.54 U	1.1 J	* 996 J	* 573	5100 J	* 3080	1440	0.2 U	4.5 U	* 145000
NM442	MW	11	12/03/1998	15	0.52 U	1 J	* 944 J	* 523	4740 J	* 3000	1410	0.2 U	4.5 U	* 135000
NM442	MW	11	12/03/1998	9	0.81 J	0.97 J	* 770 J	* 328	2940 J	* 3170	1180	0.2 U	4.5 U	* 101000
NM442	MW	23	12/06/1999	9	2 U	1 J	* 746	* 136	1610	* 3600	1520	0.53	5 U	* 122000
NM442	MW	23	12/06/1999	32	2 U	1 U	* 654	* 122	1190	* 3540	1420	0.94	5 U	
NM442	MW	23	12/06/1999	32										* 103000
NM459	MW	11	12/09/1998	13	1 U	1 U	4.8	5 U	50 U	1 U	5 U	0.2 U	5 U	1190
NM459	MW	11	12/02/1998	12.4	1 U	1 U	7	5 U	50 U	1 U	15.1	0.2 U	5 U	1730
NM459	MW	11	12/02/1998	6.4	1 U	1 U	5.9	5 U	50 U	1 U		0.2 U	5 U	
NM459	MW	11	12/02/1998	6.4							14.4			1480
NM459	MW	23	12/01/1999	6.4	2 U	1 U	8.2	5 U	25 U	0.5 U	5 U	0.2 U	5 U	1940
NM460	MW	11	12/02/1998	31	1 U	1 U	1 U	5 U	50 U	1.1 J	5 U	0.2 U	5 U	59.8
NM460	MW	11	12/02/1998	8	1 U	1 U	1 U	5 U	50 U	1 U	5 U	0.2 U	5 U	45.8
NM460	MW	11	12/02/1998	2	1 U	1 U	1 U	5 U	50 U	1.1 J	5 U	0.2 U	5 U	61.9
NM460	MW	23	12/01/1999	7	2 U	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	23.7
Groundwater - Dissolved Metals (ug/l)														
NM441	MW	11	12/03/1998	43	0.049 U	0.26 U		0.22 J	6.9 U	2.6	129	0.2 U	4.5 U	
NM441	MW	11	12/03/1998	43			16.2 J							3630 J
NM441	MW	11	12/03/1998	18	0.049 U	0.2 U	13.5 J	0.35 J	6.9 U	0.36 J	119	0.2 U	4.5 U	3370 J
NM441	MW	11	12/03/1998	12	0.049 U	0.33 U	11.1 J	0.65 J	44.6 U	0.35 J	106	0.2 U	4.5 U	2830 J
NM441	MW	11	12/09/1998	18	1 U	1 U	7	5 U	50 U	1 U	71.8	0.2 U	5 U	1710
NM441	MW	23	12/01/1999	12	2 U	1 U	11.2	5 U	25 U	11.1	7.5 J	0.2 U	5 U	2630
NM441	MW	23	12/01/1999	43	2 U	1 U	2.4	5 U	59 J	0.5 U	567	0.2 U	5 U	732
NM442	MW	11	12/09/1998	16	1 U	1 UJ	* 574	73.7	1100	* 3150	1460	0.2 U	5 U	* 82500
NM442	MW	11	12/03/1998	32	0.38 J	1.4 U	* 942 J	* 560	5130	* 2830 J	1480	0.2 U	4.5 U	* 123000 J
NM442	MW	11	12/03/1998	15	0.33 J	1.4 U	* 910 J	* 529	4650	* 2730 J	1390	0.2 U	4.5 U	* 113000 J
NM442	MW	11	12/03/1998	9	0.34 J	1.1 U	* 752 J	* 351	3220	* 2770 J	1220	0.2 U	4.5 U	* 89900 J
NM442	MW	23	12/06/1999	9	2 U	1 UJ	* 676	129	1460	* 3560	1390	0.5	5 U	* 105000
NM442	MW	23	12/06/1999	32	2 U	1 J	* 666	127	1140	* 3520	1400	0.51	5 U	* 109000
NM459	MW	11	12/09/1998	13	1 U	1 U	5	5 U	50 U	1 U	5 U	0.2 U	5 U	1270
NM459	MW	11	12/02/1998	12.4	1 U	1 U	8.3	5 U	50 U	1 U	19.4	0.2 U	5 U	1930

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Groundwater - Dissolved Metals (ug/l)														
NM459	MW	11	12/02/1998	6.4	1 U	1 U	7.3	5 U	50 U	1 U	15.4	0.2 U	5 U	1650
NM459	MW	23	12/01/1999	6.4	2 U	1 U	8.3	5 U	25 U	0.5 U	5 U	0.2 U	5 U	1840
NM460	MW	11	12/02/1998	31	1 U	1 U	1 U	5 U	50 U	1 U	5 U	0.2 U	5 U	39.2
NM460	MW	11	12/02/1998	8	1 U	1 U	1 U	5 U	50 U	1 U	5.5 J	0.2 U	5 U	45.1
NM460	MW	11	12/02/1998	2	1 U	1 U	1 U	5 U	50 U	1 U	6 J	0.2 U	5 U	54.5
NM460	MW	23	12/01/1999	7	2 U	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	24.7
Surface Water - Total Metals (ug/l)														
NM13	RV	5	10/04/1991				23.8			69				* 4540
NM300	RV	2	11/11/1997		0.43 U	0.37	0.5	0.2 U	144	5	72.8	0.11 U	0.22 U	82.5 J
NM300	RV	18	05/23/1999						20	3	12			20
NM300	RV	3	05/14/1998		0.3	2 U	0.3	2 U	531	36	52	0.2 U	0.2 U	65
NM301	RV	2	11/11/1997		1 U	0.24	33	2.9 J	60.2 J	93.6	72	0.1 U	0.22 U	* 6520 J
NM301	RV	4	05/16/1991				8.1			42				2000
NM301	RV	5	10/04/1991				28.2			83				* 5310
NM301	RV	3	05/15/1998		0.5 U	1 U	11.1	3 U	39.2 U	44.7	43.9	0.2 UJ	0.3 U	2120
NM301	RV	11	12/06/1998		1 U	1 U	49.7	5.2	97 J	119	171	0.2 U	5 U	* 9040
NM302	RV	2	11/11/1997		0.57 U	0.16 U	0.069 U	0.41 U	7.6 J	1.6	1.1 J	0.1 U	0.22 U	26.6 U
NM302	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.61	5 U	0.2 U	0.3 U	5.4
NM302	RV	11	12/06/1998		1 U	1 U	1 U	5 U	50 U	3.3	5 J	0.2 U	5 U	19.4
NM303	RV	2	11/11/1997		0.9 U	0.16 U	29.5	2 J	33.4 U	60.2	59.3	0.11 UJ	0.22 U	* 5510
NM303	RV	4	05/16/1991				7.6			41				1850
NM303	RV	5	10/04/1991				23.2			62				* 3600
NM303	RV	7	10/28/1993				30			44				* 4780
NM303	RV	7	12/02/1993				22			55				* 4560
NM303	RV	7	12/16/1993				28			81				* 5290
NM303	RV	7	01/24/1994				28			88				* 4370
NM303	RV	7	02/18/1994				28			120				* 4450
NM303	RV	7	03/08/1994				33			81				* 4030
NM303	RV	7	03/24/1994				23			97				* 3890
NM303	RV	7	04/07/1994				29			96				* 4030
NM303	RV	7	04/19/1994				27			429				* 3910
NM303	RV	7	05/04/1994				26			75				* 3360
NM303	RV	7	05/19/1994				18			67				2490
NM303	RV	7	06/07/1994				25			78				* 3260
NM303	RV	7	06/23/1994				24			92				* 3590
NM303	RV	7	07/20/1994				28			72				* 3560

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM303	RV	7	08/15/1994				27			67				* 3240
NM303	RV	7	09/08/1994				34			62				* 5490
NM303	RV	7	10/04/1994				32			79				* 4330
NM303	RV	7	11/15/1994				62			186				* 7910
NM303	RV	7	12/13/1994				51			139				* 8470
NM303	RV	7	01/10/1995				43			275				* 6220
NM303	RV	7	02/09/1995				29			113				* 4910
NM303	RV	7	03/07/1995				30			204				* 5180
NM303	RV	7	03/22/1995				29			125				* 4590
NM303	RV	7	04/13/1995				28			107				* 5130
NM303	RV	7	04/25/1995				28			87				* 5370
NM303	RV	7	05/09/1995				16			122				2960
NM303	RV	7	05/23/1995				14			96				2100
NM303	RV	7	06/12/1995				16			102				2520
NM303	RV	7	06/27/1995				22			121				* 3320
NM303	RV	7	07/11/1995				22			127				* 3510
NM303	RV	7	07/25/1995				27			142				* 4110
NM303	RV	7	08/14/1995				33			156				* 4660
NM303	RV	7	09/13/1995				33			112				* 3900
NM303	RV	3	05/14/1998		0.3	2 U	10.2	2	43	46.1	37	0.2 U	0.2 U	1850
NM303	RV	11	12/06/1998		1.3 J	1 U	44.2	5 U	59.2 J	95.8	132	0.2 U	5 U	* 8140
NM304	RV	2	11/11/1997		0.99 U	0.23 UJ	28.2	1.4 J	35.5 U	53.2	52.8	0.1 U	0.22 U	* 5290
NM304	RV	3	05/15/1998		0.5 U	1 U	11.3	3 U	45.1 U	42	39	0.2 U	0.3 U	2160
NM304	RV	11	12/06/1998		1.2 J	1 U	39.6	5 U	50 U	82.1	111	0.2 U	5 U	* 7280
NM305	RV	2	11/11/1997		1.2 U	0.16 U	27.4	1.4 J	45.8 U	47.6	44.6	0.12 UJ	0.22 U	* 5140
NM305	RV	4	05/15/1991				9			42				1800
NM305	RV	4	05/16/1991				7.7			40				1900
NM305	RV	5	10/03/1991				19			39				* 3120
NM305	RV	5	10/04/1991				22.8			51				* 4490
NM305	RV	7	10/28/1993				22			40				* 4490
NM305	RV	7	12/02/1993				23			48				* 4350
NM305	RV	7	12/16/1993				26			64				* 4590
NM305	RV	7	01/24/1994				19			68				* 3830
NM305	RV	7	02/18/1994				25			73				* 4020
NM305	RV	7	03/08/1994				24			108				* 3730
NM305	RV	7	03/23/1994				21			87				* 3750
NM305	RV	7	04/07/1994				25			85				* 3840

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM305	RV	7	04/19/1994				28			442				* 3810
NM305	RV	7	05/04/1994				22			72				* 3250
NM305	RV	7	05/20/1994				20			5				2390
NM305	RV	7	06/07/1994				25			66				3000
NM305	RV	7	06/23/1994				24			69				* 3250
NM305	RV	7	07/20/1994				22			55				2600
NM305	RV	7	08/15/1994				21			44				2260
NM305	RV	7	09/08/1994				30			40				* 4560
NM305	RV	7	10/28/1994				25			53				* 3780
NM305	RV	7	11/15/1994				48			134				* 7020
NM305	RV	7	12/13/1994				45			91				* 7170
NM305	RV	7	01/10/1995				38			200				* 5570
NM305	RV	7	02/09/1995				27			107				* 4370
NM305	RV	7	03/07/1995				26			95				* 4790
NM305	RV	7	03/22/1995				23			168				* 4240
NM305	RV	7	04/13/1995				27			106				* 4840
NM305	RV	7	04/25/1995				25			79				* 4900
NM305	RV	7	05/09/1995				16			108				2860
NM305	RV	7	05/23/1995				15			87				2050
NM305	RV	7	06/12/1995				15			83				2210
NM305	RV	7	06/27/1995				20			103				2940
NM305	RV	7	07/11/1995				20			101				2910
NM305	RV	7	07/26/1995				23			100				* 3030
NM305	RV	7	08/14/1995				27			61				* 3380
NM305	RV	7	09/13/1995				27			101				2680
NM305	RV	7	10/18/1995				36			110				* 5800
NM305	RV	7	01/17/1996				20			110				2760
NM305	RV	7	02/29/1996				16			98				2810
NM305	RV	7	03/28/1996				18			52				2730
NM305	RV	7	04/17/1996				20			109				* 3310
NM305	RV	7	05/08/1996				17			89				2900
NM305	RV	7	06/19/1996				14			46				1760
NM305	RV	7	07/24/1996				20			57				2440
NM305	RV	7	08/21/1996				21			49				2780
NM305	RV	7	09/26/1996				20			46				2500
NM305	RV	7	11/21/1995				26			196				* 4210
NM305	RV	7	12/27/1995				23			69				* 3690

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM305	RV	7	10/29/1996				26			68				* 4360
NM305	RV	7	11/27/1996				30			54				* 5220
NM305	RV	7	12/13/1996				27			96				* 4430
NM305	RV	7	01/30/1997				20			70				* 3190
NM305	RV	7	02/19/1997				15			112				2500
NM305	RV	7	03/26/1997				13			87				2160
NM305	RV	7	04/16/1997				12			80				2080
NM305	RV	7	05/15/1997				15			* 2140				2970
NM305	RV	7	06/24/1997				8.6			50				1500
NM305	RV	7	07/23/1997				14			71				2140
NM305	RV	7	08/14/1997				17			57				2720
NM305	RV	7	09/04/1997				19			56				2440
NM305	RV	7	10/16/1997				23			54				* 3430
NM305	RV	7	11/26/1997				22			47				* 4130
NM305	RV	7	12/17/1997				21			42				* 3800
NM305	RV	7	01/21/1998				21			49				* 3530
NM305	RV	7	02/25/1998				15			307				2760
NM305	RV	7	03/20/1998				14			72				2160
NM305	RV	7	04/23/1998				16			169				* 3210
NM305	RV	18	10/27/1998				31			47				
NM305	RV	18	11/19/1998							50				* 7100
NM305	RV	18	12/10/1998				39			68				* 7000
NM305	RV	18	01/21/1999				21			54				* 3800
NM305	RV	18	03/22/1999				14			330				2300
NM305	RV	18	04/19/1999				17			260				2600
NM305	RV	18	05/05/1999				17		50	52	53			2600
NM305	RV	18	05/23/1999				9		560	220	65			1300
NM305	RV	18	05/26/1999				9		2200	800	210			1500
NM305	RV	18	05/27/1999				7		1000	270	98			1100
NM305	RV	18	05/31/1999				6		270	100	33			950
NM305	RV	18	06/15/1999				6			81				870
NM305	RV	18	07/07/1999				10.6			45.6				1760
NM305	RV	18	08/04/1999				17.7			48.2				2250
NM305	RV	7	05/07/1998				8.6			74				1620
NM305	RV	7	05/28/1998				11			90				1930
NM305	RV	7	06/26/1998				16			49				2550
NM305	RV	7	07/28/1998				20			41				2660

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
NM305	RV	7	08/26/1998				24			44				* 3910
NM305	RV	7	09/24/1998				22			46				* 3650
NM305	RV	7	10/01/1998				25			42				* 4120
NM305	RV	7	10/08/1998				28			44				* 4700
NM305	RV	7	10/26/1998				22			36				2990
NM305	RV	7	11/25/1998				38			134				* 7250
NM305	RV	7	12/31/1998				31			57				* 4790
NM305	RV	7	01/15/1999				29			57				* 4100
NM305	RV	7	02/23/1999				22			41				* 3180
NM305	RV	7	03/08/1999				17			48				2870
NM305	RV	3	05/15/1998		0.5 U	1 U	11.2	3 U	44.7 UJ	39.7	36.8	0.2 U	0.3 U	2130
NM305	RV	3	05/17/1998		0.6 U	0.23 U	12.5 J	2.3 J	80.8 J		35.6 J	0.16 U	0.042 U	
NM305	RV	11	12/06/1998		1.4 J	1 U	36.8	5 U	50 U	73.1	97	0.2 U	5 U	* 6790
NM367	AD	2	11/14/1997		2.7 J	49.7	0.3 J	3.2 J	27300	155	* 8920	0.1 U	0.27 J	55.1 J
NM369	AD	2	11/15/1997		0.33 U	0.16 U	0.069 U	0.45 U	131	0.12 U	107	0.1 U	0.22 U	125 J
NM370	AD	2	11/15/1997		0.17 U	0.13 J	0.069 U	0.06 U	27.5 U	0.15 J	5.3 J	0.1 U	0.22 U	14.2 U
NM443	RV	11	12/09/1998		1 U	1 U	51	5.3	51.3 J	112	118	0.2 U	5 U	* 9230
NM443	RV	11	12/06/1998		1 U	1 U	52.5	6.2	80.7 J	137	142	0.2 U	5 U	* 10000
NM443	RV	23	12/01/1999		2 U	1 U						0.2 U	5 U	
NM443	RV	23	12/01/1999				31	5.5	40.8 J	75.5	66.1			* 5630
NM445	RV	11	12/09/1998		1 U	1 U	51	9.7	99.7 J	116	155	0.2 U	5 U	* 9170
NM448	RV	11	12/06/1998		1 U	1 U	51.9	6.3	81.6 J	131	139	0.2 U	5 U	* 9680
NM450	RV	11	12/06/1998		1 U	1 U	55.6	5.2	89.3 J	124	172	0.2 U	5 U	
NM452	RV	11	12/06/1998		1.1 J	1 U	51.4	6.7	167	148	177	0.2 U	5 U	* 9400
NM458	RV	11	12/09/1998		1.2 J	1 U	38.8	5 U	50 U	72.7	94.5	0.2 U	5 U	* 6920
NM458	RV	11	12/06/1998		1.1 J	1 U	37.8	5 U	61.6 J	80	105	0.2 U	5 U	* 7010
NM458	RV	23	12/01/1999		2 U	1 U	26.9	5 U	36.5 J	58.8	67.8	0.2 U	5 U	* 4790
NM8105	RV	13	—	0			22	35 U	12 U		38			3000
Surface Water - Dissolved Metals (ug/l)														
NM13	RV	5	10/04/1991				23.6			31				* 4710
NM300	RV	2	11/11/1997		0.5 U	0.27	0.46	0.5 U	100	3.95	75.6	0.2 U	0.03 U	77
NM300	RV	18	05/23/1999				1 U		5.9	1.3	11			22
NM300	RV	3	05/14/1998		0.3	2 U	0.2 U	2 U	48	1.4	23	0.2 U	0.2 U	34
NM301	RV	2	11/11/1997		0.51	0.19	36.4	2.5	37.3	87.7	74.1	0.2 U	0.03 U	* 6570
NM301	RV	4	05/16/1991				7.6			13 J				2040
NM301	RV	5	10/04/1991				28			37				* 5470

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM301	RV	3	05/15/1998		0.5 U	1 U	11.2	3 U	54.3	32.3	40.8	0.2 U	0.3 U	1950
NM301	RV	11	12/06/1998		1.2 J	1 U	* 50.4	5 U	50 U	77.4	170	0.2 U	5 U	* 9110
NM302	RV	2	11/11/1997		0.54	0.14	0.064	0.5 U	10 U	0.34	1 U	0.2 U	0.03 U	20.6
NM302	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
NM302	RV	11	12/06/1998		1 U	1 U	1 U	5 U	50 U	1 U	5 U	0.2 U	5 U	7.5
NM303	RV	2	11/11/1997		0.83	0.19	32.1	1.8	10	56	61.7	0.2 U	0.03 U	* 5610
NM303	RV	4	05/16/1991				7.3			12 J				1880
NM303	RV	5	10/04/1991				22.6			16				3340
NM303	RV	7	10/28/1993				29			26				* 4910
NM303	RV	7	12/02/1993				23			41				* 4490
NM303	RV	7	12/16/1993				33			55				* 5280
NM303	RV	7	01/24/1994				24			54				* 4460
NM303	RV	7	02/18/1994				29			26				* 4610
NM303	RV	7	03/08/1994				26			53				4000
NM303	RV	7	03/24/1994				23			65				400
NM303	RV	7	04/07/1994				23			66				4120
NM303	RV	7	04/19/1994				26			56				3760
NM303	RV	7	05/04/1994				22			57				3390
NM303	RV	7	05/19/1994				18			55				2610
NM303	RV	7	06/07/1994				24			62				3380
NM303	RV	7	06/23/1994				24			74				3690
NM303	RV	7	07/20/1994				28			52				3620
NM303	RV	7	08/15/1994				28			33				2750
NM303	RV	7	09/08/1994				34			34				* 5600
NM303	RV	7	10/04/1994				32			46				* 4330
NM303	RV	7	11/15/1994				* 62			* 110				* 8120
NM303	RV	7	12/13/1994				* 54			82				* 8680
NM303	RV	7	01/10/1995				* 44			67				* 6430
NM303	RV	7	02/09/1995				30			74				* 4990
NM303	RV	7	03/07/1995				31			* 148				* 5060
NM303	RV	7	03/22/1995				27			66				* 4430
NM303	RV	7	04/13/1995				29			71				* 5110
NM303	RV	7	04/25/1995				28			64				* 5150
NM303	RV	7	05/09/1995				17			70				2780
NM303	RV	7	05/23/1995				14			63				2150
NM303	RV	7	06/12/1995				17			87				2510
NM303	RV	7	06/27/1995				18			88				3270

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM303	RV	7	07/11/1995				22			93				3500
NM303	RV	7	07/25/1995				28			106				4050
NM303	RV	7	08/14/1995				33			* 114				* 4660
NM303	RV	7	09/13/1995				34			62				3920
NM303	RV	3	05/14/1998		0.3	2 U	10.2	2 U	20 U	29.8	35	0.2 U	0.2 U	1890
NM303	RV	11	12/06/1998		2.1 J	1 U	* 45.5	5 U	50 U	62.7	132	0.2 U	5 U	* 8120
NM304	RV	2	11/11/1997		0.85	0.13	30.2	1.2	10 U	45.8	54.1	0.2 U	0.03 U	* 5410
NM304	RV	3	05/15/1998		0.5 U	1 U	11.3	3 U	20 U	26.7	34.8	0.2 U	0.3 U	1960
NM304	RV	11	12/06/1998		1.5 J	1 U	* 40	5 U	50 U	58	111	0.2 U	5 U	* 7220
NM305	RV	2	11/11/1997		1	0.21	29.5	1.2	31.4	41.6	46	0.2 U	0.03 U	* 5180
NM305	RV	4	05/15/1991				8.9			14				1940
NM305	RV	4	05/16/1991				7.4			14 J				1990
NM305	RV	5	10/03/1991				27			15				2640
NM305	RV	5	10/04/1991				21.8			24				* 4550
NM305	RV	7	10/28/1993				26			29				* 4510
NM305	RV	7	12/02/1993				22			30				* 4260
NM305	RV	7	12/16/1993				29			40				* 4830
NM305	RV	7	01/24/1994				20			34				* 4210
NM305	RV	7	02/18/1994				26			34				4070
NM305	RV	7	03/08/1994				26			46				3760
NM305	RV	7	03/23/1994				22			53				3810
NM305	RV	7	04/07/1994				23			57				3940
NM305	RV	7	04/19/1994				22			48				3590
NM305	RV	7	05/20/1994				19			4				2520
NM305	RV	7	06/07/1994				26			54				3160
NM305	RV	7	06/23/1994				24			52				3300
NM305	RV	7	07/20/1994				23			49				2610
NM305	RV	7	08/15/1994				21			35				2280
NM305	RV	7	09/08/1994				32			26				* 4840
NM305	RV	7	10/28/1994				27			30				3890
NM305	RV	7	11/15/1994				* 48			90				* 6800
NM305	RV	7	12/13/1994				* 44			60				* 7390
NM305	RV	7	01/10/1995				35			54				* 5500
NM305	RV	7	02/09/1995				27			73				* 4590
NM305	RV	7	03/07/1995				30			61				* 4760
NM305	RV	7	03/22/1995				24			60				3990
NM305	RV	7	04/13/1995				26			58				* 4690

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM305	RV	7	04/25/1995				25			64				* 4740
NM305	RV	7	05/09/1995				18			64				2640
NM305	RV	7	05/23/1995				16			54				2070
NM305	RV	7	06/12/1995				16			62				2290
NM305	RV	7	06/27/1995				22			72				2930
NM305	RV	7	07/11/1995				20			72				2920
NM305	RV	7	07/26/1995				23			75				3080
NM305	RV	7	08/14/1995				27			74				3470
NM305	RV	7	09/13/1995				25			50				2560
NM305	RV	7	10/18/1995				38			91				* 5920
NM305	RV	7	01/17/1996				19			65				2830
NM305	RV	7	02/29/1996				17			39				2970
NM305	RV	7	03/28/1996				17			39				2830
NM305	RV	7	04/17/1996				20			45				3350
NM305	RV	7	05/08/1996				16			40				2910
NM305	RV	7	06/19/1996				19			37				1790
NM305	RV	7	07/24/1996				20			40				2470
NM305	RV	7	08/21/1996				22			36				2790
NM305	RV	7	09/26/1996				20			37				2540
NM305	RV	7	11/21/1995				25			67				* 4210
NM305	RV	7	12/27/1995				24			43				3800
NM305	RV	7	10/29/1996				26			41				* 4440
NM305	RV	7	11/27/1996				30			43				* 5550
NM305	RV	7	12/13/1996				28			58				* 4560
NM305	RV	7	01/30/1997				20			40				3260
NM305	RV	7	02/19/1997				16			49				2520
NM305	RV	7	03/26/1997				13			47				2110
NM305	RV	7	04/16/1997				12			49				2080
NM305	RV	7	06/24/1997				8.8			35				1500
NM305	RV	7	07/23/1997				14			52				2280
NM305	RV	7	08/14/1997				17			46				2850
NM305	RV	7	09/04/1997				18			41				2550
NM305	RV	7	10/16/1997				22			38				3410
NM305	RV	7	11/26/1997				21			39				4110
NM305	RV	7	12/17/1997				22			30				3810
NM305	RV	7	01/21/1998				23			37				3680
NM305	RV	7	02/25/1998				16			42				2620

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM305	RV	7	03/20/1998				14			38				2230
NM305	RV	7	04/23/1998				16			40				3150
NM305	RV	18	10/27/1998				28			29				* 4850
NM305	RV	18	11/19/1998				* 39			36				* 7460
NM305	RV	18	12/10/1998				31			36				* 6640
NM305	RV	18	01/21/1999				22			44				3820
NM305	RV	18	03/22/1999				12			23				2010
NM305	RV	18	04/19/1999				14			13				2400
NM305	RV	18	05/05/1999				16		10 U	26	50			2690
NM305	RV	18	05/23/1999				8.3		10 U	23	24			1240
NM305	RV	18	05/26/1999				6.5		7.9	23	21			981
NM305	RV	18	05/27/1999				6.4		6.2	23	17			1020
NM305	RV	18	05/31/1999				6.4		10 U	22	15			974
NM305	RV	18	06/15/1999				6			25				864
NM305	RV	18	07/07/1999				10			29				1570
NM305	RV	18	08/04/1999				17			33				2280
NM305	RV	18	09/01/1999				21			29				3570
NM305	RV	7	05/07/1998				8.3			23				1630
NM305	RV	7	05/28/1998				10			34				1940
NM305	RV	7	06/26/1998				16			36				2550
NM305	RV	7	07/28/1998				20			35				2680
NM305	RV	7	08/26/1998				24			31				3980
NM305	RV	7	09/24/1998				22			31				3670
NM305	RV	7	10/01/1998				25			32				4130
NM305	RV	7	10/08/1998				28			31				* 4600
NM305	RV	7	10/26/1998				21			26				2980
NM305	RV	7	12/31/1998				32			38				* 4880
NM305	RV	7	01/15/1999				25			38				4110
NM305	RV	7	02/23/1999				21			30				3190
NM305	RV	7	03/08/1999				18			37				2810
NM305	RV	3	05/15/1998		0.5 U	1 U	11.2	3 U	20 U	25.5	32.9	0.2 U	0.3 U	1960
NM305	RV	3	05/17/1998		0.6 U	0.23 U	11.8 J	2.3 J	79.1 J	47.2	33.8 J	0.16 U	0.042 UJ	2370 J
NM305	RV	11	12/06/1998		1.4 J	1 U	37.2	5 U	50 U	53.4	95.8	0.2 U	5 U	* 6680
NM367	AD	2	11/14/1997		0.61	19.7	0.043	0.23	12200	0.92	* 8560	0.2 U	0.03 U	9.15
NM369	AD	2	11/15/1997		0.5 U	0.1 U	0.022	0.18	16	0.05	64.9	0.2 U	0.03 U	109
NM370	AD	2	11/15/1997		0.5 U	0.1 U	0.04 U	0.5 U	10 U	0.1 U	5.04	0.2 U	0.03 U	3.9
NM443	RV	11	12/09/1998		1 U	1 U	* 50.3	5 U	50 U	82.2	120	0.2 U	5 U	* 9260

Data Summary Table
Nine Mile Creek - segment NmSeg04

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
NM443	RV	11	12/06/1998		1 U	1 U	* 53.7	5 U	50 U	89.8	139	0.2 U	5 U	* 9820
NM443	RV	23	12/01/1999		2 U	1 U			25 U		74.2	0.2 U	5 U	
NM443	RV	23	12/01/1999				* 44	5.4		81				* 7810
NM445	RV	11	12/09/1998		1 U	1 U	* 50.5	5 U	50 U	65.9	159	0.2 U	5 U	* 9310
NM448	RV	11	12/06/1998		1 U	1 U	* 52.5	5 U	50 U	88.2	137	0.2 U	5 U	* 9560
NM450	RV	11	12/06/1998		1 U	1 U	* 55.8	5 U	58.2 J	90.4	172	0.2 U	5 U	* 9830
NM452	RV	11	12/06/1998		2 J	1 U	* 52.3	5 U	50 U	82.8	175	0.2 U	5 U	* 9340
NM458	RV	11	12/09/1998		1.2 J	1 U	* 38.3	5 U	50 U	53.1	94.8	0.2 U	5 U	* 6980
NM458	RV	11	12/06/1998		1.1 J	1 U	* 38.2	5 U	50 U	56.8	103	0.2 U	5 U	* 6950
NM458	RV	23	12/01/1999		2 U	1 U	27.3	5 U	25 U	40.6	66.5	0.2 U	5 U	* 4590
NM8105	RV	13	—	0			18	8.4 U	3.7 U		31			2900

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Water
Segment NmSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	4	1	4.8	4.8	4.8	< 0.001	6	0	0	0
Arsenic	4	1	3.8	3.8	3.8	< 0.001	50	0	0	0
Cadmium	6	1	155	155	155	< 0.001	2	1	1	0
Copper	4	2	0.17	156	78.1	1.41	1	1	1	1
Iron	4	3	21	6,690	2,250	1.71	300	1	1	0
Lead	6	5	0.11	2,010	403	2.23	15	1	1	1
Manganese	4	2	1.1	1,590	796	1.41	50	1	1	0
Silver	4	1	2.8	2.8	2.8	< 0.001	100	0	0	0
Zinc	6	3	12	28,400	9,480	1.73	30	1	1	1

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment NmSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	4	1	0.36	0.36	0.36	< 0.001	150	0	0	0
Cadmium	6	1	150	150	150	< 0.001	0.38	1	1	1
Copper	4	1	14.9	14.9	14.9	< 0.001	3.2	1	0	0
Lead	6	3	0.6	93.1	31.5	1.69	1.09	1	1	0
Manganese	4	1	789	789	789	< 0.001	20.4	1	1	0
Zinc	6	4	4.7	24,300	6,080	1.99	42	1	1	1

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment NmSeg02
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	12	11	1.8	10.5	4.55	0.65	31.3	0	0	0
Arsenic	17	17	1.6	75.3	26.4	0.8	22	8	0	0
Cadmium	60	58	0.181	530	27.6	2.96	9.8	26	3	0
Copper	39	39	12.8	24,300	890	4.39	100	26	3	1
Iron	61	61	3,480	314,000	58,900	1.15	65,000	15	0	0
Lead	60	60	10.7	59,600	8,520	1.68	171	51	34	9
Manganese	17	17	327	2,570	1,120	0.48	3,597	0	0	0
Mercury	12	12	0.09	9.5	2.73	1.28	23.5	0	0	0
Silver	12	11	2.3	24.4	9.09	0.82	391	0	0	0
Zinc	63	63	55.1	269,000	11,800	3.56	280	47	17	3

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment NmSeg02
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	8	1	466	466	466	< 0.001	31.3	1	1	0
Arsenic	8	6	1.1	148	42.1	1.29	22	4	0	0
Cadmium	8	6	0.45	78.4	26.7	1.1	9.8	4	0	0
Copper	8	8	9.4	228	62.3	1.19	100	1	0	0
Iron	8	8	10,000	51,500	29,600	0.58	65,000	0	0	0
Lead	8	8	6.5	25,700	4,820	1.8	171	5	4	1
Manganese	8	8	310	3,210	1,620	0.76	3,597	0	0	0
Mercury	8	4	0.11	21	5.45	1.91	23.5	0	0	0
Silver	8	4	3.8	77.7	22.6	1.62	391	0	0	0
Zinc	8	8	41.1	10,900	3,320	1.2	280	5	3	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment NmSeg02
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	6	3	0.984	5.7	2.59	1.04	3.3	1	0	0
Arsenic	6	6	1.62	13.2	7.71	0.63	13.6	0	0	0
Cadmium	6	6	3.33	199	54.1	1.35	1.56	6	4	1
Copper	6	6	14.8	280	96.4	1	32.3	4	0	0
Iron	6	6	7,660	98,700	33,000	1	40,000	1	0	0
Lead	6	6	258	5,540	2,320	0.88	51.5	6	5	1
Manganese	6	6	480	6,810	2,120	1.16	1,210	3	0	0
Mercury	6	5	0.0835	1.46	0.687	0.94	0.179	4	0	0
Silver	6	6	0.344	9.08	4.68	0.72	4.5	3	0	0
Zinc	6	6	265	21,900	8,630	0.89	200	6	5	1

Statistical Summary of Total Metals Concentrations in Groundwater
Segment NmSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	4	2	1.8	2	1.9	0.07	6	0	0	0
Cadmium	4	4	5.1	7.3	6.4	0.15	2	4	0	0
Iron	4	4	210	1,410	789	0.84	300	2	0	0
Lead	4	4	1.6	30.6	13.9	1.01	15	2	0	0
Manganese	4	4	54.8	2,730	775	1.69	50	4	1	0
Zinc	4	4	817	4,600	2,260	0.77	30	4	4	1

Statistical Summary of Dissolved Metals Concentrations in Groundwater
Segment NmSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	4	1	2.1	2.1	2.1	< 0.001	2.92	0	0	0
Cadmium	4	4	5.3	9.7	7.4	0.25	0.38	4	4	0
Iron	4	3	69.4	407	213	0.82	1,000	0	0	0
Lead	4	3	0.54	2	1.51	0.56	1.09	2	0	0
Manganese	4	4	11	3,010	964	1.46	20.4	3	2	1
Zinc	4	4	765	4,440	2,500	0.72	42	4	4	1

Statistical Summary of Total Metals Concentrations in Surface Water
Segment NmSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	51	4	0.29	9.4	3.02	1.41	6	1	0	0
Arsenic	51	19	0.1	10.9	1.59	1.82	50	0	0	0
Cadmium	235	230	0.12	1,810	42.3	3.69	2	193	122	3
Copper	51	26	0.22	340	29	2.61	1	22	8	2
Iron	52	36	14.4	16,600	820	3.39	300	9	1	0
Lead	236	229	0.28	4,260	140	2.92	15	186	48	3
Manganese	53	47	0.4	26,800	1,360	3.88	50	30	9	2
Mercury	51	1	0.15	0.15	0.15	< 0.001	2	0	0	0
Silver	47	2	0.043	3	1.52	1.38	100	0	0	0
Zinc	236	233	15.5	540,000	9,340	4.83	30	232	202	139

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment NmSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	50	4	0.26	1	0.688	0.46	2.92	0	0	0
Arsenic	50	23	0.11	8	1.02	1.78	150	0	0	0
Cadmium	233	226	0.056	1,810	43.8	3.72	0.38	222	188	62
Copper	50	27	0.22	347	24.4	2.89	3.2	14	3	1
Iron	52	18	10	4,080	654	1.71	1,000	4	0	0
Lead	233	211	0.14	1,370	71.2	1.69	1.09	206	171	35
Manganese	52	43	1	28,300	1,520	3.77	20.4	36	20	3
Silver	47	1	0.27	0.27	0.27	< 0.001	0.43	0	0	0
Zinc	232	230	5.5	532,000	9,540	5.02	42	224	188	114

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment NmSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	3	3	16	23.2	20.6	0.2	22	2	0	0
Cadmium	3	3	1.8	3.7	2.9	0.34	9.8	0	0	0
Copper	3	3	17.9	22.8	20.1	0.12	100	0	0	0
Iron	3	3	16,700	18,100	17,400	0.04	65,000	0	0	0
Lead	3	3	80.6	323	174	0.75	171	1	0	0
Manganese	3	3	418	810	570	0.37	3,597	0	0	0
Zinc	3	3	223	507	318	0.52	280	1	0	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment NmSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	2	1	0.2	0.2	0.2	< 0.001	6	0	0	0
Arsenic	2	1	0.31	0.31	0.31	< 0.001	50	0	0	0
Cadmium	4	3	0.3	0.4	0.367	0.16	2	0	0	0
Iron	2	2	81	157	119	0.45	300	0	0	0
Lead	4	3	0.38	4	1.76	1.11	15	0	0	0
Manganese	2	2	11	35	23	0.74	50	0	0	0
Zinc	4	3	13	73	50	0.65	30	2	0	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment NmSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Cadmium	4	2	0.2	0.3	0.25	0.28	0.38	0	0	0
Iron	2	2	49	150	99.5	0.72	1,000	0	0	0
Manganese	2	2	10	38.7	24.4	0.83	20.4	1	0	0
Zinc	4	2	4.9	30	17.5	1.01	42	0	0	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment NmSeg04
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	5	5	2.8	17.5	9.46	0.63	31.3	0	0	0
Arsenic	5	5	16.6	52.8	29.1	0.53	22	3	0	0
Cadmium	5	5	3.5	29.3	13.6	0.79	9.8	2	0	0
Copper	5	5	59.6	201	122	0.48	100	2	0	0
Iron	5	5	16,700	35,500	25,400	0.34	65,000	0	0	0
Lead	5	5	1,060	7,770	3,990	0.74	171	5	4	0
Manganese	5	5	759	3,100	1,440	0.68	3,597	0	0	0
Mercury	5	5	0.38	7.6	2.2	1.38	23.5	0	0	0
Silver	5	5	2.6	26.9	10.5	0.92	391	0	0	0
Zinc	5	5	735	5,770	2,630	0.83	280	5	2	0

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment NmSeg04
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	7	1	26.6	26.6	26.6	< 0.001	31.3	0	0	0
Arsenic	7	7	0.96	22.3	10.5	0.71	22	1	0	0
Cadmium	7	2	1.7	27.4	14.6	1.25	9.8	1	0	0
Copper	7	7	9.5	153	37.4	1.37	100	1	0	0
Iron	7	7	8,770	33,500	16,500	0.48	65,000	0	0	0
Lead	7	7	20.7	13,000	1,970	2.47	171	2	1	0
Manganese	7	7	226	1,670	816	0.61	3,597	0	0	0
Mercury	7	3	0.05	5.1	1.74	1.67	23.5	0	0	0
Silver	7	1	29.4	29.4	29.4	< 0.001	391	0	0	0
Zinc	7	7	38.4	4,800	808	2.19	280	2	1	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment NmSeg04
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	13	9	1.14	241	69.9	1.17	3.3	8	6	0
Arsenic	13	13	2.34	216	41.1	1.57	13.6	4	1	0
Cadmium	13	13	0.945	194	37.1	1.46	1.56	11	7	1
Copper	13	13	18	211	91.4	0.71	32.3	10	0	0
Iron	13	13	10,900	47,800	26,200	0.39	40,000	1	0	0
Lead	13	13	154	20,100	6,000	1	51.5	13	12	5
Manganese	13	13	529	6,830	1,700	0.98	1,210	7	0	0
Mercury	13	8	0.0587	1.43	0.327	1.4	0.179	4	0	0
Silver	13	13	1.02	40.7	13.9	0.97	4.5	8	0	0
Zinc	13	13	278	17,600	5,070	1.11	200	13	8	0

Statistical Summary of Total Metals Concentrations in Groundwater
Segment NmSeg04
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	20	1	0.81	0.81	0.81	< 0.001	6	0	0	0
Arsenic	20	5	0.25	1.1	0.864	0.4	50	0	0	0
Cadmium	20	16	3.2	996	299	1.33	2	16	6	6
Copper	20	9	0.89	573	196	1.14	1	7	6	5
Iron	20	10	12.6	5,100	1,790	1.03	300	8	2	0
Lead	20	14	0.76	3,600	1,390	1.2	15	6	6	6
Manganese	20	14	7.3	1,520	726	0.95	50	11	7	0
Mercury	20	2	0.53	0.94	0.735	0.39	2	0	0	0
Zinc	20	20	23.7	145,000	35,600	1.53	30	19	16	9

Statistical Summary of Dissolved Metals Concentrations in Groundwater
Segment NmSeg04
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	20	3	0.33	0.38	0.35	0.08	2.92	0	0	0
Arsenic	20	1	1	1	1	< 0.001	150	0	0	0
Cadmium	20	16	2.4	942	288	1.33	0.38	16	15	6
Copper	20	9	0.22	560	197	1.14	3.2	6	6	3
Iron	20	7	59	5,130	2,390	0.82	1,000	6	0	0
Lead	20	10	0.35	3,560	1,860	0.87	1.09	8	7	6
Manganese	20	16	5.5	1,480	587	1.12	20.4	11	7	0
Mercury	20	2	0.5	0.51	0.505	0.01	0.77	0	0	0
Zinc	20	20	24.7	123,000	32,200	1.51	42	18	16	6

Statistical Summary of Total Metals Concentrations in Surface Water
Segment NmSeg04
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	31	9	0.3	2.7	1.18	0.59	6	0	0	0
Arsenic	31	4	0.13	49.7	12.6	1.96	50	0	0	0
Cadmium	165	160	0.3	62	24.1	0.47	2	157	101	0
Copper	32	15	1.4	9.7	4.35	0.55	1	15	0	0
Iron	38	25	7.6	27,300	1,330	4.08	300	5	1	0
Lead	166	165	0.15	2,140	106	1.71	15	158	18	1
Manganese	38	37	1.1	8,920	320	4.53	50	25	1	1
Silver	31	1	0.27	0.27	0.27	< 0.001	100	0	0	0
Zinc	166	164	5.4	10,000	3,870	0.53	30	161	157	100

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment NmSeg04
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	31	15	0.3	2.1	1.03	0.54	2.92	0	0	0
Arsenic	31	7	0.13	19.7	2.98	2.47	150	0	0	0
Cadmium	165	160	0.022	62	24.1	0.48	0.38	157	156	18
Copper	32	8	0.18	5.4	1.85	0.9	3.2	1	0	0
Iron	38	13	5.9	12,200	973	3.46	1,000	1	1	0
Lead	164	161	0.05	148	47.3	0.51	1.09	158	154	3
Manganese	38	35	5.04	8,560	316	4.56	20.4	31	1	1
Zinc	165	164	3.9	9,830	3,810	0.56	42	158	155	59

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

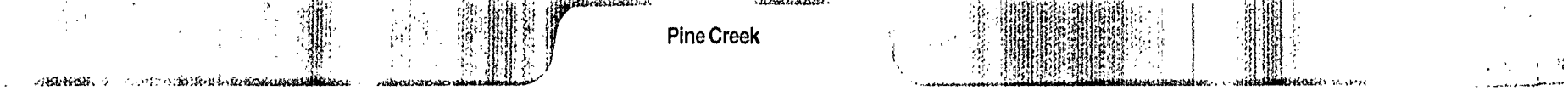
Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram


Pine Creek

CSM Unit 1, Upper Watersheds

Pine Creek

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ABBREVIATIONS AND ACRONYMS

AWQC	ambient water quality criteria
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic foot per second
CIA	Central Impoundment Area
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
DMEA	Defense Minerals Exploration Program
EPA	U.S. Environmental Protection Agency
EV	expected value
FS	feasibility study
IDEQ	Idaho Division of Environmental Quality
MFG	McCulley, Frick & Gilman, Inc.
µg/L	microgram per liter
msl	mean sea level
PDF	probability density function
PineCrkSeg	Pine Creek segment
PRG	preliminary remediation goal
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
SL	screening level
South Fork	South Fork Coeur d'Alene River
TMDL	total maximum daily load
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Pine Creek Watershed is located within the Coeur d'Alene River basin and is a north-flowing tributary of the South Fork Coeur d'Alene River (South Fork). The Bureau of Land Management (BLM) has identified 131 source areas (e.g., mining waste rock dumps, adits, and jig tailings piles) within the watershed (BLM 1999). The watershed has been affected by mining activities, and past and continuing releases of metals from mining wastes.

Several time-critical and non-time critical clean-up responses have been implemented by the Bureau of Land Management on public lands in the Pine Creek watershed. In the 1996 and 1997 field seasons under a time-critical removal, two tailings ponds associated with the Douglas mine and mill site were removed from the east fork of Pine Creek (USEPA, 1996). Approximately 25,000 cubic yards of materials were removed and placed into a temporary repository near the mine (Fortier, 2000). Following the flooding in 1996 and 1997, funding by the Federal Emergency Management Agency was used to conduct time-critical removals of approximately 23,000 cubic yards of contaminated soils and tailings from the Amy-Matchless, the Liberal King, and a portion of the Denver Creek tailings piles (BLM, 1998). These materials were initially removed to a Temporary Storage area at the Upper Constitution Mill site, and then in 1998, were relocated from the Temporary Storage Area to the Central Impoundment Area (CIA) within the Bunker Hill Site.

Following these time-critical removals, additional non-time critical removals were performed in 1998 at the Amy Matchless site, and at the Liberal King Site. About 2,200 cubic yards of tailings were removed to the CIA as a part of this action. These areas were then re-graded, soil media was imported, and the disturbed areas at these sites were re-vegetated. BLM plans additional actions to cleanup the mill site in 2000, along with a pilot treatment system for the adit drainage (Fortier, 2000).

In the 1998 and 1999 field seasons, contaminated soils from around the mill at the Upper Constitution were also excavated and disposed of in the CIA. A subsurface wetlands treatment facility to address adit and seep drainage was installed at this site in 2000; however, most of the tailings, and the waste rock dump at this site are located on private land, and have not been addressed to date.

A CERCLA non-time critical action was also implemented at the Sidney (Red Cloud) mine and mill site during the 1998, 1999, and 2000 field seasons. This action included removal of contaminated soils from around the mill site, regrading the waste rock dump, installation of

run-on and run-off controls and on-site culvert improvements. Excavated soils were disposed of in the CIA. BLM has plans to close the adit and treat the drainage in a wetlands treatment system (Fortier, 2000).

In the 1999 field season, Highland Creek was also diverted around the waste rock dump at the Highland Surprise mine and mill site in order to reduce erosion. As most of the facilities at this site are on private land, no other actions have been taken to date. In addition, EPA correspondence indicated the removals of about 600 cubic yards of contaminated sediment from the Hilarity Mine, about 4,300 cubic yards from the Little Pittsburg site, and 5,200 mixed waste rock from the Nevada Stewart Mine site for disposal at the CIA (CH2MHILL, 1998).

In 1995, the private owner of the Nabob Mine property installed a soil cover over the tailings pile and a portion of the mill area. The cover was revegetated with limited success (BLM, 1998). In the 1998 and 1999 field seasons, BLM implemented channel improvements through this reach to help stabilize the channel and prevent erosion of the tailings pile embankment. Stream channel stabilization, including barbs and in-stream structures have been implemented since 1997 in Denver Creek and the East Fork of Pine Creek to improve riparian habitat (Stevenson, 1998).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself has been divided into three segments to focus this investigation (Figure 1.1-1). Brief descriptions of each segment are presented in this section.

1.1 SEGMENT DESCRIPTIONS

Segment 1 contains the headwaters of the East Fork of Pine Creek down to its confluence with the main stem of Pine Creek (Figure 4.1-1). The BLM identified 78 source areas in this segment. Extensive stream channel and floodplain remediation activities have been conducted in this segment. Some mining wastes have been removed from BLM lands and taken out of the watershed to the Central Impoundment Area near Kellogg. However, at several of the mines and mill sites where work was done by BLM, wastes remain on private land. Some of these wastes may be discharged by ongoing erosion to the creek during high flows. Sampling of surface water indicates that metals concentrations are greater than ambient water quality criteria (AWQC). Fish populations are dominated by brook trout, with native cutthroat trout making up a small proportion of the samples collected during one year, and absent the following year. Sculpin were not encountered at any location during sampling, reflecting their sensitivity to anthropogenic impacts and water quality.

Segment 2 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork (Figure 4.1-4). The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped prospects or mines. No tailings deposits were identified. Sampling of surface water indicates that metals concentrations in surface water are rarely greater than AWQC. Though this segment has been subject to little mining-related activity, other anthropogenic impacts, including residential development, forest roads, and timber harvest, are present.

Segment 3 begins at the confluence of the East Fork with the main stem of Pine Creek and continues to the confluence of Pine Creek with the South Fork (Figure 4.1-5). The BLM identified 23 source areas in this segment. As with Segment 1, some mining wastes have been removed from BLM lands; however, some removals from BLM land did not include wastes on adjacent private land, and waste remains in place with possible or ongoing erosion to the creek. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC. The lower portion of this segment lies within the town of Pinehurst. The stream system in this area has some development. There is extensive channelization and limited riparian vegetation. As with Segment 1, fish populations are dominated by brook trout, with native cutthroat trout making up a small proportion of the samples collected during one year, and absent the following year. Sculpin were not encountered at any location during sampling, reflecting their sensitivity to anthropogenic impacts and water quality.

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Pine Creek Watershed is one of eight reports contained within Part 2 presenting the remedial investigation (RI) results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on the U.S. Environmental Protection Agency's (EPA) *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (USEPA 1988). This report contains the following sections:

- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology.
- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination, includes a summary of chemical results and estimates of mass loading from source areas

- Section 5–Fate and Transport, includes chemical and physical transport processes for metals

- Section 6–References

Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment, the ecological risk assessment, and the feasibility study (all under separate cover).

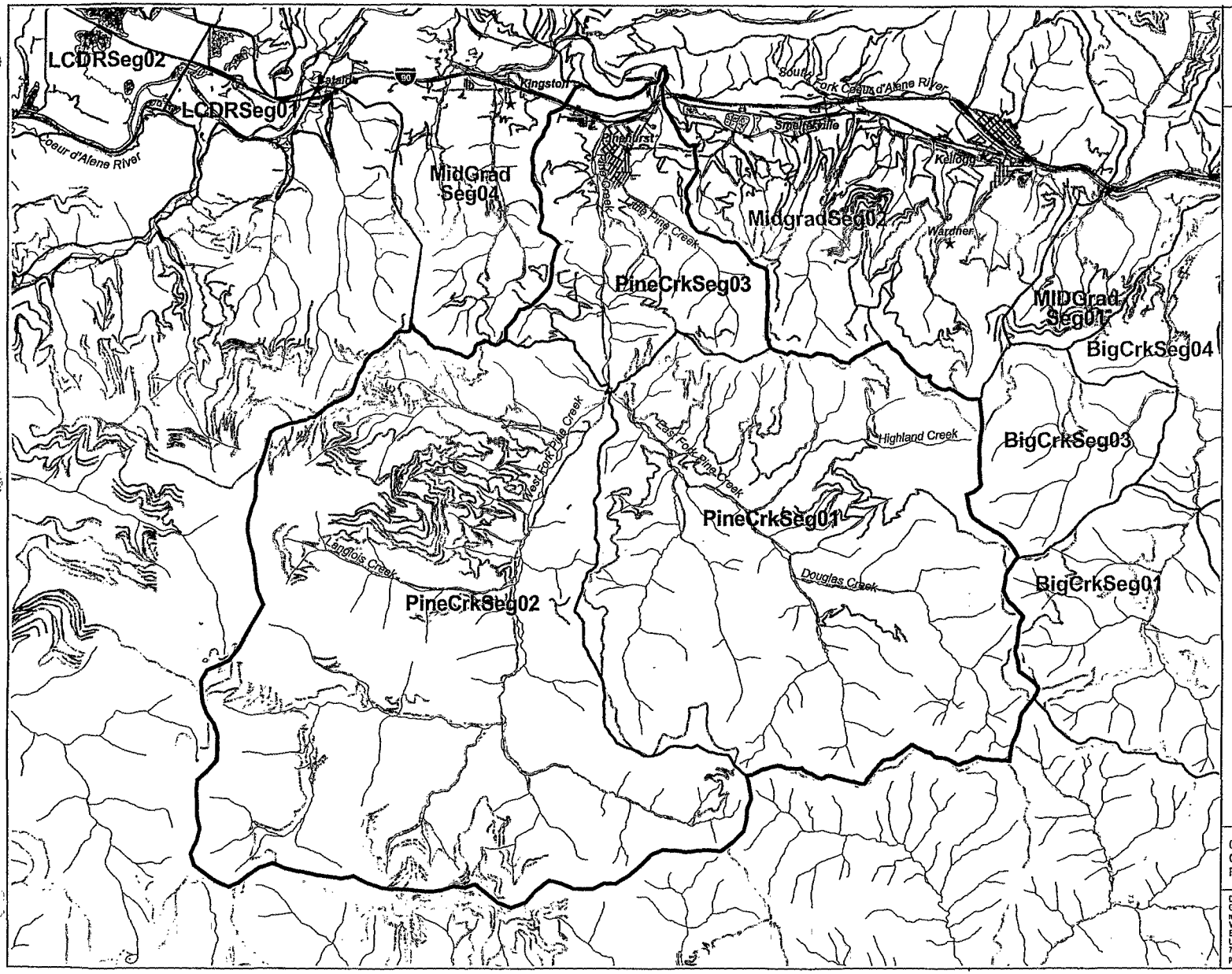

Figure 1.1-1
Pine Creek Watershed

LEGEND

- Stream
- Road
- Interstate-90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:84,000

0.5 0 0.5 Miles

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Coeur d'Alene Basin RI/FS
RI REPORT

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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Pine Creek Watershed are presented in this section.

2.1.1 Geomorphic Setting

The Pine Creek Watershed is located 5 miles west of Kellogg on the south side of the South Fork and drains an area of approximately 60 square miles (Figure 1.1-1) (Quivik 1999). Pine Creek, the principal drainage of the watershed, discharges to the South Fork just upstream of the confluence with the North Fork Coeur d'Alene River (North Fork). East Fork Pine Creek and West Fork Pine Creek begin at an elevation of approximately 5,400 feet in the St. Joe Mountains and join approximately 4 miles south of Pinehurst to form the main stem of Pine Creek.

East Fork Pine Creek, West Fork Pine Creek, and main stem flow northerly. In headwater areas the canyons are narrow. West Fork Pine Creek is flanked by steep hillsides in the reach immediately above the confluence with the East Fork. In the lower portion of the main stem, the floodplain broadens (0.75 mile wide).

2.1.2 Bedrock Geology

The Pine Creek Watershed is mostly underlain by weakly metamorphosed sedimentary rocks assigned to the Precambrian Belt Supergroup (Part 1, Figure 3.2-1). The Prichard Formation is by far the most prevalent formation in the watershed. The Prichard consists of either argillite (more common in the lower part of the formation) or quartzite (more common in the upper part). The Burke Formation (mainly a quartzite) is the predominant formation at the headwaters of East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1). Near Pinehurst to the west of Pine Creek, a small area of outcropping quartzite is assigned to the Ravalli Group, which is a combination of the Revett and Burke Formations (Part 1, Figure 3.2-1).

Waste rock piles are present at all mine workings in the Pine Creek Watershed. Waste rock consists of broken, angular rock that is generally unmilled and typically dumped near the mouth of workings. The largest waste rock piles in the watershed are at the Sidney (Red Cloud), Sidney (Denver), Constitution, and Nabob Mines (Box, Bookstrom, and Kelley 1999). The chemical and mineralogical content of waste rock is discussed further in Section 4, Nature and Extent of Contamination.

2.1.3 Structural Geology

Roughly east-west-trending faults dominate the structural fabric of the watershed. The Osburn Fault is the principal structure of the district, and other large faults mimic the trend of the Osburn Fault. Aside from the Osburn, the most prominent east-west faults are the Placer Creek and Ross Faults (located near the confluence of East Fork and West Fork), and the Spring Fault (located about 1 mile south of Pinehurst). Both normal faults and reverse faults are common in the watershed and are differentiated from one another on the basis of movement on either side of the fault plane. Dip-slip movement along the fault plane yields displacement on the order of hundreds of feet (Umpleby and Jones 1923). Both the Osburn and Placer Creek Faults display right-lateral movement.

The Liberal King (Sunset) Mine (also referred to as the Sunset Minerals Mine [Part 1, Figure 3.2-3]) is localized along an east-west-trending fault zone. Although east-west structures are most prevalent, it appears that northwest-trending structures are associated with the following mines: Constitution, Douglas, Sydney (Red Cloud), Highland-Surprise, and Nabob, all located along smaller drainages discharging to the East Fork (Gott and Cathrall 1980). In addition to northwest-trending faulting, the Pine Creek Anticline crosses Pine Creek at the intersection of East Fork and West Fork, and weakly metamorphosed Belt Supergroup sedimentary rocks are folded along the northwest-trending axis of the anticline (Part 1, Figure 3.2-3).

2.1.4 Soils

Like most of the soils throughout the district, the soils of the Pine Creek Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay, generally less than 2 feet thick (MFG 1992; Camp Dresser & McKee 1986). Valley soils are found within and along the flanks of the major drainages of the Pine Creek Watershed.

The valley soils are most extensive in the floodplain located in the town of Pinehurst, and along West Fork Pine Creek, just above the confluence with East Fork Pine Creek (see Part 1, Figure 3.2-1, symbol Qal). Soils within and flanking the channels at these two locations typically consist of well-developed sandy soil overlying cobbly to bouldery gravels (Box, Bookstrom, and Kelley 1999). Deposits of alluvial fan gravels are also found in West Fork Pine Creek, just above the confluence with East Fork Pine Creek.

West and east of the town of Pinehurst is an extensive area of terrace gravels, which are characterized by well-developed sandy soil overlying cobbly to bouldery gravels (Box,

Bookstrom, and Kelley 1999). Smaller masses of terrace gravels are scattered along East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1).

2.1.5 Ore Deposits

The Pine Creek Watershed drains the Pine Creek Mineral Belt and the Douglas Subbelt (Part 1, Figure 3.2-3). According to the ore production records, zinc and lead were the most abundant metals produced. The dominant type of ore deposit in the Pine Creek Watershed contains what is referred to as zinc-lead fissure-vein deposits, which are steeply dipping veins that are hosted by and typically cut across argillite of the Prichard Formation (Umpleby and Jones 1923). Most of the fissure-vein deposits occur in fault zones, which are closely spaced faults aligned in roughly the same direction (Umpleby and Jones 1923). For example, the Highland-Surprise vein is associated with the Placer Creek Fault, and the Constitution vein closely parallels the Pine Creek Fault. Other examples of fissure-vein deposits in the watershed occur at the Nabob and Sunset Minerals (also known as the Liberal King [Sunset]) Mines.

The Highland-Surprise vein is somewhat unusual compared to the other vein deposits in the watershed in that a portion of the ore forms as replacement deposits, which is a deposit type more prevalent in the Canyon Creek and Ninemile Creek Watersheds. Replacement deposits occur when ore-bearing fluids alter the host argillite by replacing the quartz and clay minerals with sphalerite and galena.

The principal non-ore minerals in both the vein-type deposits and the replacement deposits are quartz and pyrite. Pyrrhotite is the most common non-ore mineral after quartz and pyrite and is abundant in parts of the Highland-Surprise, Little Pittsburgh, and Nabob Mines. With regard to carbonate minerals, the occurrence and relative abundance of calcite, ankerite, and particularly siderite vary greatly throughout the district. In the Pine Creek Watershed, ankerite is the most common carbonate mineral (Forrester and Nelson 1944). Siderite is either absent from most deposits (e.g., the Douglas and Constitution Mines) or present as a relatively minor constituent as at the Highland-Surprise. Calcite is also either absent from most deposits in the watershed or present as an accessory mineral of the deposits at the Douglas and Constitution.

For both the vein deposits and the replacement deposits, total sulfide content is typically relatively low (perhaps on the order of 3 to 5 percent or less, according to the descriptions of deposits in Umpleby and Jones 1923 and Ransome and Calkins 1908) and the carbonate mineral content (i.e., siderite and calcite) is low to absent.

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

The initial mining boom along Pine Creek began in the early 1910s. From 1884 to 1980, an estimated 50 mines, 10 mills, and 500 patented and unpatented mining claims were in operation in the basin. Most of the mining operations along Pine Creek were concentrated along East Fork Pine Creek, where there were about 45 patented mining claims and approximately 100 unpatented mining claims (Ridolfi 1998).

In the early mining operations in the basin, there were problems with separation of the complex mixture of lead and zinc that was predominant in the area. Pine Creek ores typically required over-grinding to facilitate mineral extraction. This processing technique resulted in a very fine-grained process residue. Selective flotation processes, which were used starting in the 1920s, remedied some of these separation problems, and allowed a greater amount of Pine Creek ore to be profitably mined.

Although some of the ore mined in the Pine Creek Watershed was shipped to other mills for processing, most mine sites built on-site ore processing mills at one time or another. The Surprise (later Highland-Surprise) Mill was the first ore-processing mill to be constructed along the creek. Ore processing consists of the removal of waste material (tailings) from the raw ore to yield a concentrated product for smelting. Early milling operations used gravity concentration to produce concentrates from the raw ore. Gravity separation was an inefficient recovery process, and jig tailings frequently contained as much as 10 percent lead or zinc (Stratus 1999). By the 1920s, most newly constructed mills and some retrofitted existing mills used some type of flotation process for more efficient ore processing. Tailings were typically disposed of directly into or next to the nearest creek.

In 1919, Jacob Pollack won a landmark lawsuit against the Bunker Hill, Hecla, and Gold Hunter Mining Companies. The U.S. District Court in Wallace found the mining companies negligent in their maintenance of the Pine Creek tailings dam, which was reported to have been full by 1914. Pollack was awarded a $3,500 judgment. When the Bunker Hill Mining Company appealed, the Ninth Circuit Court of Appeals in San Francisco made the following statement regarding Bunker Hill's defense on the grounds of miner's preferential water rights:

We find no merit in the contention and no authority to sustain it. It asserts for the miner in Idaho constitutional rights unknown to American constitutional law–the right not only to preference in the use of a stream, but the right to inflict unlimited injury upon property of those who have acquired vested rights as manufacturers or agriculturist (as cited in Casner 1989).

Within this watershed, approximately 50 mines and 10 mills produced approximately 3.2 million tons of ore (Mitchell and Bennett 1983; Mitchell 1996). Of this 3.2 million tons, approximately 102,000 tons of lead, 210,000 tons of zinc, 900 tons of copper, and 140 tons of silver were produced (Mitchell and Bennett 1983). An estimated 2,531,500 tons of tailings were produced from ore processing (SAIC 1993), and an estimated 3,489 tons of tailings were reprocessed (Mitchell 1996). The mines with the largest production, in decreasing order of volumes produced, were the Sidney (Red Cloud), Constitution (Spokane-Idaho), Highland-Surprise, Little Pittsburgh (not shown in figure), Sunset Minerals (also known as the Liberal King [Sunset]), and Nabob (Part 1, Figure 3.2-3).

2.1.6.1 Mines

The mines that operated in the Pine Creek Watershed for which ore production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity, and the segment in which the mine is (or was) located. Only mines with documented ore production are listed. Additionally, some mining operations were carried out at more than one location, occasionally in more than one segment or even more than one watershed. The ore production listed in Table 2.1-1 is the total production for all mining operations.

2.1.6.2 Mills

Table 2.1-2 lists the mills with operations in the Pine Creek Watershed for which there are records. This table includes the operating years of the mill and a summary of ownership, as well as the segment in which the mill is located. Not all mills are listed because records were not available for all mills.

2.1.7 Mine Workings

Underground workings in many mines in this watershed are very extensive and act as collection and distribution systems for groundwater. Individual mine workings in this watershed are typically located within a single, relatively steep ridge. Recharging water infiltrates at the highest levels of a mountain ridge and discharges on the same ridge. This is referred to as a local

flow system, characterized by short groundwater flow paths (a flow path is the route by which the water enters and exits the groundwater system) (Toth 1963).

Adits and tunnels in this watershed act as discharge points for groundwater. Typically adit drainage discharges directly to surface water or first infiltrates waste rock piles before discharging to surface water from seeps. Over 70 adits and 11 shafts have been reported in the Pine Creek Watershed, and at least 22 named adits (not shown in a figure) in the watershed are known to discharge mine drainage (CCJM 1995). Fifteen of the 22 adits with discharging mine drainage are located in tributaries to East Fork Pine Creek; 5 adits are located along East Fork Pine Creek; and 2 adits are along Pine Creek (Ridolfi 1999). The discharge of metals from mine workings is discussed further in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2 HYDROGEOLOGY

2.2.1 Conceptual Hydrogeologic Model

The Pine Creek Watershed occupies approximately 80 square miles, and West Fork Pine Creek, East Fork Pine Creek, and Pine Creek are the principal drainages of the watershed (Part 1, Figures 1.2-1 and 1.2-2). West Fork Pine Creek flows approximately 5 miles to the confluence with Pine Creek to the north. East Fork Pine Creek flows approximately 7 miles to the confluence with Pine Creek to the north. From the confluence with West Fork Pine Creek, Pine Creek flows about 5 miles in a northerly direction to the point where the East Fork meets Pine Creek. From the confluence with East Fork Pine Creek, Pine Creek flows north about 5 miles to the confluence with the South Fork Coeur d'Alene River (South Fork). The elevation change in the watershed is approximately 3,200 feet, with elevations ranging from 5,400 feet above mean sea level (msl) at the headwaters of East Fork Pine Creek in the St. Joe Mountains, to 2,200 feet above msl at the confluence with the South Fork.

The hydrogeology of the Pine Creek Watershed can be divided into two main groundwater systems: the bedrock aquifer and the shallow alluvial aquifer (CCJM 1995). The conceptual hydrogeologic model for the watershed assumes that a single unconfined aquifer is present in the shallow alluvial sediments, and these sediments are the principal hydrostratigraphic unit in the watershed. The shallow alluvial sediments consist of natural materials as well as mine tailings and waste rock.

Although relatively little hydrogeologic data is available for the watershed as a whole, a study of the largest millsites located along East Fork Pine Creek and Pine Creek confirmed the presence of an unconfined alluvial aquifer overlying bedrock in the vicinity of these millsites (CCJM 1995). In general, the alluvium increases in thickness from the headwaters of East Fork and West Fork Pine Creek toward their confluence with the South Fork.

The bedrock aquifer within the Pine Creek Watershed consists of argillites and lesser quartzites of the Precambrian formations of the Belt Supergroup, including (principally) the Prichard Formation, and a relatively minor amount of Burke Formation at the headwaters of East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1).

In general, the bedrock has very low permeability. Secondary features such as fractures, faults, or mine workings may increase the permeability substantially. Mine workings that may influence recharge to the bedrock aquifer were discussed in Section 2.1.7, Mine Workings.

The groundwater system of unconsolidated sediments overlying less permeable rocks occurs in elongate, V-shaped troughs along the entire lengths of East Fork Pine Creek and West Fork Pine Creek; and along the reach of Pine Creek from the confluence with the East Fork and West Fork to an area about one mile above the town of Pinehurst, near the confluence with the South Fork (Part 1, Figure 3.2-1). Pine Creek is located within a relatively wide, U-shaped valley along the one mile reach between Pinehurst and the South Fork.

2.2.1.2 Groundwater Level Fluctuations

As observed in wells in the Canyon Creek, Moon Creek, and Ninemile Creek Watersheds, it is assumed that groundwater levels fluctuate seasonally in the Pine Creek Watershed. Groundwater levels are generally highest in the late spring and lowest during winter and early spring when precipitation rates are lowest and snowmelt is not occurring.

2.2.2 Aquifer Parameters

Aquifer parameters are not available from the Pine Creek Watershed for the presumed single unconfined aquifer in unconsolidated sediments overlying bedrock. However, based on reported lithologic similarities between the presumed single unconfined aquifer in the Pine Creek Watershed and the upper aquifer of the Smelterville Flats-Bunker Hill groundwater system, it is reasonable to expect that aquifer parameters presented in Table 2.2-1 are similar to the presumed

single unconfined aquifer of the Pine Creek Watershed. The range of horizontal hydraulic conductivities presented in Table 2.2-1 are typical of clean sand and gravels (Freeze and Cherry 1979).

2.2.3 Flow Rates and Directions

Based on similar watersheds (e.g., Canyon Creek, Moon Creek, and Ninemile Creek), it can be assumed that the general groundwater flow direction in the Pine Creek Watershed parallels the flow of Pine Creek surface water and its tributaries. Further from the axis of the creek, there may be a component of flow toward the creek. Based on water level data recorded in Canyon Creek, it can be assumed that there are localized areas in Pine Creek where the flow direction is downstream and toward the creek (gaining reaches) and some areas where the flow direction is downstream and away from the creek (losing reaches).

2.2.4 Surface Water/Groundwater Interaction

Based on groundwater information collected from millsites along Pine Creek and East Fork Pine Creek, it can be assumed that shallow alluvial deposits along Pine Creek and its tributaries serve as aquifers (CCJM 1995). Based on groundwater information collected from Canyon Creek, it is also assumed that the aquifer and adjacent creeks are hydraulically connected, and they are capable of taking from or adding to flow in the creek. The interaction of the surface water in Pine Creek and groundwater in the shallow alluvial aquifers has the potential to create gaining or losing reaches, based on data collected in Canyon Creek. During the spring snowmelt and resulting high creek levels, the gaining reaches of the stream may temporarily experience reversals in the surface water/groundwater hydraulic gradient (i.e., become losing reaches).

2.2.5 Water Quality and Water Chemistry

Water quality parameters (temperature, pH, specific conductance, salinity, turbidity, and oxidation-reduction [redox] potential) and water chemistry data (e.g., chloride, sulfates, and sulfides) are discussed in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2.6 Groundwater Use

Domestic water for Pinehurst, the largest town in the watershed, is recovered from a well network located in Pinehurst. Water is drawn from the alluvial material deposited in the valley bottom of Pine Creek (CCJM 1995).

Use of groundwater supplies for domestic, municipal, and industrial applications (as it relates to human consumption) is discussed in the baseline human health risk assessment.

2.3 SURFACE WATER HYDROLOGY

The following sections describe the surface water hydrology of the Pine Creek Watershed, a tributary to the South Fork Coeur d'Alene River. The Pine Creek Watershed has a drainage area of approximately 79.6 square miles, with approximately 10.22 miles of mapped channel length in the main stem and West Fork.

2.3.1 Available Information

The available hydrologic information for Pine Creek includes United States Geological Survey (USGS) stream flow data for Pine Creek for water year 1999, climatological data for Kellogg, ID, and instantaneous discharge data from a variety of consultants obtained between 1991 and 1999. In addition, historic USGS discharge data is available for Placer Creek, of similar size and near Canyon Creek.

The United States Geological Survey (USGS) began reporting stream flow discharge data from Station Number 12413445, Pine Creek below Amy Gulch near Pinehurst, ID, on October 1, 1998 (USGS 2000). This station is located near the downstream end of PineCrkSeg04 and has a drainage area of approximately 77 square miles, 97 percent of the total Pine Creek Watershed. This station records water stage at 15-minute intervals. Discharge is calculated from the stage data based on a rating curve developed for the specific gage. The rating curve is developed through time by measuring discharge at known stages to relate stage to discharge. Once a rating curve is developed, a discharge can be calculated by comparing a known stage to the rating curve. One complete year of discharge data, water year 1999, is available at this time for Pine Creek at Amy Gulch. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Kellogg were collected for the same period (WRCC 2000). This precipitation gage is the nearest gage to Pine Creek. The mean daily discharge hydrograph and precipitation data are presented in Figure 2.3.1-1. The maximum mean daily discharge recorded during water year 1999 was 1,370 cubic feet per second (cfs) with an instantaneous peak of 1,560 cfs on May 25, 1999.

The USGS has several gages near Pine Creek with historic streamflow data; most notably USGS station number 12413140, Placer Creek at Wallace, ID. The Placer Creek gage has a drainage area of 14.9 square miles and a period of record from November 1967 to September 1995,

October 1996 to September 1997, and water year 1999 (USGS 2000). This data can be used to extrapolate estimates of historic hydrographs within Pine Creek.

Stream discharge measurements were taken in association with water quality sampling events completed by McCulley, Frick & Gilman Inc. (MFG), URS, Idaho Division of Environmental Quality (IDEQ), and USGS. These measurements have occurred since 1991. These data can be used to evaluate the adequacy of the historic hydrographs developed from the Placer Creek data. These data are summarized in Table 2.3.1-1.

In addition to the USGS hydrologic information, the U.S. Department of Housing and Urban Development, Federal Insurance Administration completed a flood insurance study for Shoshone County, Idaho (FIA 1979). Peak discharges were computed for 10-year (3,885 cfs), 50-year (8,525 cfs), 100-year (11,380 cfs) and 500-year (19,510 cfs) events for Pine Creek at the mouth.

2.3.2 Hydrologic Description

The hydrology of the Pine Creek Watershed based on water year 1999 stream discharge data, precipitation data, and estimates of historical discharge developed from USGS discharge data from other watersheds is presented in this section.

2.3.2.1 Historical Description

Continuous discharge data for Pine Creek is not available so an estimate of mean daily discharge at the mouth of Pine Creek was developed by extrapolating from historic data from Placer Creek. Mean daily discharge for Placer Creek was scaled by the ratio of drainage area of Pine Creek to Placer Creek at the Pine Creek gage, to produce an estimate of mean daily discharge for Pine Creek for the period of record of Placer Creek. This hydrograph is presented as Figure 2.3.2-1.

To assess the adequacy of this approach, the difference between estimate and measured discharge at the Pine Creek gage was calculated. The difference and the estimated and measured hydrographs are presented in Figure 2.3.2-2. Agreement between the estimated discharge and measured discharge is relatively good; however, 40 to 60 percent discrepancies should be expected as indicated by the variation in values indicated in Figure 2.3.2-2. The estimated discharge in Pine Creek underestimates flows for events occurring in the winter and spring while overestimating discharges in the summer. This is likely the result of the different elevations of the two watersheds. The Pine Creek Watershed is situated at lower elevations than the Placer Creek Watershed. Therefore, precipitation in the Pine Creek Watershed more likely occurs as

rain than in the Placer Creek Watershed during the winter and spring months. Rain quickly runs off the surface while snow is stored until melted, later in the season.

From Figure 2.3.2-1, the maximum mean daily discharge is estimated at 4,650 cfs and occurred on January 15, 1974. Base flow is estimated to be 20 to 30 cfs. Average annual discharge is estimated at approximately 190 cfs. The maximum discharge recorded at the Placer Creek gage is outside the period of record; however, the USGS has estimated this discharge at 2,200 cfs on February 9, 1996. Applying the relationship presented above results in an estimate of maximum discharge for Pine Creek of 11,600 cfs. The discharge measurement presented in Table 2.3.1-1 are consistent with the extrapolated estimates of discharge for shown in Figure 2.3.2-1.

2.3.2.2 Flood Frequency

Table 2.3.2-1 presents the estimated discharges for specified flood frequency recurrence intervals for Pine Creek. Because historic discharge data is not available for Pine Creek and the estimates of mean daily discharge are already subject to uncertainty, additional manipulation to obtain flood frequency estimates was not completed. Instead, flood frequency developed in the FIS is presented. The bankful discharge, the approximately 1.5-year event, is estimated to be approximately 1,000 cfs.

2.3.2.3 Water Year 1999

Total annual average precipitation at the WRCC Kellogg Station for the 95-year period of record is 30.8 inches, while for water year 1999 the total precipitation was 37.8 inches (WRCC 2000). Total annual average snowfall for the WRCC station is 54.3 inches, while for water year 1999 the total snowfall was 35.5. While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was somewhat typical with above average total precipitation and below average snowfall.

Table 2.3.2-2 summarizes the mean monthly flows for Pine Creek, mean monthly precipitation at the WRCC Kellogg Station (rain and snow water content), and total snowfall at the WRCC station at Kellogg for water year 1999. Table 2.3.2-2 and Figure 2.3.1-1 indicate the majority of precipitation occurred from October to March, 78 percent of the total annual precipitation at the Kellogg gage. Much of this precipitation was in the form of snow and did not run off into the stream channels immediately. However, increased discharge at the Pine Creek gage, above the average annual discharge of 190 cfs, occurred seven times during the winter and spring months, November 21, November 26, December 1 to December 4, December 29 to January 2, January 14 to January 23, February 7, and February 24 to March 4 for a total of 26 days. In contrast, during

the spring and summer months, discharge at the Pine Creek gage remained above the average annual discharge from March 15 to June 27 with the exception of April 4 to April 13, a total of 95 days. This type of drainage pattern is similar to historical flows in surrounding watersheds where much of the annual discharge occurs during the spring and summer with limited periods in the fall and winter with above average annual discharge, Figures 2.3.2-1 and 2.3.2-2.

The increase in discharge during the spring and summer is attributed to increased runoff caused by snowmelt in the upstream watersheds. Maximum daily temperature and mean daily discharge for water year 1999 for the Pine Creek are presented in Figure 2.3.2-3. Increased temperatures over these periods melted much of the snow in the upper basin. Rain on snow also may have contributed to these increased discharges as indicated in Figure 2.3.1-1 where precipitation events also occurred during periods of increased temperature.

Based on the existing data, it is expected that water year 1999 was typical from a total snowfall and total water budget perspective in the Pine Creek Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the peak discharges.

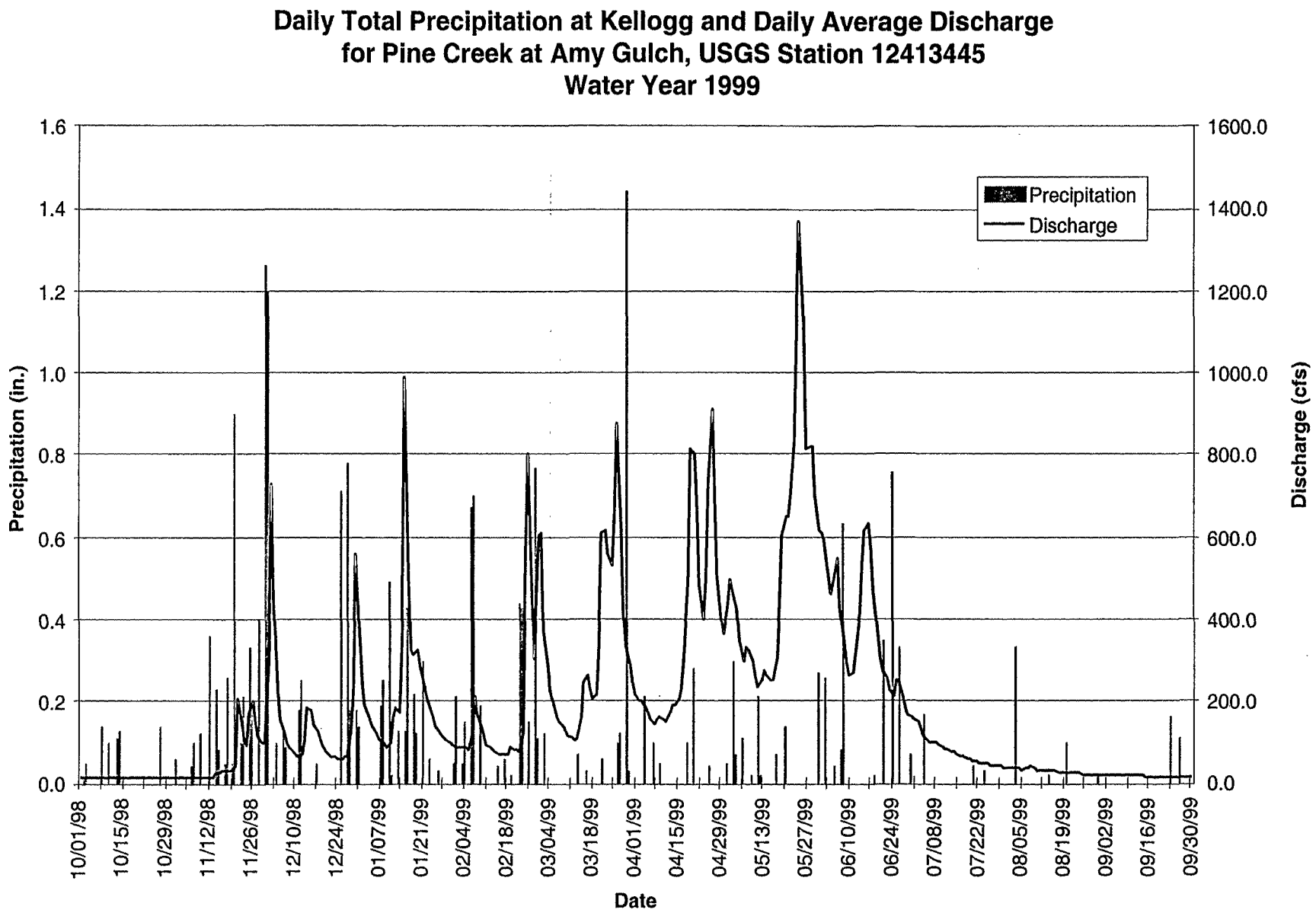

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Figure 2.3.1-1

Pine Creek Estimated Discharge From Placer Creek Data

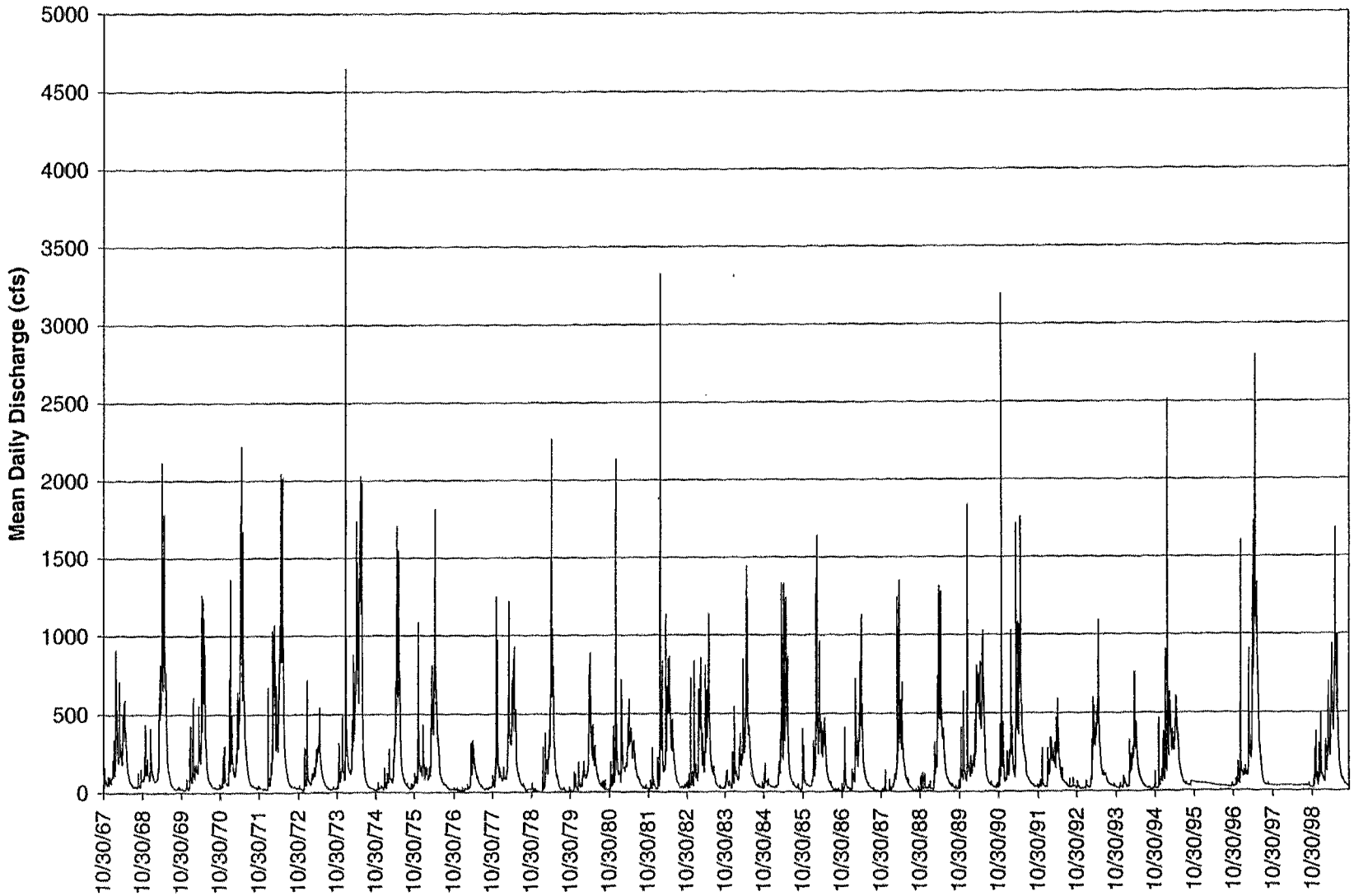

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Figure 2.3.2-1

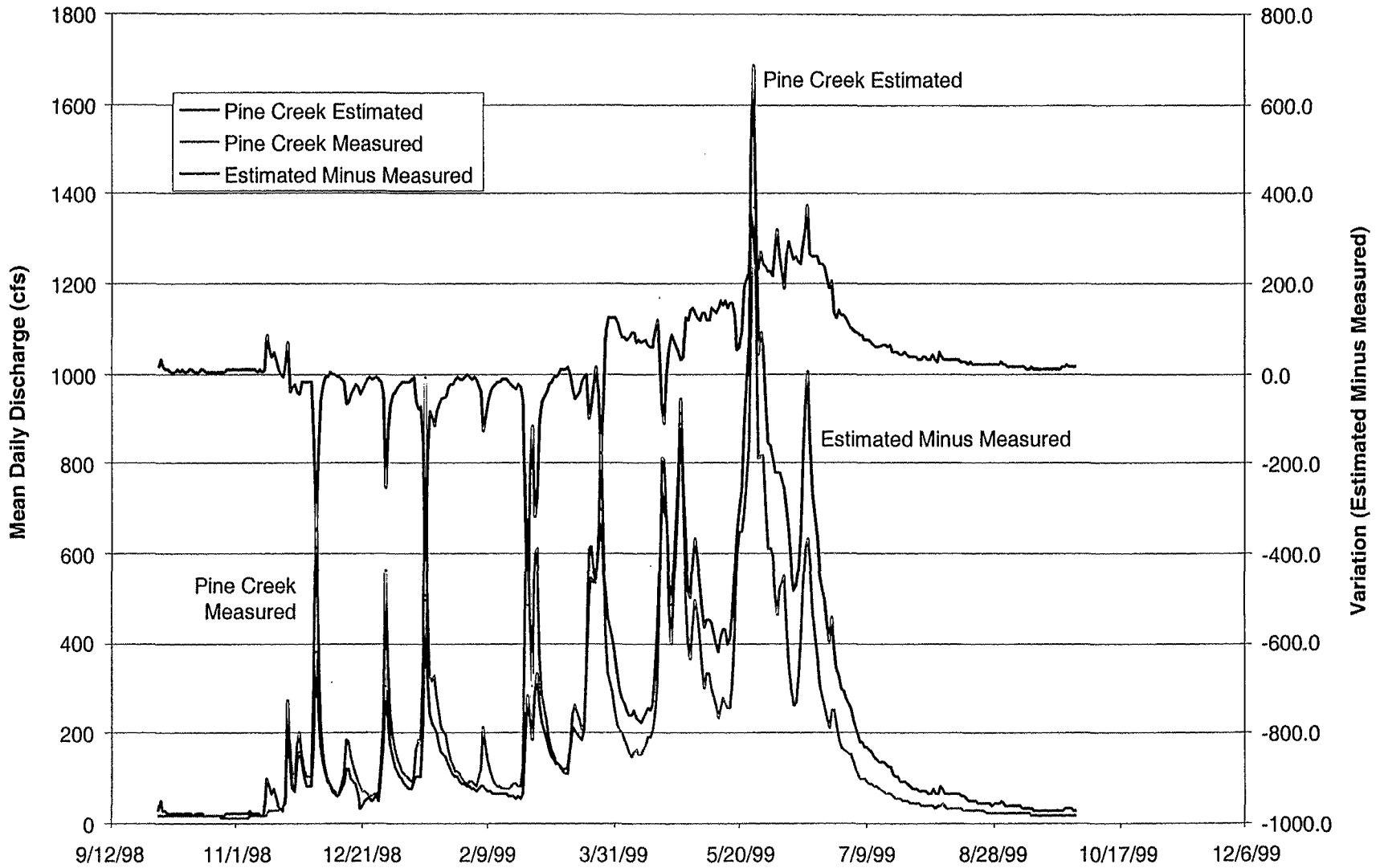

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Figure 2.3.2-2

Daily Maximum Temperature and Daily Average Discharge for Pine Creek at Amy Gulch, USGS Station 12413445 Water Year 1999

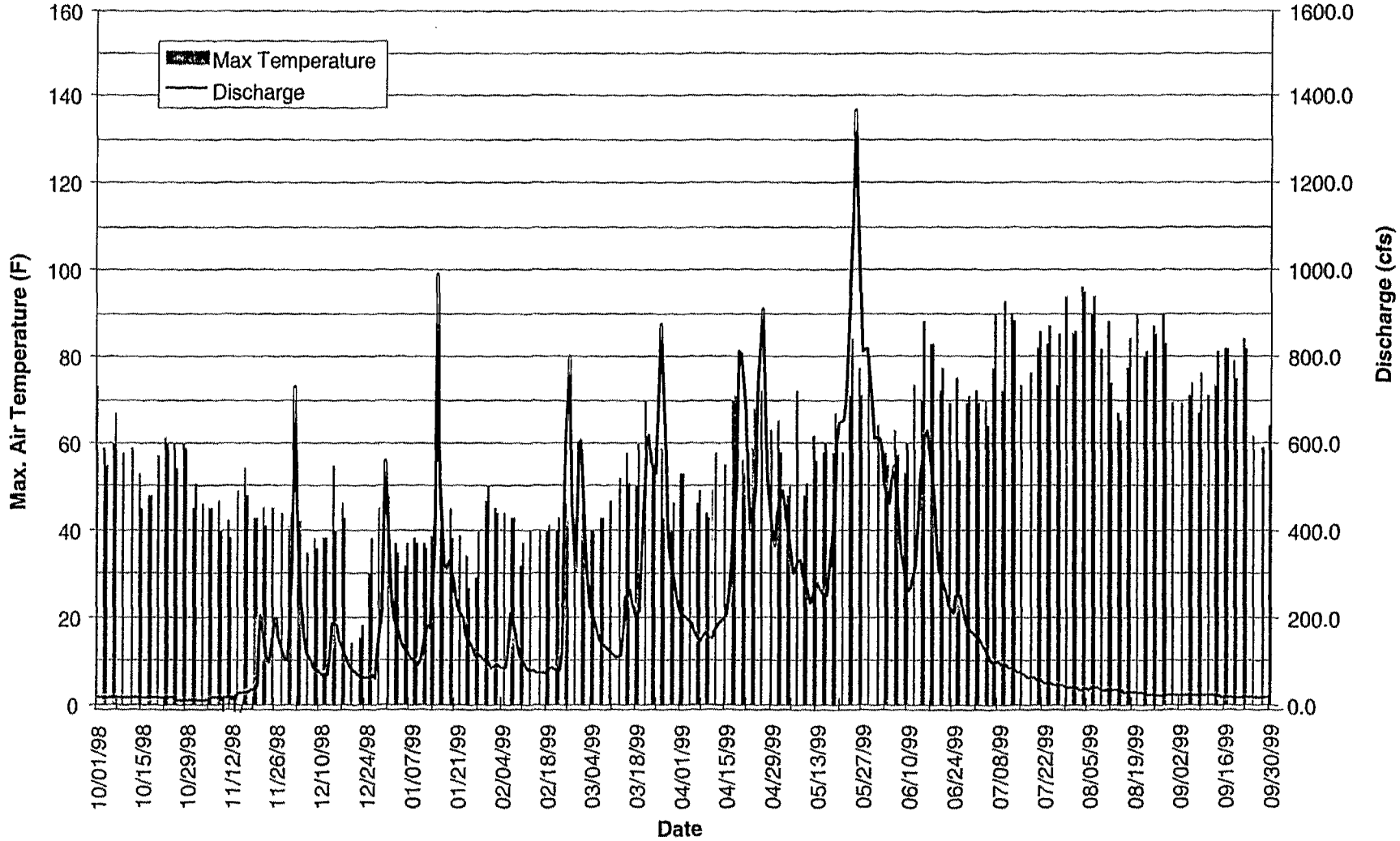

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Figure 2.3.2-3

Table 2.1-1
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Amy-Matchless Mine					
PineCrkSeg03	1912 - 1956	4,569	Amy-Matchless	4,359	The Amy-Matchless Mine was located by Gus Smith in 1887. By 1911, the mine was being operated by the Culver Mining Company, and in 1912 the first car of ore was shipped from the mine. Later that year, the mine was taken over by the Amy-Matchless Mining & Milling Company. In 1929, the Amy-Matchless Mining & Milling Company and Olympic Mines combined to form the Pine Creek Consolidated Mining Company. In 1931, the company's property was sold under court order. Little else was done at the mine until it was acquired by the Lynch-Pine Creek Mining Company in 1942. In 1946, the Lynch-Pine Creek Mining Company changed its name to the Amy Silver-Lead Company. During the 1940s, ores from the Nabob and other mines were being processed at the mill, but the mine saw little activity. In 1947, Nancy Lee Mines, Inc., was given a perpetual working agreement on the mine. Some development and rehabilitation work was done during this time. In 1954, New Era Mines acquired a perpetual working agreement on the property and the mine was later explored by Cominco American in the early 1980s (Mitchell 1996).
Bobby Anderson (Signal) Mine					
PineCrkSeg01	1927 - 1951	523		432	The Bobby Anderson Mining Co. was incorporated in 1906. In 1939, the name was changed to the Signal Mining Co. In 1944, small shipments of ore were made by Benjamin J. Harmon, who was operating the mine under a lease agreement. (SAIC 1993).
Coeur d'Alene Antimony (Fourth of July) Mine					
PineCrkSeg03	1885 - 1919	1,000		NA	The Coeur d'Alene Antimony Mine was reopened by new owners in 1915 in response to demand from ore buyers. The mine operated until 1919, when unfavorable market conditions forced its closure. The operation history of the mine prior to 1915 is unclear (Quivik 1999).

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Constitution (Spokane-Idaho)					
PineCrkSeg01	1915 - 1968	667,326	Constitution, Amy-Matchless	538,249	The first claims of the Constitution Mine were staked in 1901 by Thomas Gilbert, Henry Gilbert, Thomas Thwaite, and George Green. Thomas Gilbert was the officer of the newly organized Constitution Mining & Milling Company by the following year. In 1915, the company secured several investors and began a "vigorous" development campaign. The company shipped at least three car loads of rich ore within the same year. The mine continued to operate until 1919, when it was closed because of low post-war prices for metals and shipping difficulties due to the lack of rail transportation on Pine Creek. The mine was reopened in 1923 and ore began to be shipped again in 1924. In 1925, the Constitution was the largest mine in the Pine Creek Watershed. Mine operations continued through the 1920s, and then production was suspended in June 1930 because of low metals prices. The property remained idle and was then sold in 1936 to satisfy a judgement in favor of the miners employed at the property. The Spokane-Idaho Mining Company was organized and began operating at the mine in 1940. The Spokane-Idaho Mining Company operated the mine through March 1953, and it was operated by lessees until its closure in June 1955. The Constitution Mining Company was organized in 1967, and records indicate ore production from the mine in 1968. The property was later explored by Cominco in the early 1980s (Mitchell 1996).
Denver					
PineCrkSeg01	1916 - 1944	13,000	Bunker Hill Complex, Sullivan, Sidney	8,220	The Nabob Mining Co. had acquired and was actively developing the Denver Mine by July 1916. By 1944 the mine was being controlled by the Denver Mining Co. (SAIC 1993)

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Douglas					
PineCrkSeg01	1916 - 1972	167,162	Douglas, Great Falls, Constitution	138,440	The Douglas Mine was operated by the Douglas Mining Company and by several others under various agreements beginning about 1911 and through 1929. During this time, ore from the mine was shipped to a variety of off-site mills for concentration. Between 1943 and 1955, the mine was operated intermittently by several companies, including the Small Leasing Company, Douglas Leasing Company, and Spokane-Idaho Mining Company (Quivik 1999).
Highland-Surprise					
PineCrkSeg01	1904 - 1971	518,706	Highland-Surprise	332,847	The Surprise Prospect was located in April 1900 by M.J. Sinclair, and the Highland Chief was located later the same year by Henry Gilbert, Sanford Lamb, and W. Pipes. Each mine operated independently until 1912, when the Highland-Surprise Consolidated Mining Company was organized and the two mines were merged. In 1916, the Highland-Surprise Mine was the largest producer of zinc-lead ore in the Pine Creek district, but as was typical of mines in the Pine Creek Watershed, production was hampered by poor transportation. The mine was idle from 1918 through 1921 and was operated by lessees for the next 3 years. The Highland-Surprise Consolidated Mining Company resumed operations at the mine in 1925 and continued operations through 1928. The mine was then shut down until 1940. The company discontinued all underground operations at the mine in 1955. Various lessees performed intermittent work at the mine through 1969 (Mitchell 1996).

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Hilarity					
PineCrkSeg01	1926 - 1952	3,330		3,103	The Hilarity Mine is located on Denver Creek, above its confluence with East Fork Pine Creek. The early history of the mine is unclear. Both Gus Smith and J. Ran Sanborn have been credited with locating the mine about 1886. The Hilarity Mining Company was incorporated and acquired control of the mine in 1899. By 1913, two tunnels on opposite sides of Denver Creek had been developed. In 1917, the Hilarity Mining Company and the Pine Creek Mining & Milling Company were consolidated. The newly consolidated company retained the name Pine Creek Mining & Milling Company. Development work on the mine continued and then in July 1922, the name of the company was changed to the Hilarity Lead-Silver Mining Company. A fire destroyed the surface plant of the mine in 1924. By 1926, total development at the mine consisted of 2,000 feet of workings. Several small shipments of ore to the Sweeny Mill yielded satisfactory results that year. Little work was done at the mine for the next several years, and the Hilarity Lead-Silver Mining Company forfeited its charter in November 1930. The New Hilarity Mining Company acquired control of the property in 1945. By 1949, the Signal Mining Company had acquired a lease on the property. Signal was involved with a Defense Minerals Exploration Program (DMEA) contract on the property in the early 1950s. The ore located by this project was of marginal grade. Only assessment work has been conducted at the property since that time (Mitchell 1996).
Liberal King (Sunset)					
PineCrkSeg03	1937 - 1963	256,437	Liberal King (Sunset)	220,006	The Liberal King Mine was located by Sanford Lamb and Magnus Cheyne before 1905. Sanford Lamb or his heirs apparently retained at least partial ownership of the property until 1928, but historical records indicate several property owners before the property was acquired by the Liberal King Mining Company (Mitchell 1996). The Liberal King Mining Company was incorporated on June 12, 1928, and began developing the mine the same year (Quivik 1999). Development work and some ore production continued through February 1943, when the mine was closed because of a lack of funding for further development. In

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Liberal King (Sunset)					
PineCrkSeg03	1937 - 1963	256,437	Liberal King (Sunset)	220,006	July 1943, Sunset Minerals, Inc., acquired a lease with the option to buy the property. Sunset Minerals acquired title to the property and equipment in 1948. Sunset Minerals continued to operate the mine directly or through lessees until 1957. Cominco American, Inc., rehabilitated some of the workings and conducted an exploration program from 1981 to 1985 (Mitchell 1996).
Little Pittsburgh					
PineCrkSeg01	1916 - 1955	320,674	Little Pittsburgh, Great Falls, Nabob	275,624	The Little Pittsburgh Mine was located about 1897 by George Augustus Smith. The Colonial Mining & Milling Company began operation of the Little Pittsburgh Mine in 1915. The mine shipped its first car of high-grade zinc ore in 1916. The mine was then closed around the end of World War I and did not operate for most of the next decade. In 1929, the Pine Creek Lead-Zinc Company was organized and assumed control of the mine. The newly organized company began a vigorous development of the mine and constructed a new mill at the site. However, little production was accomplished through the 1930s because of low metals prices. The Lessee Mining Company leased the mine in 1941 and later the Denver Development Company operated the mine through a lease agreement from 1941 to 1951. Mascot Mines, Inc., then operated the mine from 1952 to 1955. U.S. Antimony Corp. and Intermountain Mineral Engineers, Inc., leased the property from 1975 to 1980. Ore produced from this project was shipped to the 250-tons-per-day Nabob Millsite. Cominco American, Inc., conducted an exploration project at the mine from 1982 to 1985. Intermountain Mineral Engineers, Inc., also mined some ore in 1985 (Mitchell 1996).

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Lookout Mountain					
PineCrkSeg03	1922 - 1952	1,595	Charles Dickens, Liberal King (Sunset), Amy-Matchless	1,149	Ore was discovered in the No. 2 tunnel of the Lookout Mountain Mine about 1921. By 1922, a train had been constructed and the mine began shipping ore. In 1944, the mine was under lease and bond by the Lookout Leasing Co. In 1947, a cross cut was driven to tie in the Liberal King Mine, thus allowing exploration from the bottom of the Liberal King shaft. (SAIC 1993)
Nabob					
PineCrkSeg01	1907 - 1977	134,069	Nabob, Amy-Matchless	111,759	The Nabob Claim was located by George E. Stone in April 1890. The first recorded production for the mine dates back to 1907, at which time the mine was operated by the Nabob Mining Company. Later the mine was operated by the Nabob Consolidated Mining Company. In 1923, the Nabob Silver-Lead Company took over the property and assumed the liabilities of the Nabob Consolidated Mining Company. Operations at the mine were interrupted in 1926 and 1927 by legal proceedings against the board of directors. After settlement of the legal proceedings, the mine remained closed because of low metals prices. Little work was done at the mine until 1943, when the Lynch-Pine Creek Mining Company obtained a lease on the property. This lease was relinquished in June 1945, and the Nabob Silver-Lead Company continued work at the mine. The mine was operated intermittently, closing several times because of low metals prices. The upper workings of the mine were also being worked by lessees at this time. In 1959, the Sidney Mining Company obtained a 5-year lease on the property. This lease agreement was terminated the following year. The mine continued to be intermittently operated by various lessees through the 1960s. The mine was involved in a joint-venture exploration program with U.S. Antimony Corp. and Intermountain Mineral Engineers, Inc., from 1975 to 1981. Cominco American, Inc., then leased the property from 1982 to 1985 (Mitchell 1996).

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Nevada-Stewart					
PineCrkSeg01	1900 - 1917	377	Highland-Surprise	NA	Small producer
Sidney (Red Cloud)					
PineCrkSeg01	1921 - 1967	1,071,197	Sidney, Galena, Sweeny, Star/Morning, Bunker Hill Complex	816,733 816,733	The early history of the Sidney Mine is unclear. Various sources provide several accounts of the first locators, who established the claim sometime in the 1890s. Little work was done other than the required annual assessment, until the Sidney Mining Company was established in 1910. L.W. Gray, who is reported by at least one source as being a locator of the mine, was president of the newly established company. Some development work continued at the mine in the mid-1910s, but the mine was apparently inactive from 1917 through 1919. The mine was operated by lessees during the early 1920s. The Sidney Leasing Company, organized in 1925, acquired a 10-year lease on several of the Sidney Claims during the same year. Shipment of ore from the mine was soon facilitated by the construction of a 3.5-mile aerial tramway. Sidney was the third largest producer of zinc and the tenth largest producer of lead in Idaho in 1928. The Sidney Leasing Company was able to operate the mine at a substantial profit even during the period of low metals prices in the late 1920s. Production was halted at the mine in 1930 but development continued. The Sidney Leasing Company continued intermittent production at the mine throughout the 1930s. In 1942, the Sidney Mining Company resumed operation of the mine. Production at the mine was aided by the construction of a 50-ton mill that began operating in 1944. The Sidney Mining Company continued production at the mine until the early 1960s. The mine was operated or explored by several lessees through the 1980s (Mitchell 1996).

Notes:
Blank cells indicate that there was most likely no mill located on site, and ores were probably shipped elsewhere for milling. No records were found identifying the mill to which the ores were shipped. Estimated tailings produced by each mine were not necessarily disposed of within the reach where the ores were mined.
Source: Stratus 1999 (unless other noted).

Table 2.1-2
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Amy-Matchless Mill	PineCrkSeg03	1923 - 1928 1935 - 1951	Amy-Matchless Mining & Milling Company, Lookout Mountain Mining & Milling Company,[a] Lynch-Pine Creek Mining Company	Prior to 1923, ores from the Amy-Matchless Mine were shipped off site for milling or were hand jigged on site. In 1923, the Amy-Matchless Mining & Milling Company built a concentration mill on the east side of Pine Creek. The mill was operated by the Lookout Mountain Mining & Milling Company in 1928 and was then closed until it was remodeled in 1935. The mill saw little activity after the remodeling until 1943, when it was used to treat ore from the Little Pittsburgh, which lost its mill to fire. The Lynch-Pine Creek Mining Company purchased the mine and mill in 1944 and used the mill to treat ore from the Nabob Mine. The mill was abandoned by 1951, and a cleanup was conducted in 1956 (Quivik 1999). The mill was destroyed by fire in July 1994 (Mitchell 1996).
Coeur d'Alene Antimony Mill	PineCrkSeg03	1915 - 1919	Coeur d'Alene Antimony Mining Company	The Coeur d'Alene Antimony Mining Company completed the construction of a new mill in 1915. A flotation unit was installed at the mill in 1918 but unfavorable market prices forced closure of the operation in 1919 (Quivik 1999).
Constitution Mill	PineCrkSeg01	1917 - 1955	Constitution Mining & Milling, Spokane-Idaho Mining Company, undetermined lessees	The Constitution Mining & Milling Company built a 100-ton gravity flotation mill on East Fork Pine Creek in 1917. The mill proved ineffective in separating the complex mixture of lead and zinc that was predominant in the Pine Creek Watershed. In 1924, the company installed new separating process equipment. Production at the mine was suspended and the mill closed about 1930. The mill was reopened in 1941 by the Spokane-Idaho Mining Company. In 1944, the company changed its milling practice to produce high-grade lead concentrate as well as zinc-lead concentrate. Between 1953 and 1955, ore was treated at the mill by lessees (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Douglas Mill	PineCrkSeg01	1943 - 1955	Small Leasing Company, Douglas Leasing Company, Spokane-Idaho Mining Company	Prior to 1943, ore from the Douglas Mine was shipped off site to a variety of mills for separation. In 1943, the Small Leasing Company built a 100-ton flotation plant at the Douglas Mine. The Douglas Leasing Company operated the mill in 1948; however, it is unclear whether the mill operated after that time, as there is some evidence that ore from the Douglas Mine was milled at the Constitution Mill. A cleanup of the mill was completed in 1956 (Quivik 1999).
Highland-Surprise Mill	PineCrkSeg01	1907 - 1927 1941 - 1955	Highland-Surprise Mining Company	The Surprise Mill began operation in October 1907. The mill operated intermittently until the company's merger with the owners of the Highland Chief Property in 1912. It was at this time that the mine and mill were renamed Highland-Surprise. The mill was enlarged in 1916 and flotation cells were installed to improve separation efficiency. The mill continued to operate until about 1917. In 1925, the mill was completely remodeled to treat ore by differential flotation. The mill then operated sporadically until its closure in 1927. A new 100-ton flotation mill was constructed in 1941. In 1948, mill capacity was increased to 300 tons per day. The mill was closed in 1955 and a cleanup was conducted in 1956. The mill was scrapped in 1962 (Quivik 1999).
Liberal King Mill	PineCrkSeg03	1944 - 1957	Sunset Minerals, Inc., undetermined lessees.	Although the Liberal King Mining Company was incorporated on June 12, 1928, a mill was not constructed on the property until 1944. Sunset Minerals, Inc., obtained a lease on the property and constructed a flotation plant around the same time. Sunset later purchased the property and operated the mill through 1956. Lessees operated the property through 1957, and a cleanup of the mill was completed in 1962 (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Little Pittsburg Mill	PineCrkSeg01	1930 - 1943 1943 - 1952	Pine Creek Lead-Zinc Company, Denver Development Company,[a] Mascot Mines, Inc.[a]	The newly organized Colonial Mining & Milling Company began construction of a 250-ton concentrator mill on Denver Creek in 1915. There is no record of the mill's completion or operation. In 1929, the Pine Creek Lead-Zinc Company took possession of the property and began construction of a 250-ton fine-grinding flotation concentrator. This mill was completed in 1930 but did not treat any ore for the next decade. The property was leased to the Denver Development Company in 1942, and the mill was used to treat ore until 1943, when it was destroyed by fire. A new 100-ton flotation mill was built in its place and used to treat ore until Denver's lease ended in 1949. Mascot Mines, Inc., operated the mill during 1952 (Quivik 1999).
Nabob Mill	PineCrkSeg01	1919 - 1924 1946 - 1957	Nabob Consolidated Mining Company, Nabob Silver-Lead Company	The Nabob Consolidated Mining Company planned the construction of a 150-ton mill in 1918, after the discovery of a good grade of lead-zinc ore. The mill was built on the lower stretches of Nabob Creek above the confluence with Pine Creek. The mill operated intermittently through the early 1920s, until it was destroyed by fire in 1924. Although the mine continued to be developed after this time, ore was shipped off site for processing. In 1945, the Nabob Silver-Lead Company began construction of a new 250-ton flotation mill, which operated through 1957 and was then closed because of low metals prices. The mill was rehabilitated in 1975 by Intermountain (Quivik 1999).
Sidney Mill (Denver Creek)	PineCrkSeg01	1944 - 1945	Sidney Mining Company	Ore from the Sidney Mine was not processed on site until 1944, when the Sidney Mining Company began treating its own ore in a new 50-ton flotation mill (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Sidney Mill (Red Cloud Creek)	PineCrkSeg01	1945 - 1961	Sidney Mining Company	In 1945, the Sidney Mining Company began erecting a new 250-ton selective flotation plant on Red Cloud Creek. The new mill was operated intermittently until about 1957. A cleanup of the mill was completed in 1962 (Quivik 1999).

[a]Leased to this company.
Source: Quivik 1999.

Table 2.2-1
Summary of Aquifer Parameters of the Smelterville Flats-Bunker Hill Upper Aquifer

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Vertical Hydraulic Conductivity (ft/day)	Transmissivity 2 (ft /day)	Storativity (unitless)	Effective Porosity
Upper Aquifer	500 - 10,790	0.0025[a]	10,002-216,852	0.0015-0.09	23.6-29.0

[a] Based on one test conducted on a sample of upper aquifer alluvium from borehole GR-26U (see Part 1, Figure 3.2-1) at 13.5 feet below ground surface. No units given in original source document.

Source: MFG (1992)

Table 2.3.1-1
Summary of Discharge Data From Project Database
Segments PineCrkSeg01 to 03

Segment Name	Site Location		Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
PineCrkSeg01	PC	306	URS, USGS	3	11/13/97	05/23/99	0.801	63	cfs
PineCrkSeg01	PC	307	IDEQ, URS, USGS	43	10/29/93	05/15/98	0.54	38.1	cfs
PineCrkSeg01	PC	308	IDEQ, URS, USGS	36	10/29/93	05/15/98	0	2	cfs
PineCrkSeg01	PC	309	URS	2	11/12/97	05/15/98	2.7	13.8	cfs
PineCrkSeg01	PC	310	URS	1	11/12/97	11/12/97	0.163	0.163	cfs
PineCrkSeg01	PC	312	URS	2	11/11/97	05/14/98	15.3	70.6	cfs
PineCrkSeg01	PC	322	URS	1	05/15/98	05/15/98	7.14	7.14	cfs
PineCrkSeg01	PC	323	URS	1	05/15/98	05/15/98	0.88	0.88	cfs
PineCrkSeg01	PC	324	URS	1	05/17/98	05/17/98	0.27	0.27	cfs
PineCrkSeg01	PC	325	URS	1	05/17/98	05/17/98	0.135	0.135	cfs
PineCrkSeg01	PC	326	URS	1	05/18/98	05/18/98	0.07	0.07	cfs
PineCrkSeg01	PC	328	URS	1	05/18/98	05/18/98	0	0	cfs
PineCrkSeg01	PC	338	URS	1	05/15/98	05/15/98	43.7	43.7	cfs
PineCrkSeg01	PC	360	URS	1	05/15/98	05/15/98	72.5	72.5	cfs
PineCrkSeg02	PC	311	URS, USGS	3	11/12/97	05/23/99	19.9	412	cfs
PineCrkSeg03	PC	100	URS	1	11/16/98	11/16/98	295	295	cfs
PineCrkSeg03	PC	303	USGS	1	08/14/97	08/14/97	23.1	23.1	cfs
PineCrkSeg03	PC	305	EPAREG10, IDEQ, MFG, USGS	43	05/14/91	02/04/97	4.58	2030	cfs
PineCrkSeg03	PC	313	IDEQ, URS, USGS	9	04/24/97	11/16/98	9.33	1570	cfs
PineCrkSeg03	PC	314	URS	2	11/11/97	05/14/98	10.6	11.9	cfs
PineCrkSeg03	PC	315	URS, USGS	3	11/04/97	05/25/99	60	1380	cfs
PineCrkSeg03	PC	339	IDEQ, URS, USGS	24	05/16/98	08/31/99	5	1340	cfs

Table 2.3.2-1
Estimated Recurrence Intervals, Pine Creek at Mouth

Recurrence Interval (Years)	Flood Insurance Study Pine Creek at Mouth Estimated Peak Flow (cfs)
2	not available
5	not available
10	3,885
25	not available
50	8,525
100	11,380

Table 2.3.2-2
Precipitation Summary and Discharge Comparison for Water Year 1999
Kellogg, Idaho
NOAA Cooperative Station 104831

Climate Indicators	Monthly Totals												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Total Precipitaiton (in)	1.4	7.5	5.3	4.6	5.7	5.1	1.7	1.5	2.7	0.5	1.3	0.4	37.8
Total Snowfall (in)	0.0	0.8	11.0	5.2	13.1	5.1	0.3	0.0	0.0	0.0	0.0	0.0	35.5
Average Precipitation for Period of Record (in)	2.7	3.8	3.9	3.7	2.8	2.9	2.4	2.5	2.2	1.0	1.1	1.7	30.8
Average Snowfall for Period of Record (in)	0.3	5.0	14.1	18.5	10.1	5.6	0.7	0.0	0.0	0.0	0.0	0.0	54.3
Mean Monthly Discharge (cfs) (Pine Creek at Amy Gulch)	13.6	60.7	167.7	213.8	178.2	326.5	367.2	542.1	375.9	75.2	29.4	17.7	197.4

Note:
cfs - cubic feet per second

3.0 SEDIMENT TRANSPORT PROCESSES

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movements incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing provides exposed soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. For purposes of this discussion, sediment yield will be referred to in units of tons per square mile per year. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling sliding or hopping on the channel bed (Dunne and Leopold 1978).

All sediment motion downstream is dictated by the shear and gravitational forces acting at a given time and place within the channel. For sediment transport purposes, gravitational forces are essentially constant. Shear forces, however, are dynamic through space and time and are dependent upon the location, depth of water, and slope of the water surface. Sediment transport occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et. al. 1992)

Sediment derived in Pine Creek is transported to the South Fork Coeur d'Alene River. Likely sediment sources in Pine Creek include are mine wastes, rock debris situated adjacent to channels, mobilization of channel bed sediment, and bank erosion. Based on USGS sediment transport and stream discharge data, approximately 2,900 tons of sediment was transported past the USGS gage station on Pine Creek during water year 1999. In this discussion, the available information and analyses, and likely sources are described.

3.1 AVAILABLE INFORMATION

One year of sediment transport gaging data is available for Pine Creek. The USGS installed a stream gaging station (Pine Creek below Amy Gulch near Pinehurst, number 12413445) and began reporting hydrologic data for water year 1999 (October 1, 1998 through September 31, 1999) (USGS 2000a). Associated with this gage, the USGS established suspended and bedload sampling locations. To date, data from eight suspended load and six bedload sampling events are available. The suspended load data were further divided into sand and fines fractions. The suspended and bedload sampling events were completed over a range of stream discharges to establish a rating curve relating sediment discharge to stream discharge. In addition, sampling was completed on both the rising and falling limbs of high water events to examine the transport during these differing conditions. Instantaneous stream discharge was recorded at the time of sampling for use in rating curve development.

Mean daily discharge estimates prior to 1999 have been calculated, as outlined in Section 2.3. These estimates were developed based on relationships between the discharge patterns in Pine Creek as compared to Placer Creek for which discharge data prior to 1999 has also been collected.

In addition to the gaging data, historical and current aerial photography is available. For Pine Creek, 1998 photographs by URS Greiner, Inc., and CH2M HILL, Inc. (URSG and CH2M HILL 1999) and 1991 photographs by U.S. Department of Agriculture (USDA) (USDA 1991) were reviewed.

3.2 ANALYSES

3.2.1 USGS Sediment Gaging Data

The USGS sediment transport data from the station at on Pine Creek were analyzed in general accordance with the Army Corps of Engineers (USACE) guidance manual for sedimentation investigation (USACE 1989). Sediment rating curves were developed by relating measured stream discharge to measured sediment discharge. These curves were integrated with the stream discharge for water year 1999, and estimates of historical stream discharge, to produce estimates of annual sediment yield for the Pine Creek. These sediment transport data were further examined to delineate threshold discharges where different particle size classes become mobil

The USGS sediment discharge station on Pine Creek is located approximately 3 miles upstream of the mouth. As such, these data are expected to be representative of sediment discharge for most of the Pine Creek Watershed.

The suspended sediment data for the station on Pine Creek are presented on Figure 3.2-1, with rating curves established for the sand fraction, and the fine fraction. The stream discharge presented is the instantaneous discharge noted at the time of sampling. The correlation analysis used to establish the curves is a power function that calculates the least squares fit through the points. The grain size break between sand and fines is 63 microns.

The relationships indicated on Figure 3.2-1 were integrated with the mean daily discharge data from USGS gage 12413445, Pine Creek near Pinehurst (USGS 2000b), to obtain mean daily suspended sediment discharge for water year 1999. Like the original data, the sand and fines fractions were calculated separately and summed to estimate the total suspended sediment discharge. Cumulative sediment discharge for water year 1999 year was calculated by summing the mean daily sediment discharges. The results are presented in Figures 3.2-2 through 3.2-4. With a drainage area of approximately 77 square miles, the total suspended sediment yield for the Pine Creek Watershed for water year 1999 was approximately 12 tons per year per square mile. Of that, approximately 7 tons was sand and 5 tons was fines. A total of approximately 900 tons of suspended sediment was transported past the Pine Creek gage in water year 1999.

A similar analysis was completed for the bedload sediment data. The USGS provisional report titled *Sediment Transport in the Coeur d'Alene River Basin of Northern Idaho* (USGS 2000c) presents the rating curves and regression relationship for bedload transport at the Enaville gage. As with the suspended sediment data, the regression relationship for bedload was integrated with the mean daily discharge hydrograph to obtain daily and cumulative bedload discharge for water year 1999. These results are presented in Figure 3.2-5. Based on the USGS data, annual bedload sediment yield was approximately 26 tons per year per square mile for Pine Creek in water year 1999 for a total of about 2,000 tons.

Summing the total suspended load and bedload sediment gives the total sediment yield for the Pine Creek Watershed for water year 1999 as approximately 37 tons per square mile, or a total of 2,900 tons. Water year 1999 appears to be typical from a water and snow budget perspective as discussed in Section 2.3; however sediment yields can vary significantly from year to year based on hydrologic conditions, sediment inputs, changing land use, and other conditions.

As indicated by the USGS data, the majority of sediment transport occurs during high flow events. Much larger discharge events are likely in the Pine Creek than were observed during

water year 1999. During larger events, much more additional sediment load should be expected. Peak discharges predicted by the Flood Insurance Study, for the mouth of Pine Creek are 3,885 cfs for a 10-year event and 11,380 cfs for a 100-year event (FIA 1979).

Review of Figures 3.2-2 through 3.2-5 indicates the majority of sediment transport occurred during discrete periods with approximate dates of December 1 to 4, December 29 to January 2, January 14 to 23, February 24 to March 4, March 23 to 27, April 19 to 27, and May 19 to June 6. High temperatures, rainfall, and snowmelt caused large stream discharges during these periods, which is discussed in Section 2.3. These high stream discharges mobilized and transported the vast majority of the sediment yield for water year 1999. Similar high sediment transport rates would be expected on a seasonal basis, as snowmelt in the upper watershed mobilizes and transports sediment through the system.

To estimate sediment transport in years before water year 1999, the estimated discharge based on Placer Creek data, described in Section 2.3, were integrated with the sediment transport relationships developed for Pine Creek in 1999. The results are presented in Table 3.2-1. As described in Section 2.3, there is a 40 to 60 percent variation in measured verses estimated discharge that would likely have a similar impact on sediment transport. In addition, extrapolation of the rating curves to stream discharges greater than discharges that were used to develop the rating curved needed to be employed. Nevertheless, a wide range of sediment transport quantities is indicated. In this type of analysis, the quantity of sediment is directly correlated to the magnitude and duration of stream discharge. Years with high peak discharge and long duration will produce more sediment than years with low discharge and short duration. This information is presented in Figures 3.2-6 through 3.2-8. These figures present estimates of cumulative sediment transport (for fines, sand, and bedload, respectively) through time, for example water years 1991 to 1999. A wide range of sediment transport rates is estimated.

To identify potential thresholds of sediment transport based on the USGS data, calculated estimates of daily sediment discharge for sand, fines, and bedload were examined. For each daily estimate and size class, for water year 1999, the percentage of total annual sediment discharge was calculated. These values were plotted against stream discharge and percent of maximum daily discharge for water year 1999 (Figure 3.2-9). As would be expected, this figure indicates increasing sediment discharge with increasing stream discharge. For both suspended load (sand and fines) and bedload, rapid increases in sediment discharge occur at stream discharges at or above approximately 800 cfs for water year 1999. Although this analysis is based on a few measurements of sediment concentration, it provides guidance to discrete stream discharges where increased sediment transport may be expected.

Additionally, Figure 3.2-9 suggests that approximately 68 percent of the total annual sediment discharge in Pine Creek was bedload, 17 percent was sand, and 14 percent was fines.

3.2.2 Channel Classification

Channel classifications may provide a level of understanding and description of a channel behavior. Some channel classification systems require fieldwork and in-depth study, while others only require topographic map and aerial photograph interpretation. The level of information provided by a classification based solely on topographic map and aerial photograph interpretation is limited but does provide a basic framework for channel processes and conditions.

Rosgen (Rosgen and Silvey 1996) proposed a classification that delineates channel types based on plan-view morphology, cross-section morphology, channel sinuosity, channel slope, and bed features to provide a broad level delineation. Aerial photograph and topographic map interpretation can be used for this type of classification, Level 1. The Rosgen methodology builds from this broad classification when combined with more detailed information. The Rosgen Level 1 classification was used for this study to identify broad reach level channel morphologies.

Additional information on stream channel classifications available from the Idaho Division of Environmental Quality's Beneficial Use Reconnaissance Project (IDEQ/BURP) is currently under review and will be incorporated into the Draft RI report. IDEQ/BURP information is based on field surveys and offer greater resolution, for the limited areas surveyed, than available topographic maps and aerial photographs. Based on this information, some channel classifications presented in this report may change.

Electronic USGS 7 ½ minute quadrangle maps containing three dimensional topographic data were analyzed using AutoCAD Land development software. Plots of channel profile and slope were produced for PineCrkSeg01 and PineCrkSeg03, Figures 3.2-10 through 3.2-11. In general, the divisions between segments were established based on changes in channel type or other morphologic feature. As such, each segment contains one or two channel types. The channel type was determined based on channel slope and observation of aerial photographs from 1998. Further description of the aerial photographs and topographic maps, current and historical, is contained in a separate section.

Channel stationing was established from the confluence of Pine Creek with the South Fork at 100-foot stations upstream from the mouth for ease of locating specific features. This stationing

is indicated on Figures 3.2-10 through 3.2-12. This stationing is approximate and is intended for general locating of discussed areas, more detailed stationing and survey should be used for precise locating, and project construction.

In the portion of the Pine Creek Watershed that was evaluated, two Rosgen stream types occur, "B," and "C." The following paragraphs briefly summarize these two types of channel and the mapping effort of channel classification.

"B" stream types are moderately steep to gently sloped channels, 2 to 4 percent. Faults, joints, contacts often influence "B" type channels by restricting the development of wide floodplains. Stream erosion rates, aggregation and degradation rates are generally low. Lateral movement of "B" type channels is typically low. Rapids and scour pools are typical bed forms in type "B" channels.

"C" stream types generally are located in valleys constructed from alluvial deposition, with well-developed floodplains. Primary morphologic features of the "C" stream type are the sinuous low relief channel, and the well-developed floodplain built sediment derived from the river. Lateral migration, aggregation and degradation rates in "C" type channels are dependent on the stability of the banks, discharge and sediment supply from upstream. "C" type channels may be significantly altered by changes in bank stability, discharge, or sediment supply

The channel types within Pine Creek Watershed are identified on the topographic maps, Figures 3.2-10 and 3.2-11. Based on the topographic maps and sections, segment PineCrkSeg01 contains type "C" and type "B" channels. Segment PineCrkSeg03 contains only a type "C" channel.

IDEQ developed a Rosgen classification for a 100-meter reach of channel in PineCrkSeg01 under the BURP project (see Figures 3.2-11 and 3.2-12). This reach was selected to be representative of general conditions in that area of the watershed. The reach was classified as Rosgen type A in the BURP study (IDEQ 1998, 1999). The differences between the BURP classification and the results presented here are most likely due to differences in the methods used to classify the channel. This classification is based on maps, elevation profiles derived using a GIS-based analysis, and aerial photographs. The BURP classification is based on field observations and channel measurements. Both classifications are preliminary in nature and are presented here for baseline characterization purposes only. They are not intended for use in the design phase of remediation planning. Detailed, site-specific hydrologic studies may be needed to guide actual remedial design development.

3.2.3 Channel Descriptions

The 1998 set of aerial photographs by URS Greiner, Inc., and CH2M HILL, the 1991 set by USDA, and the topographic map and profile presented in Figures 3.2-10 through 3.2-12 were reviewed to further describe Pine Creek. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system.

3.2.3.1 Segment PineCrkSeg01 (Station 270+00 to 540+00)

Segment PineCrkSeg01 has approximately 28,000 feet (5.3 miles) of mapped channel, as indicated in Figure 3.2-10. Photographic coverage extended to station 540+00. Through this section, Pine Creek flows through a valley bottom typically 200 to 300 feet wide. In areas, the channel appears to be confined by hillslopes. Channel slope varies from 1 to 8 percent. In general, the valley bottom is unvegetated and consists of river gravel. Evidence of relict channels, and migration is abundant through this segment. Several cuts, mines and tailings deposits are situated adjacent to the channel within this segment. Likely sediment sources in this segment are apparently from the cuts, mines, tailings deposits, waste rock piles, lateral migration, and channel bed remobilization.

From station 270+00 to 338+00, Pine Creek flows through a valley bottom approximately 200 feet wide with few constraints on channel location. Channel slope is approximately 1 percent. Unvegetated gravel in a band 100 to 200 feet surrounding the active channel indicates frequent movement. Both the 1991 and 1998 aerial photographs indicate the gravel may have been reworked to construct a dike to constrain the channel on the southwest bank from approximate station 320+00 to 335+00. Likely sediment sources in this reach include channel bed remobilization, minor bank erosion, and lateral migration.

Pine Creek from Station 338+00 to 370+00 is constrained in location by steep valley walls, bridge abutments, and road embankments. Channel slope is approximately 1 to 2 percent. Several tributaries enter Pine Creek within this section that may contribute sediment to the system. At approximate station 338+00, a tributary channel enters Pine Creek. This tributary flows adjacent to and through the tailings dam and mine and millworks of Nabob Mine. This tributary is likely to contribute sediment to the system. Other likely sediment sources in this reach are channel bed remobilization, minor bank erosion and sediment from the tributary channels.

From station 370+00 to 414+00, the channel exhibits a meandering pattern with little or no vegetation on the banks. Channel slope is approximately 1 to 2 percent. From station 370+00 to 382+00, an exposed rock cut is located adjacent to the channel. Likely sediment sources in this reach are channel bed remobilization, bank erosion, lateral migration and sediment derived from the exposed rock cut.

Pine Creek from station 414+00 to 480+00 flows through a valley approximately 200 feet wide with a slope of approximately 2 percent. The channel displays a braided pattern with relict channels. Little or no vegetation in the braid zone indicated frequent sediment movement. Likely sediment sources in this reach are channel bed remobilization, minor bank erosion, and channel migration.

From station 480+00 to 540+00, the channel slope increases and becomes more confined by steep valley walls, minor meandering is still evident. Exposed rock debris is situated directly adjacent to the channel from the Constitution Mine from station 520+00 to 540+00. The likely sediment sources in this reach include exposed deposits surrounding the Constitution Mine, channel bed remobilization, and minor bank erosion.

3.2.3.2 Segment PineCrkSeg02 (Station 270+00 to 540+00)

Aerial photographs were not available for review of this segment. No slope profiles were developed.

3.2.3.3 Segment PineCrkSeg03 (Station 00+00 to 270)

Segment PineCrkSeg03 has approximately 27,000 feet (5.1 miles) of mapped channel, Figure 3.2-11. Channel slope ranges from 0.5 to 1.5 percent. Likely sediment sources in segment PineCrkSeg03 are channel bed remobilization, minor bank erosion, lateral migration and possibly rock debris piles adjacent to the stream. There have been removal actions at mines such as the Amy-Matchless, Liberal King, and Douglas, which may have a local effect on sediment movement in the channel.

From station 00+00 to 18+00, the channel slope is approximately 0.5 percent. The confluence with the South Fork has a braided pattern, and several channels may serve as the confluence depending on the stage. Likely sediment sources include channel bed remobilization and lateral migration.

Pine Creek from station 18+00 to 78+00 is confined in location by dikes adjacent to the I-90 embankment. Intermittently (at lower flows), surface water may be absent over this reach; water is not visible in the 1998 photographs in this reach. Likely sediment sources are channel bed remobilization and minor bank erosion.

From station 78+00 to 115+00, Pine Creek displays a braided pattern with little or no vegetation on the banks. The channel is located in different locations in the photographs reviewed indicating channel migration. Likely sediment sources in this reach are channel bed remobilization, bank erosion and channel migration.

Pine Creek from station 115+00 to 127+00 is constrained by dikes on both banks. Channel slope is approximately 0.5 percent. Lateral gravel bars are developed on both banks. Little or no vegetation exists on the gravel bars. Sediment sources in this reach include channel bed remobilization, and minor bank erosion.

From station 127+00 to 152+00, the channel slope is approximately 0.5 percent. The channel exhibits a braided pattern and occupies different locations in the 1991 and 1998 photographs. Little or no vegetation is visible on gravel bars surrounding the channel, indicating a mobile bed and channel migration. Likely sediment sources in this reach include channel bed remobilization and bank erosion.

From station 152+00 to 204+00, the channel is situated in a band of exposed gravel 100 to 200 feet wide. Pine Creek exhibits a braided pattern through this reach. Channel slope is approximately 0.5 percent. From station 152+00 to 158+00, an exposed rock hillslope around the Gold Eagle Mining Company is located near the channel. However, there is no apparent surface water connection visible in the photographs reviewed. Likely sediment sources in this reach include mines, tailings deposits, waste rock piles, channel bed remobilization, minor bank erosion, and lateral migration.

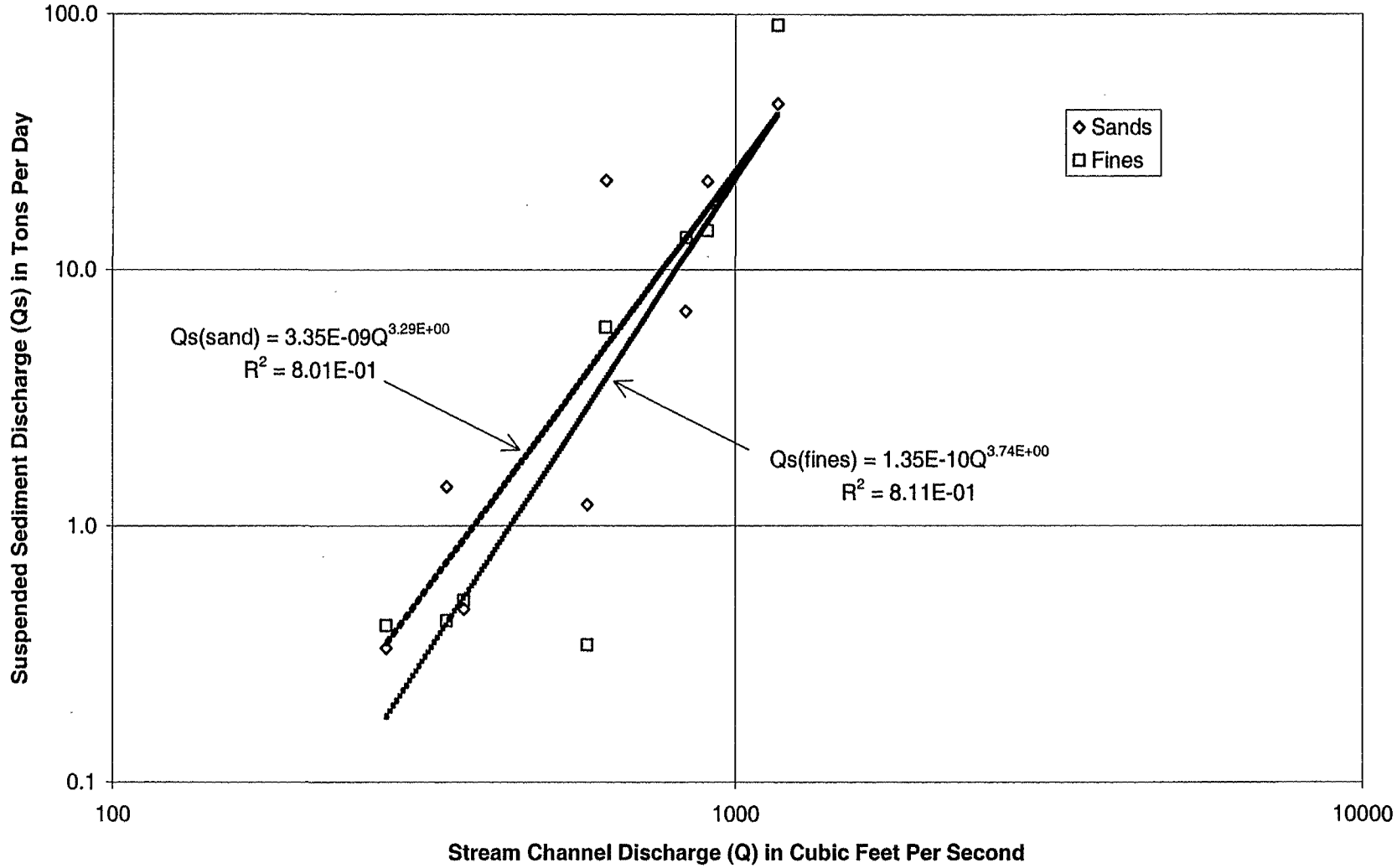
From station 204+00 to 249+00, Pine Creek displays a single thread channel with possible relict channels. The channel may be channelized and the floodplain reworked as indicated by roughened surface and linear appearance. Little or no vegetation surrounds the channel in this reach. From station 237+00 to 241+00, exposed rock debris from the Liberal King Mine extends from the hillslope to the valley bottom and Pine Creek. Likely sediment sources in this reach include the rock pile from the Liberal King Mine, channel bed remobilization, and minor bank erosion.

Pine Creek from station 249+00 to 260+00 is constrained in location by bridges and possible dikes. Relict channels and linear vegetation pattern on gravel bars through this reach indicate historical channel migration. Likely sediment sources in this reach include channel bed remobilization, minor bank erosion and lateral migration.

3.3 SUMMARY

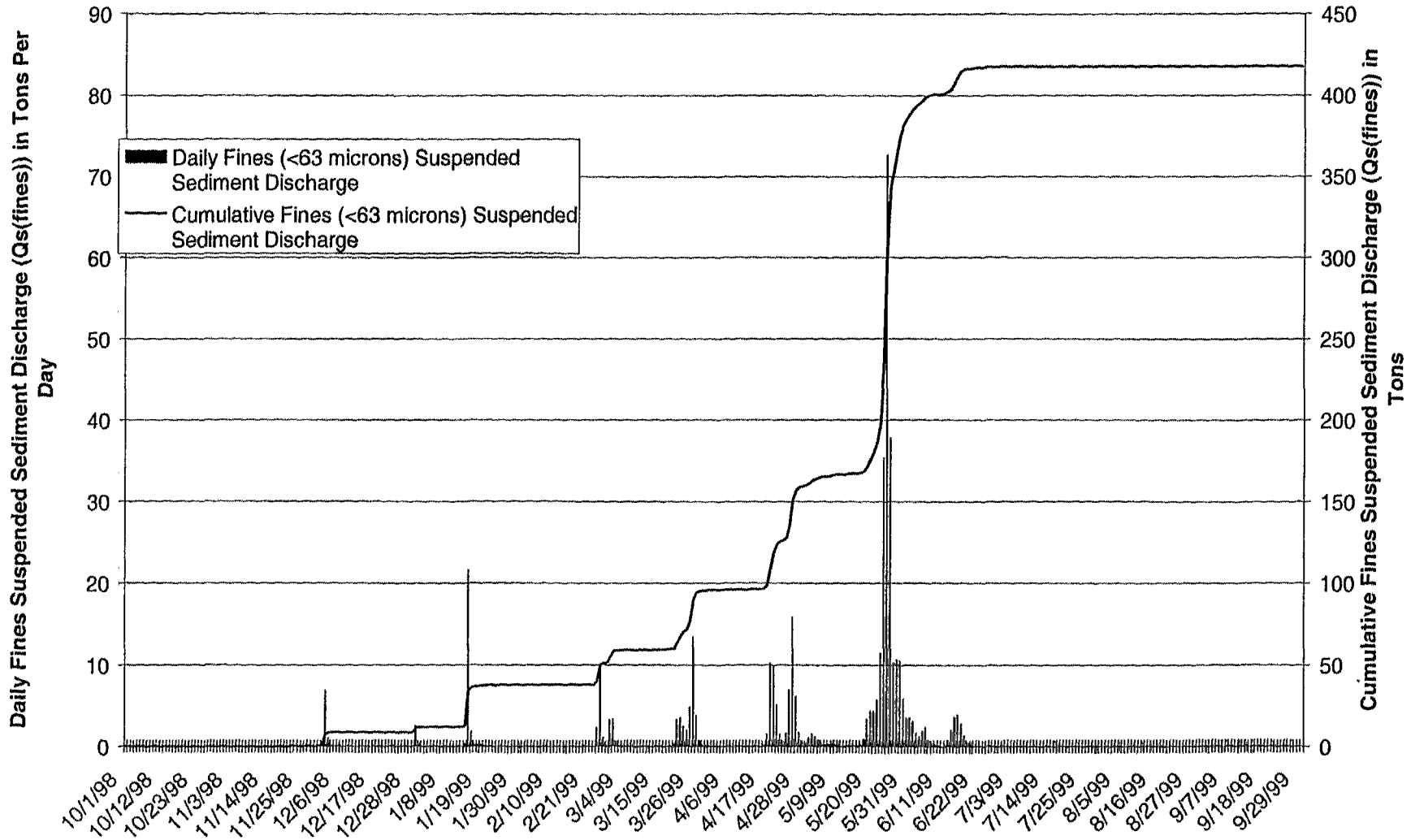
Based on the information discussed above, approximately 2,900 tons, or 37 tons per square mile, of sediment was transported in Pine Creek in water year 1999. Large fluctuations in sediment transport should be expected based on stream discharge. Extrapolation of discharge data from other watersheds in the vicinity of Pine Creek, indicate that significantly greater flows occur in Pine Creek. During larger discharges, much more sediment volume and larger particle sizes would be expected to be transported.

Suspended Sediment Rating Curves, Pine Creek near Pinehurst, Station 12413445, Suspended Sediment by Sand Break, Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 3.2-1

Fines Suspended Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Daily and Cumulative Totals, Water Year 1999



EPA REGION

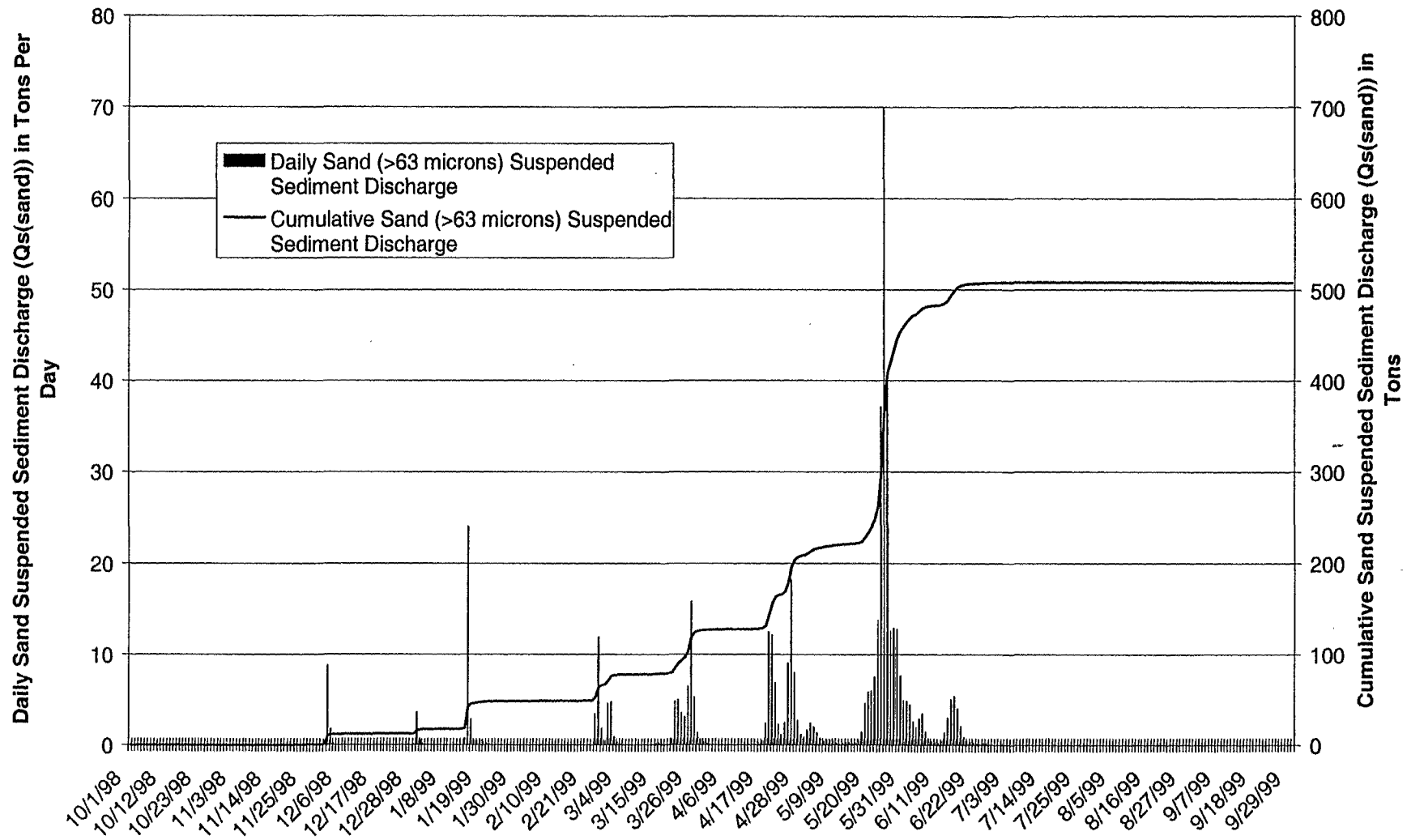
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-2

Sand Suspended Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Daily and Cumulative Totals, Water Year 1999



EPA REGION 10

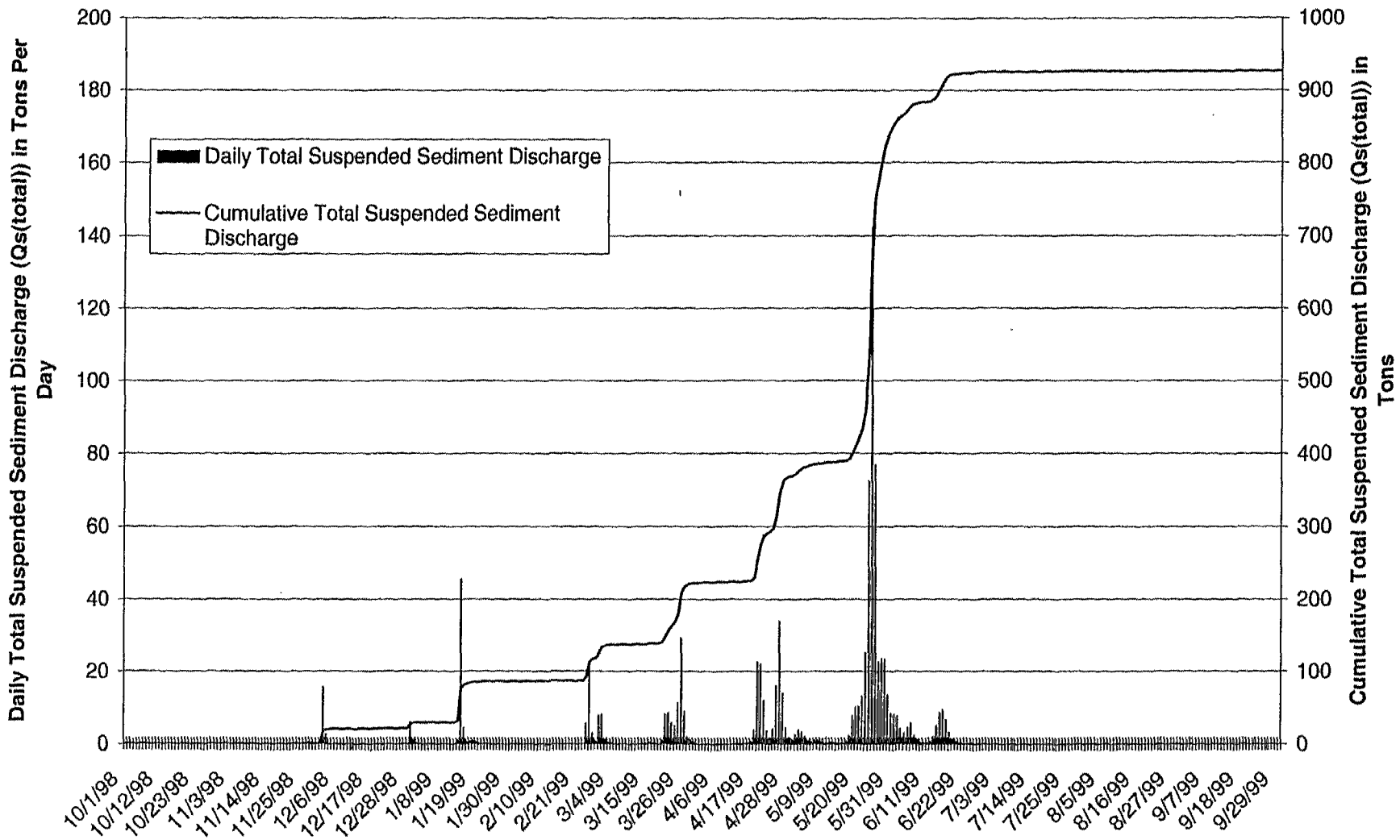
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-3

Total Suspended Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Daily and Cumulative Totals



EPA REGION 10

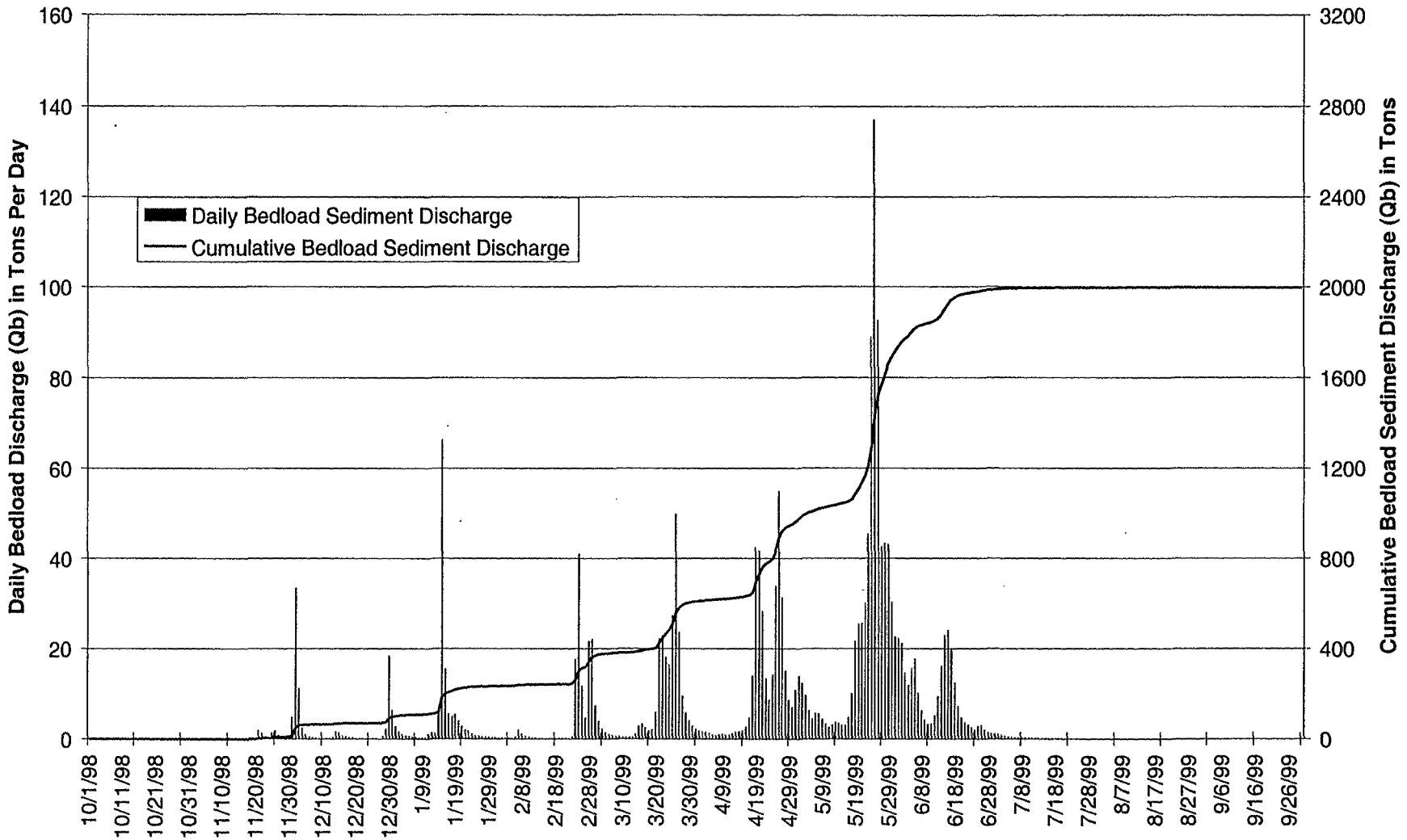
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-4

Bedload Sediment Discharge, Pine Creak near Pinehurst, Station 12413445, Water Year 1999



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

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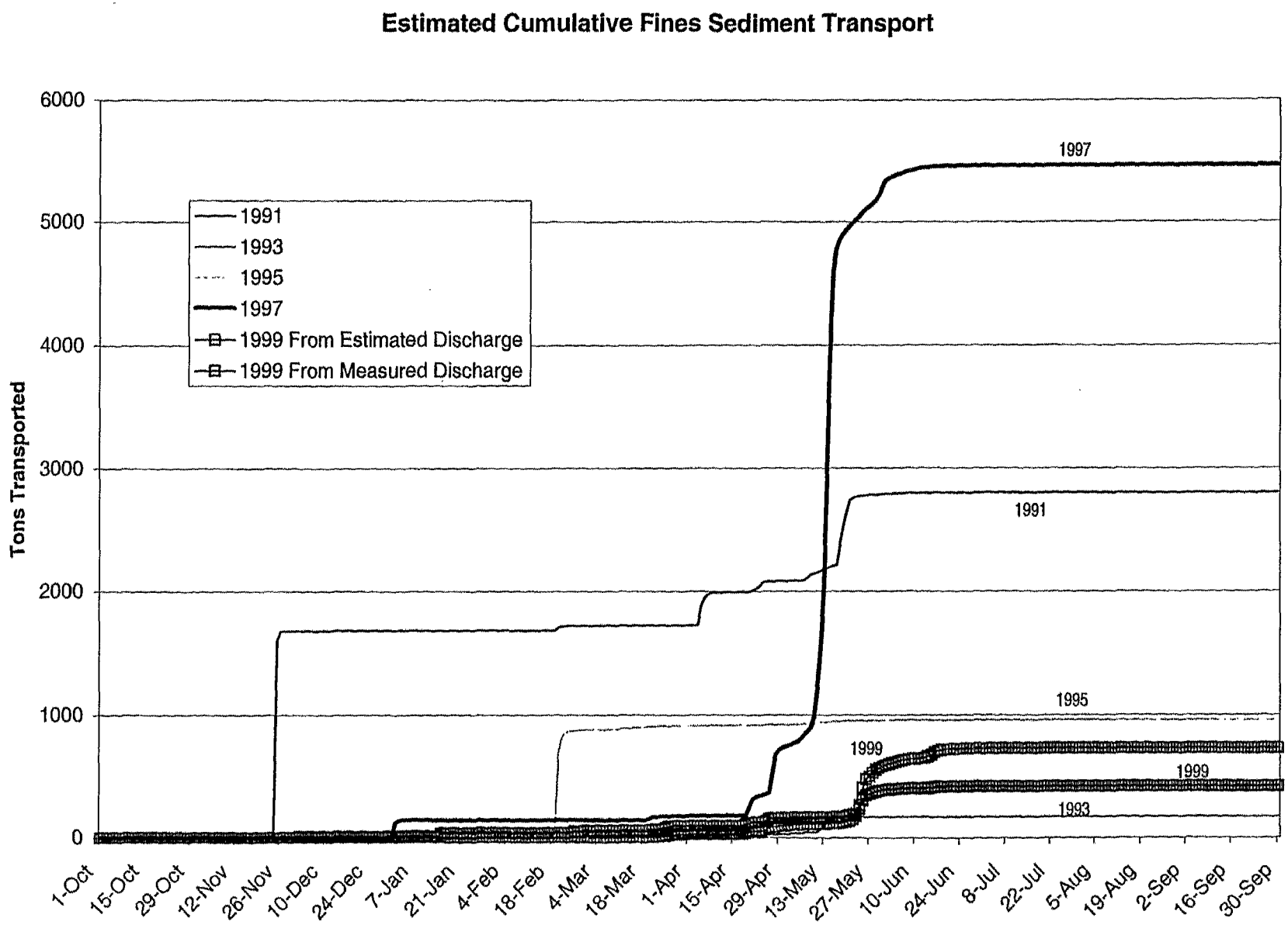
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-5



EPA REGION 8

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

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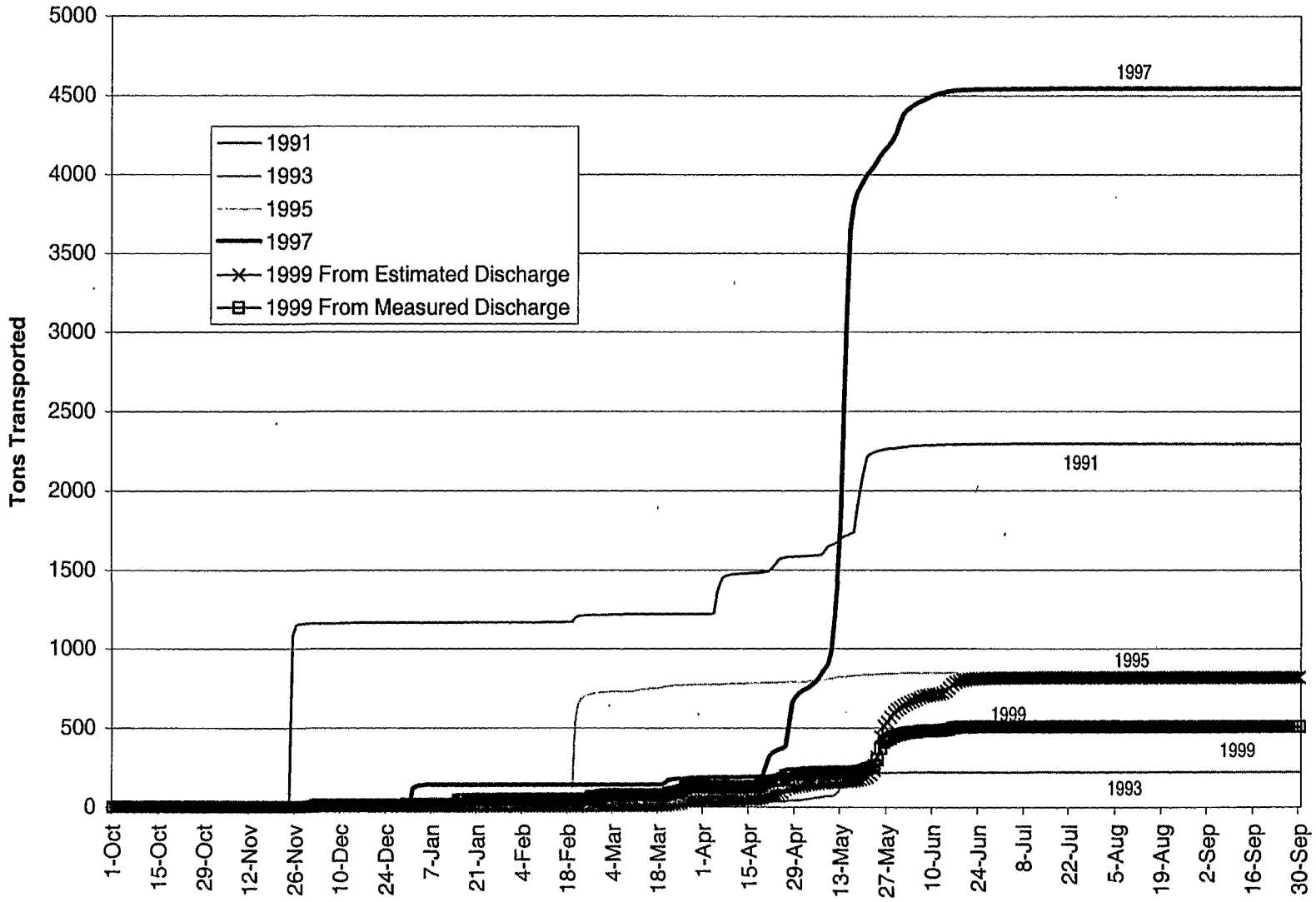
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-6

Estimated Cumulative Sand Sediment Transport, Pine Creek



EPA REGION 10

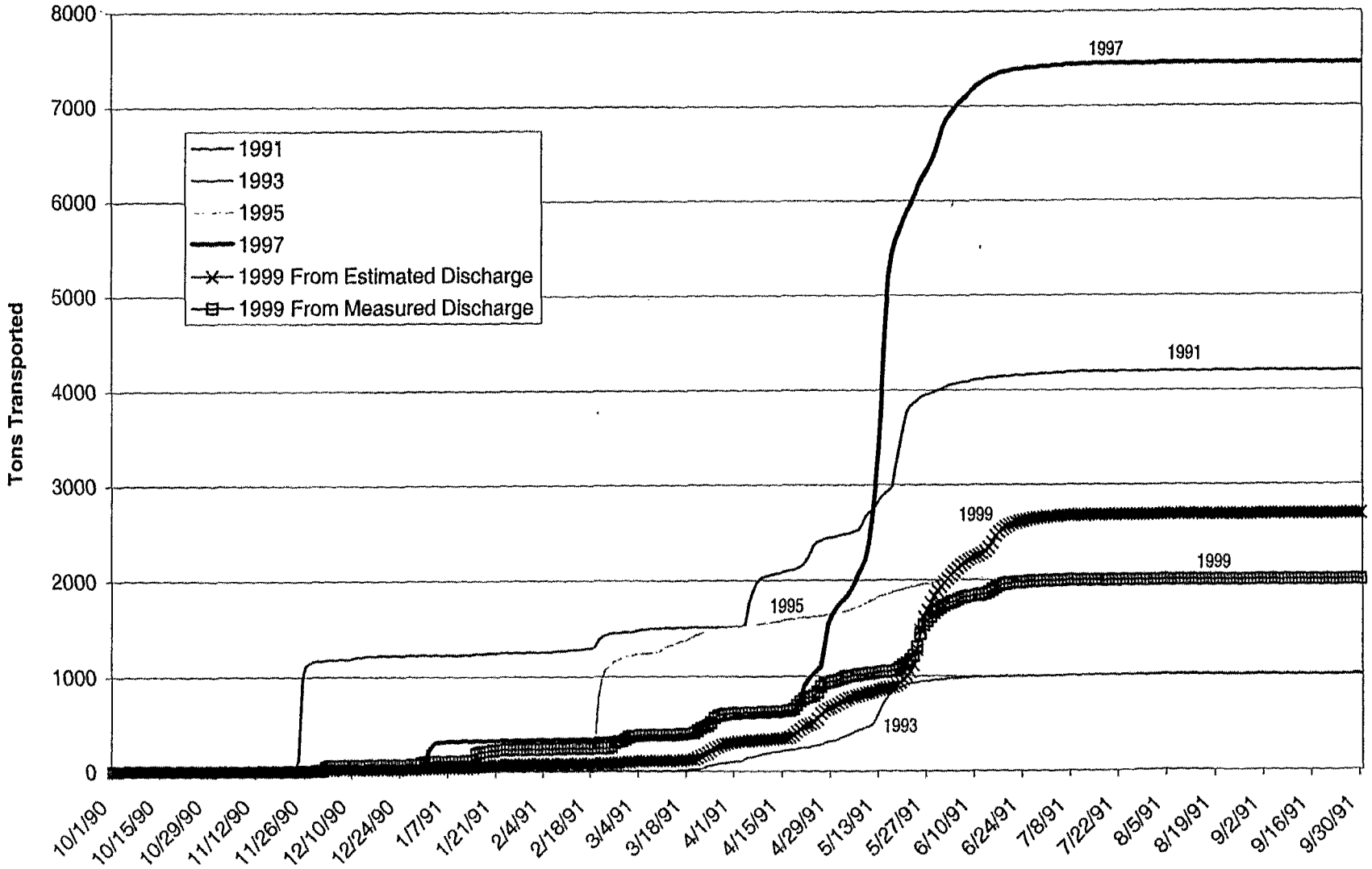
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-7

Estimated Cumulative Bedload Sediment Transport, Pine Creek



EPA REGION 8

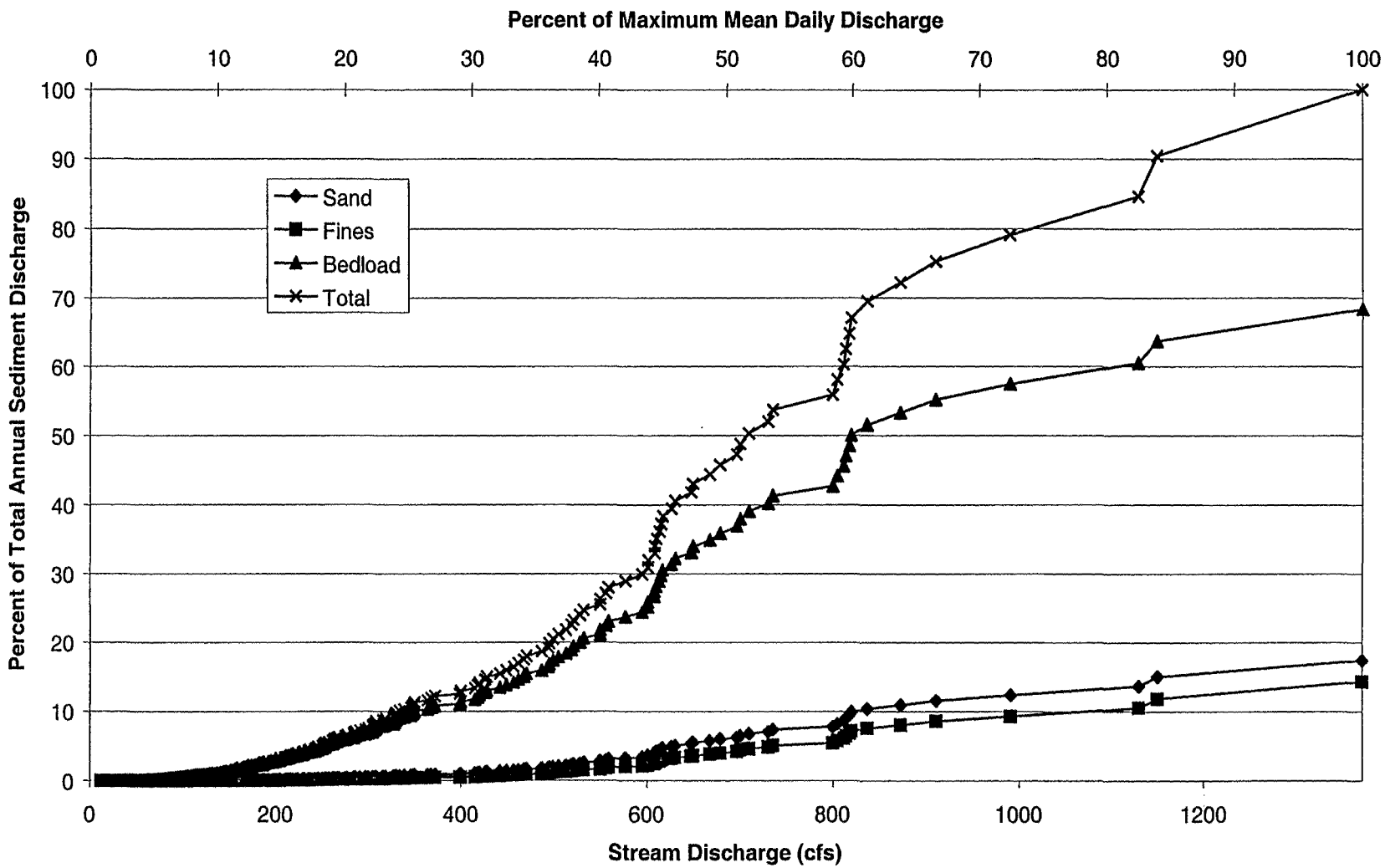
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-8

Pine Creek near Pinehurst, Percent of Total Annual Sediment Discharge Versus Stream Discharge, Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 3.2-9

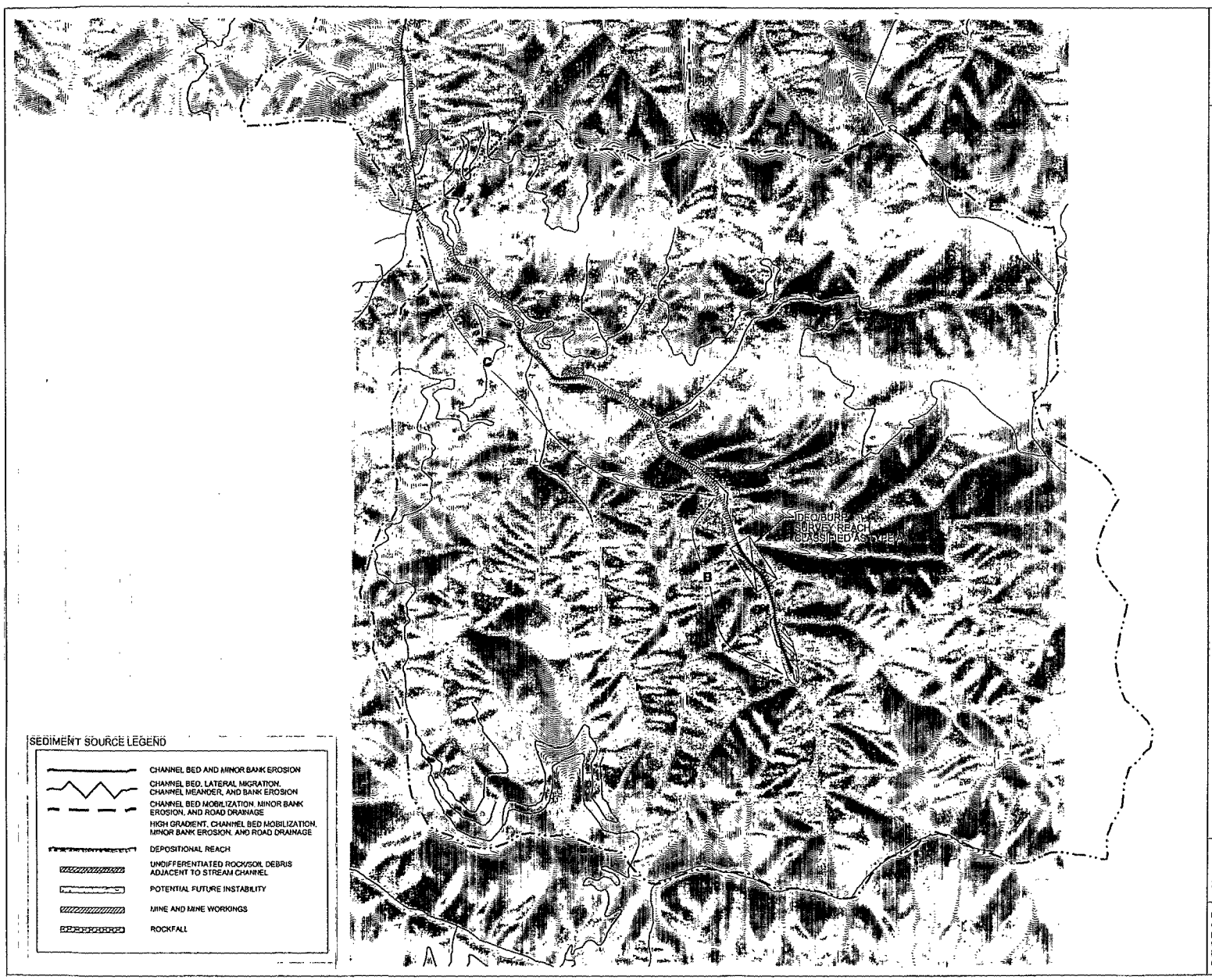
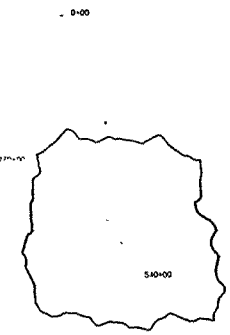


Figure 3.2-10
Pine Creek Segment 01 Site Plan



PINECRKSEG01

LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY. COPYRIGHT 1995. AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977. ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION

N W E S

0 4000 8000

Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

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07/26/2001

This map is based on Idaho State Plane Coordinates West Zone North American Datum 1983

Date of Plot July 26 2001

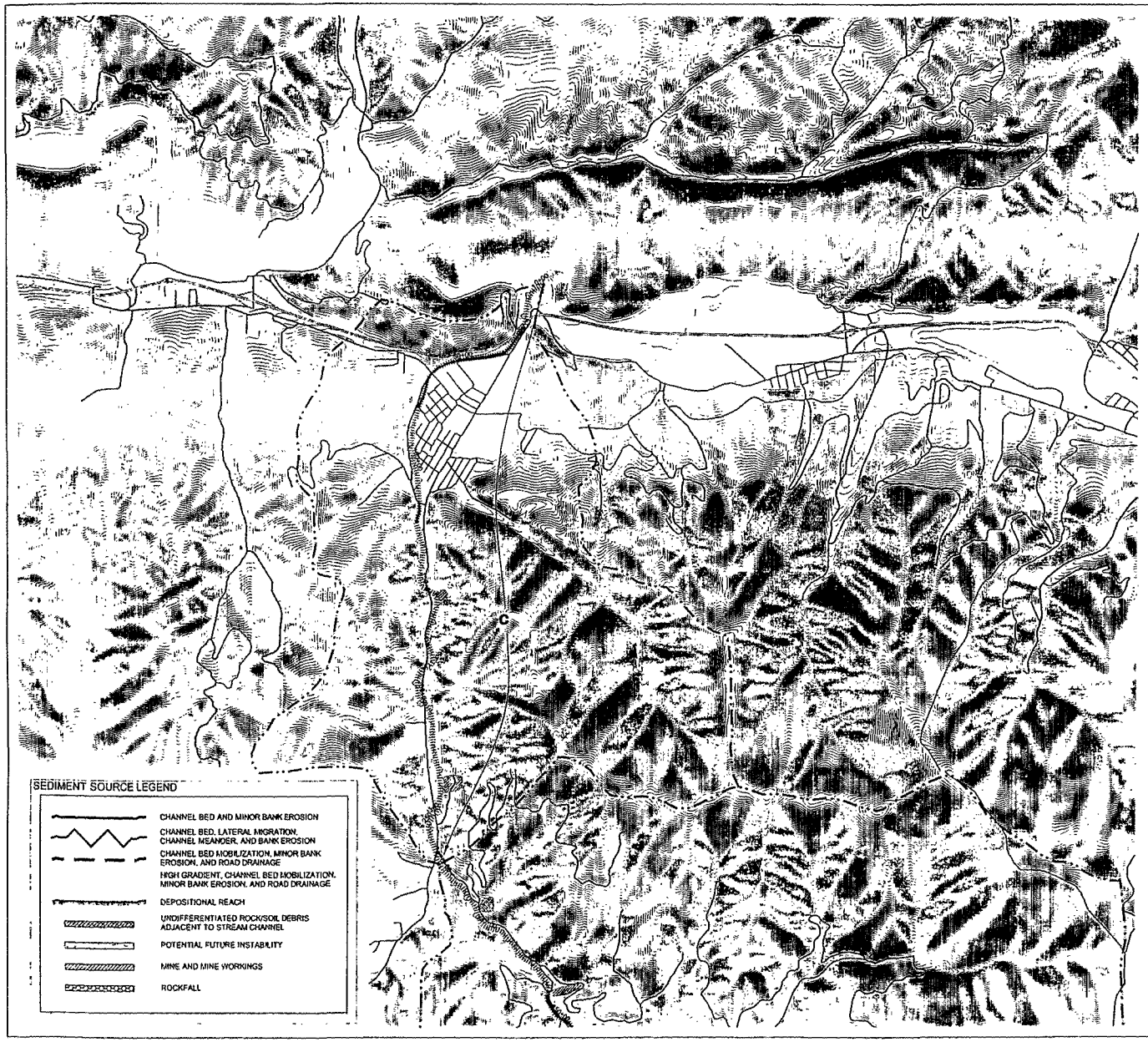

Figure 3.2-11
Pine Creek Segment 03 Site Plan

540+00

LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY. COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION

N W E S

0 4000 8000
Scale in Feet

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Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

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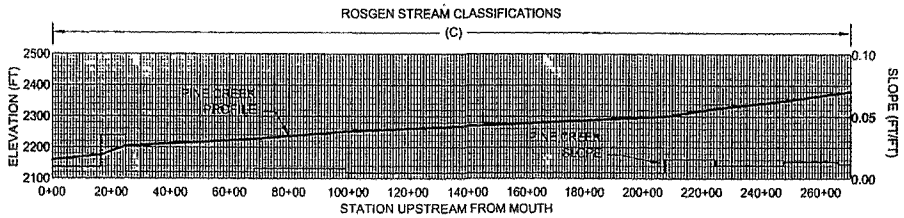
07/26/2001

This map is based on Idaho State Plane Coordinates West Zone North American Datum 1983

Date of Plot: July 26, 2001

PINECRKSEG03

ROSGEN STREAM CLASSIFICATIONS



PINECRKSEG01

ROSGEN STREAM CLASSIFICATIONS

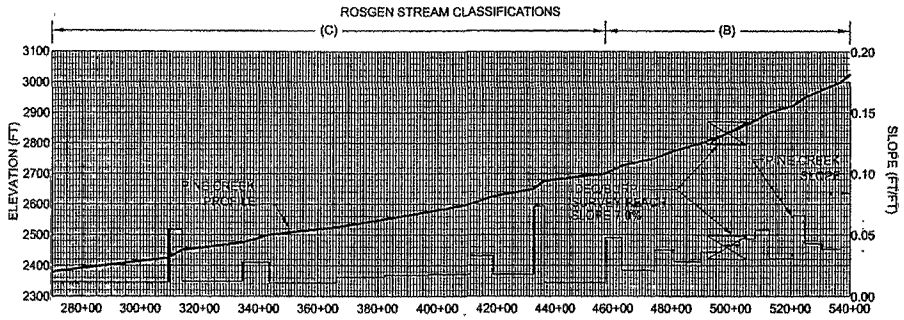
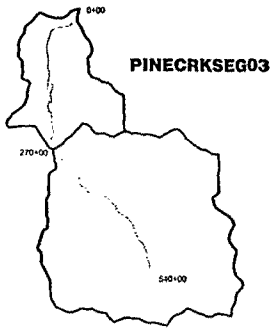


Figure 3.2-12
Pine Creek Segment 01 and 03 Section
Rosgen Stream Classifications



LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

Doc. Control: 4162500 0615.05 05e
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\Pine Creek\Pine_Section.dwg
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07/20/2000

Table 3.2-1
Historical Estimates of Sediment Transport in Pine Creek Based on Discharge Estimates Derived From Placer Creek and Sediment Transport Data From Pine Creek, Water Year 1999

Year	Sands (tons)	Fines (tons)	Bedload (tons)	Total (tons)
1991	2,294	2,799	4,206	5,093
1992	39	22	388	449
1993	220	170	1,015	1,406
1994	69	46	443	558
1995	847	958	2,043	3,848
1997	4,544	5,463	7,452	17,459
1999	508	418	1,997	2,923
Yearly Average of Sediment Transport				4,738

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the three segments of the Pine Creek watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels (Part 1, Section 5.1); and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x) and 100 times (100x) the screening level were identified and presented in the following data summary tables. The magnitudes of exceedence (10x and 100x) were arbitrarily selected to delineate areas of contamination. Metals identified in this evaluation are further evaluated in either the human health or ecological risk assessments (under separate cover).

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4. Data source references are included as Attachment 1. Chemical data collected in Pine Creek and used in this evaluation are presented at the end of this report. Data summary tables, including sampling location, data source reference, collection date, depth, and reported concentration, are included as Attachment 2. Screening level exceedences are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-7.

The nature and extent of contamination were evaluated by screening chemical results against applicable risk-based screening criteria and available background concentrations. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the feasibility study (FS).

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening

level (SL) to which the detected concentration is compared. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional baseline or background studies for soil, sediment, and surface water, and other guidance documents (e.g., Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1.

Source areas within Pine Creek are presented in Tables 4.1-1 through 4.1-3. These sites are based on source areas initially identified by the BLM (1999) and further refined during the RI/FS process. The tables include source area names, source area ID, source area acres, description, number of samples by matrix type, and metals exceeding 1x, 10x, and 100x the screening levels in surface soil, subsurface soil, sediment, groundwater, and surface water.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-7) are included in Tables 4.1-1 through 4.1-3; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Tables 4.1-1 through 4.1-3.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment PineCrkSeg01

4.1.1.1 Surface Soil

Seven surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Antimony, arsenic, copper, lead, and zinc were detected at concentrations in surface soil in excess of 10x the screening levels.

4.1.1.2 Subsurface Soil

Five subsurface soil samples were collected and analyzed for total metals. Lead and zinc exceeded 10x the screening levels at three sampling locations in this segment.

4.1.1.3 Sediment

Fifty-two sediment samples were collected and analyzed for total metals. Arsenic, cadmium, lead, and zinc were detected at concentrations in excess of 10x the screening levels for several sampling locations. The concentration of lead at two locations exceeded 100x the screening level.

4.1.1.4 Groundwater

Seven groundwater samples were collected and analyzed for total metals. Cadmium, copper, manganese, and zinc exceeded 10x the screening levels. The concentration of zinc at three locations exceeded 100x the screening level.

4.1.1.5 Surface Water

One hundred and thirty-one surface water samples were collected and analyzed for total metals in segment PineCrkSeg01. One to many samples showed antimony, cadmium, copper, iron, lead, manganese, and zinc at concentrations in excess of 10x the screening levels. Concentrations of copper, lead, and zinc exceeded 100x the screening levels.

One hundred and seventy-seven samples were collected and analyzed for dissolved metals in segment PineCrkSeg01. One to many samples throughout this segment showed concentrations of antimony, cadmium, copper, iron, lead, manganese, and zinc in excess of 10x the screening levels. Cadmium, copper, lead, manganese, and zinc were also detected in two to many samples in excess of 100x the screening level.

4.1.1.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg01 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-1.

Twenty-one of the 79 source areas in this segment were sampled. Many of the sampled source areas show concentrations of antimony, arsenic, cadmium, lead, manganese and zinc in excess of 10x the screening levels.

4.1.2 Segment PineCrkSeg02

4.1.2.1 Surface Water

Three surface water samples were collected and analyzed for total metals. Six surface water samples were collected and analyzed for dissolved metals. Total and dissolved metal concentrations in surface water were all less than 10x the screening level.

4.1.2.2 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg02 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-2. Thirty source areas are located in this segment. No samples were collected at these sites. No significant source areas were identified in this segment.

4.1.3 Segment PineCrkSeg03

4.1.3.1 Surface Soil

Nine surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Arsenic and lead were detected at concentrations in excess of 10x the screening levels.

4.1.3.2 Subsurface Soil

Six subsurface soil samples were collected and analyzed for total metals in segment PineCrkSeg03. Arsenic, cadmium, lead and zinc were detected at concentrations in excess of 10x the screening levels.

4.1.3.3 Sediment

Twenty-two sediment samples were collected and analyzed for total metals in segment PineCrkSeg03. The concentrations of lead at one location exceeded 10x the screening level.

4.1.3.4 Groundwater

Eight groundwater samples were collected and analyzed for total and dissolved metals. The total copper and zinc concentrations in two samples exceeded 10x the screening levels. These copper

concentrations also exceeded 100x the screening level. The dissolved cadmium concentration in one sample exceeded 10x the screening level.

4.1.3.5 Surface Water

One hundred and fifteen surface water samples were collected and analyzed for total metals. One hundred and twenty-one surface water samples were collected and analyzed for dissolved metals. Results for total metals indicate concentrations of copper, lead, and zinc in excess of 10x the screening level. Results for dissolved metals indicate cadmium, lead, and zinc concentrations greater than 10x the screening levels.

4.1.3.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg03 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-3.

Three of the 22 source areas in this segment were sampled. Concentrations greater than 10x the screening levels for arsenic, cadmium, lead and zinc were detected at the Amy-Matchless Millsite. These concentrations were detected in the surface and subsurface soil.

4.1.4 Adit and Seep Summary

Most adits and seeps with drainage that have been identified and sampled have flows under 1 cfs and relatively low concentrations of metals. However, very high concentrations of total zinc were measured in ten of the adits and four of the seeps identified in the Pine Creek watershed (Gearheart et al. 1999). A total of twenty-one adits and ten seeps were identified. Available adit and seep data for the Pine Creek watershed are summarized in Table 4.1.4-1. Discharge, average total zinc concentration, average total zinc mass loading, and associated source areas are listed. Zinc mass loading from the Sidney (Red Cloud), Nevada-Stewart, and Nabob 1300 Level adits and the Amy-Matchless seep were greater than 1 pound per day. Total zinc mass loading for all adits and seeps identified in the Pine Creek watershed is estimated to be approximately 15 pounds per day.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and Extent further discusses the use of the plotting discrete sampling events versus the probabilistic analysis of the mass loading data in Fate and Transport.

This section presents the discrete mass loading measurements made during several low- and high-flow sampling events. The events were selected to show variations in mass loading throughout the stream system relative to source areas. The events selected are not intended to represent all the available mass loading data. The locations sampled during each event are plotted on a map of the watershed (Figures 4.2-1 through 4.2-6). Each sampling location shows the cumulative mass loading of lead or zinc and the difference in mass lead from the next upstream location. The difference in mass load is indicated on the maps by the term "delta." The remainder of this section presents the indicator metal correlation and selected maps with a discussion of discrete sampling events on a watershed basis.

4.2.1 Indicator Metal Correlation

In Section 4.2 of the Canyon Creek Watershed Nature and Extent, the correlation of chemical concentrations for 8 chemicals of potential concern (COPCs) are evaluated for total lead and dissolved zinc. These two metals appear to be reasonable indicators of the other chemicals of potential concern. The following mass loading discussion is limited to total lead and dissolved zinc.

4.2.2 Pine Creek Watershed Mass Loading

Of the available sampling data, three sampling events were selected and mapped. Table 4.2-1 summarizes the sampling events, sampling locations and calculated mass loads for total lead and dissolved zinc. For consistency and comparison, the same sampling periods were selected as that used in Canyon and Ninemile Creeks. The low-flow events used were November 1997 (Figures 4.2-1 and 4.2-4) and November 1998 (Figures 4.2-2 and 4.2-5). The high flow event used was May 1998 (Figures 4.2-3 and 4.2-6). Data from these sampling events is summarized in Table 4.2-1. The following sections discuss observations made from plotting the low- and high-flow mass loading data.

4.2.2.1 Total Lead Mass Loading

Loading observations are as follows:

As shown on Figures 4.2-1, 4.2-2 and 4.2-3, total lead mass loading at low-flow is low. Mass loading of total lead did not exceed 1 pound per day. Under high-flow conditions lead loading did not exceed 1 pound per day except close to the mouth of Pine Creek. Sample location PC315 had a mass load of 2.5 pounds per day (May 1998). Side streams or tributaries do not appear to contribute substantial load to the main stream system.

4.2.2.2 Dissolved Zinc Mass Loading

Loading observations are as follows:

Under low-flow conditions, zinc loading increases between PC306 and PC312. Sample location PC307 (located in Highland Creek near the mouth) had a zinc load of 29 pounds per day (November 1997). This load may account for the difference in mass load of 34 pounds per day at location PC 312. Between location PC312 and the mouth of Pine Creek, the zinc load decreases. The differences in mass load ranged from -1 to -20 pounds per day.

Under high-flow conditions, zinc load increases from PC306 to PC360. Highland Creek adds 31 pounds per day to this increase. PC360 was measured several days prior to other sampling locations, so it is difficult to assess the overall load increase or delta. Between PC339 and the mouth of Pine Creek the load is variable. At PC313, zinc load decreases with a -30 pounds per day difference. At location PC315, closer to the mouth, the difference is -8 pounds per day. The decreases in load may indicate loss of water to the underlying aquifer.

Potential sources include the Constitution Mine Complex, Owl/Fred Mine and Douglas Mine Tailings along Pine Creek and above location PC338. On Highland Creek, the Antimony rock dump and Sidney mine among others could contribute the observed loading. Further downstream, general floodplain waste, the Denver Mine, the Pittsburgh Mine and the Hilarity Mine (mines in Denver Creek) are possible sources. Downstream of PC360, the Nabob Mine, and Denver Creek Tailings, Liberal King Tailings, Matchless Mine are possible sources of loading.

4.2.2.3 Groundwater Mass Loading

The mass loading data does not show a consistent pattern of losing or gaining stream reaches. It is likely that where flood plains are developed, there is an active exchange of metal load with groundwater. A review of groundwater data summarized in Section 4.1 indicates that metal concentrations in many locations exceed the 1 times (1x) screening level, but do not exceed the 10x or 100x screening levels.

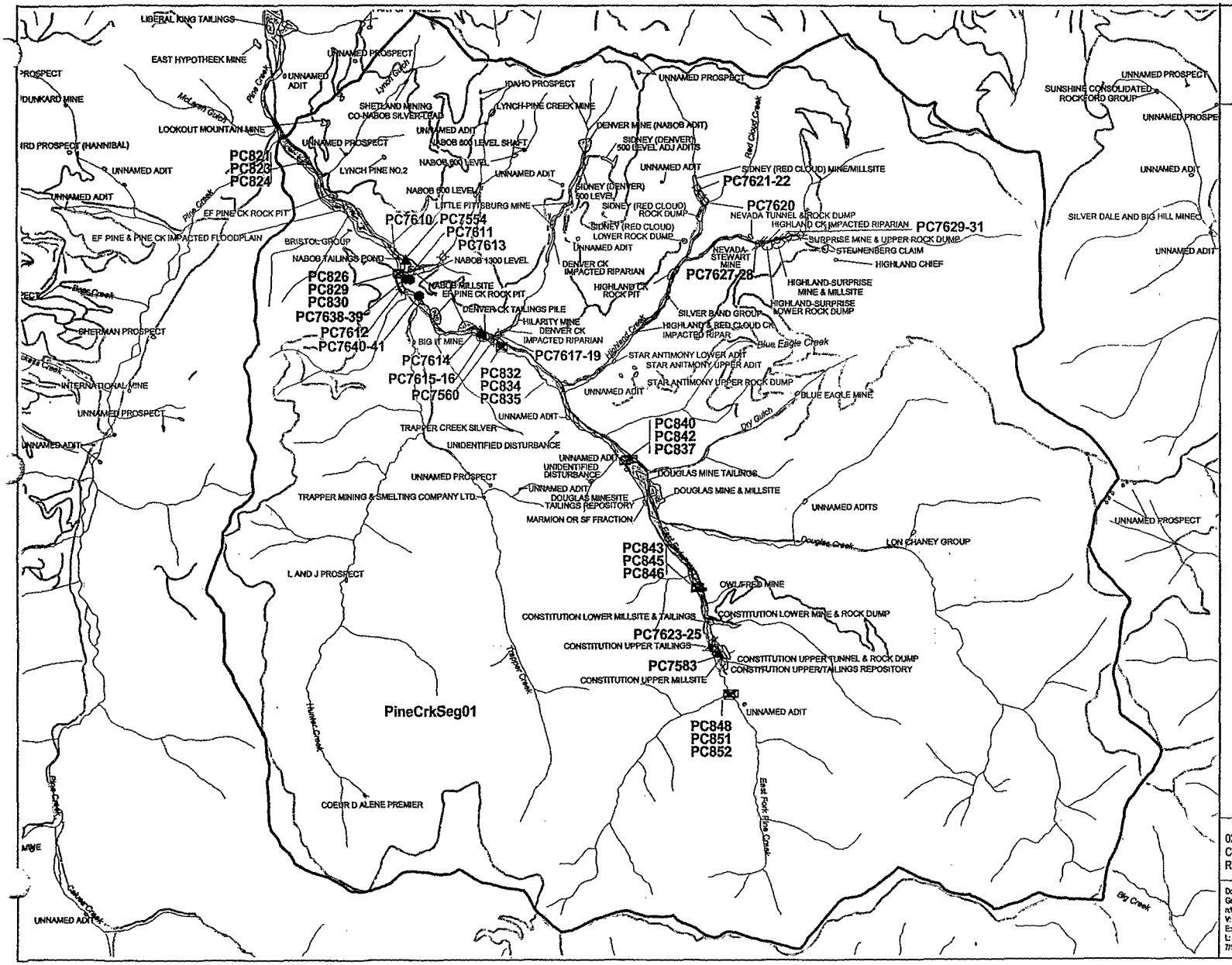

Figure 4.1-1
Pine Creek Segment PCSeg01 Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Ground Sampling Location
- Wetlands/Marsh Sampling Location
- Tailings Pile Sampling Location
- Seep Sampling Location
- River Sampling Location
- Test Pit Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:40,000

0 0.5 1 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.6515.05e
Generation 1
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V: PCSeg01Soil 1
Esoil
L: Final RI\ PCSeg01 Soil1
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

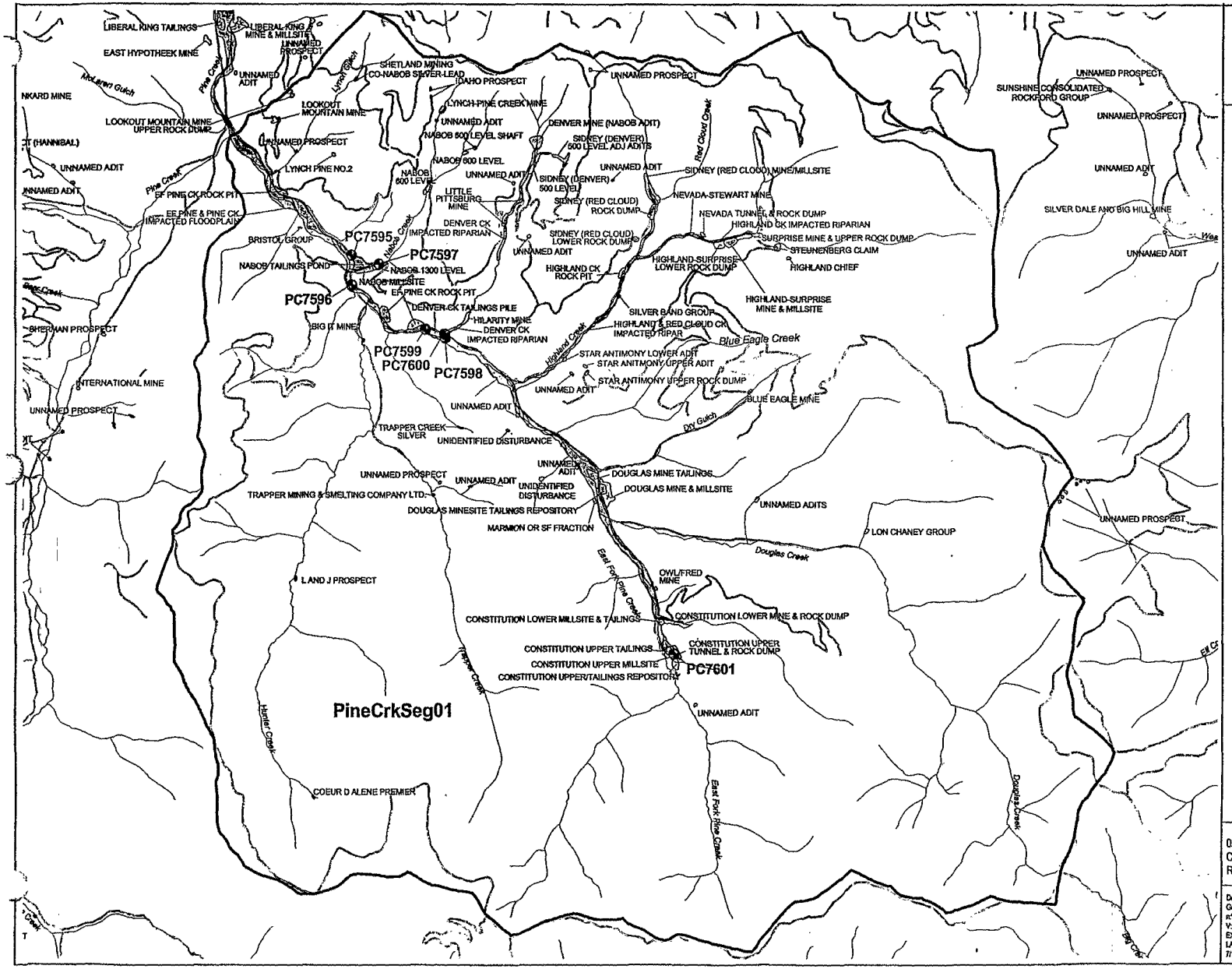
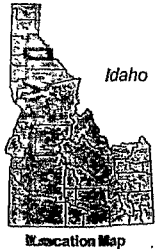


Figure 4.1-2
Pine Creek Segment PineCrkSeg01
Source Areas and Groundwater Sampling Locations

LEGEND

- Monitor Well Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

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027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615[illegible]
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EXTENT:groundwater
LAYOUT: Final RI Pine 1 GW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

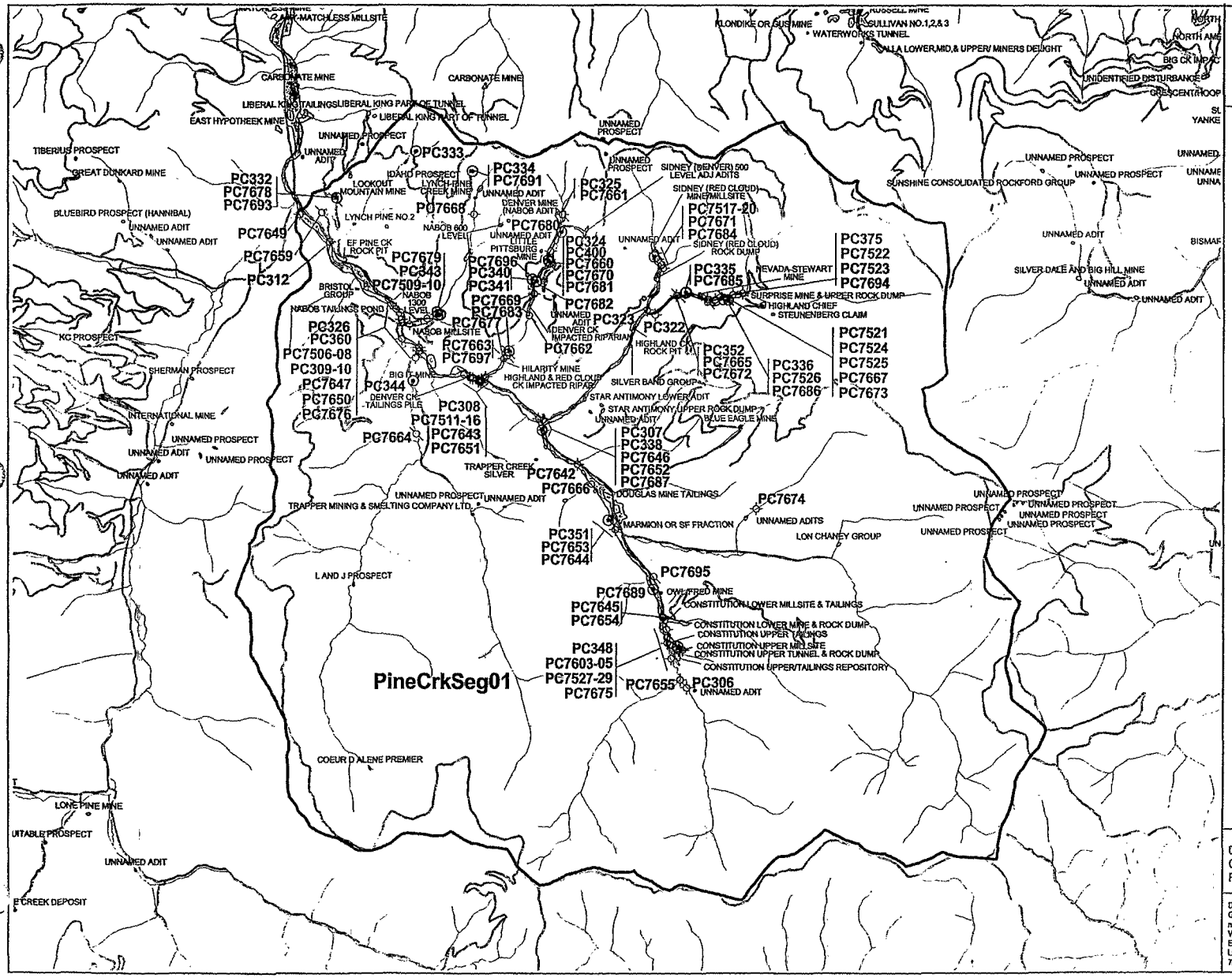

Figure 4.1-3
Pine Creek Segment PCSeg01 Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:48,000

0 0.5 1 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.6815.05a
Generation 1
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E:SW
L: Final RI PC1SW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 13, 2001

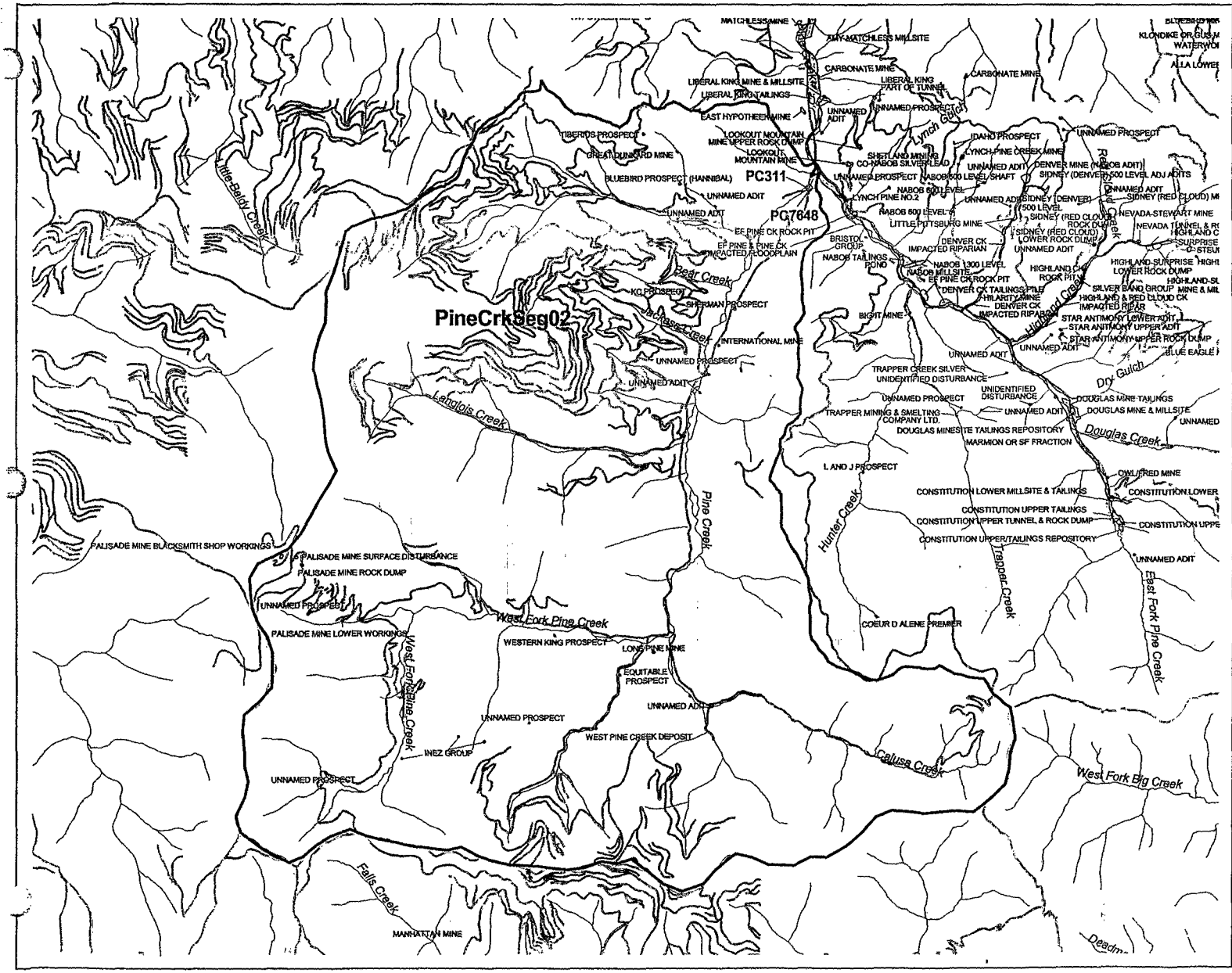

Figure 4.1-4
Pine Creek Segment PCSeg02
Source Areas and Surface Water Sampling Locations

LEGEND

- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 2
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:50,000

0 0.5 1 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.8615.05a
Generation 1
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V: PineCrkSeg02
E:\surfacewater
L: Final RI PCSeg2 SW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

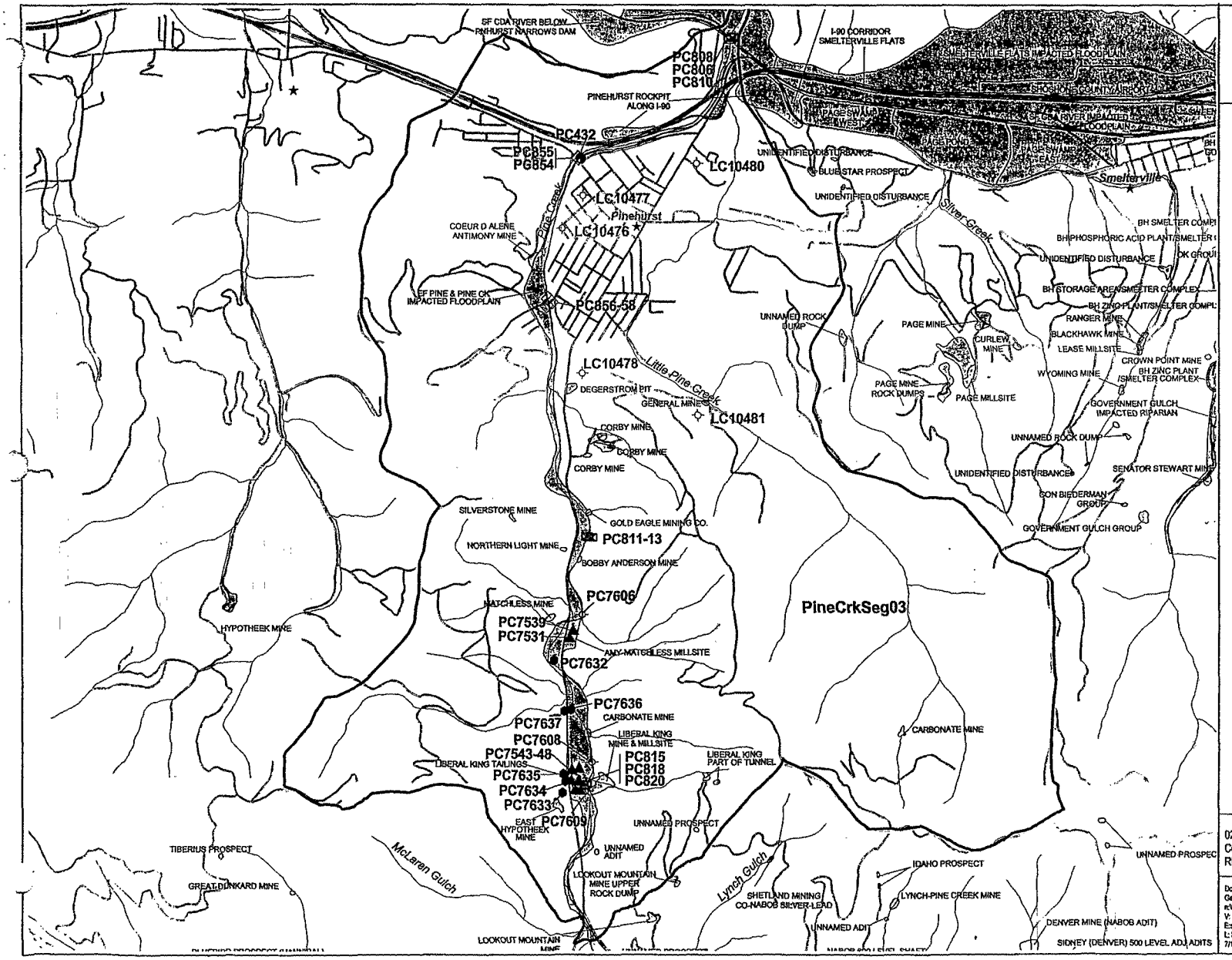

Figure 4.1-5
Pine Creek Segment PineCrkSeg03
Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Monitor Well Sampling Locations
- Ground Sampling Location
- Waste Rock Sampling Location
- Test Pit Sampling Location
- Tailings Pile Sampling Location
- Hand Auger Sampling Location
- River Sampling Location
- Seep Sampling Location
- Wetlands/Marsh Sampling Location
- Waste Rock Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling Locations from URS Greiner Woodward Clyde Technical Data Management Database as of 10/18/99

SCALE 1:28,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615.05e
Generation 1
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V: PCSeg03 Soil
E:soil
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7/13/2001

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Date of Plot: July 13, 2001

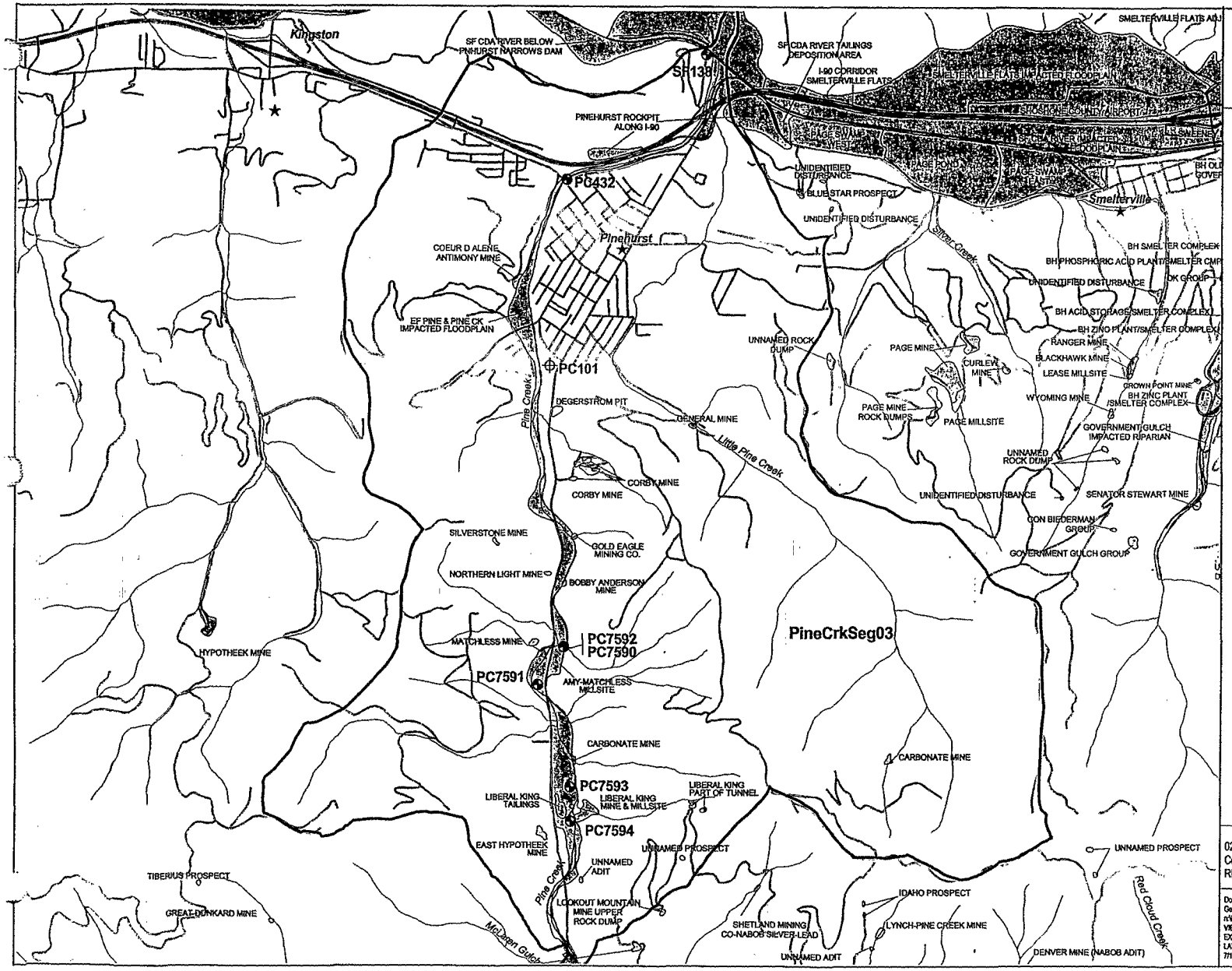

Figure 4.1-6
Pine Creek Segment PCSeg03
Source Areas and Groundwater Sampling Locations

LEGEND

- Monitor Well Sampling Location
- Production Well Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:28,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4152500.6615.05e
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EXTENT:groundwater
LAYOUT: Final RI PineCrk Seg3 Groundwater
7/13/2001

This map is based on Idaho-State Plane Coordinates WestZone, North American Datum 1983

Date of Plot: July 13, 2001

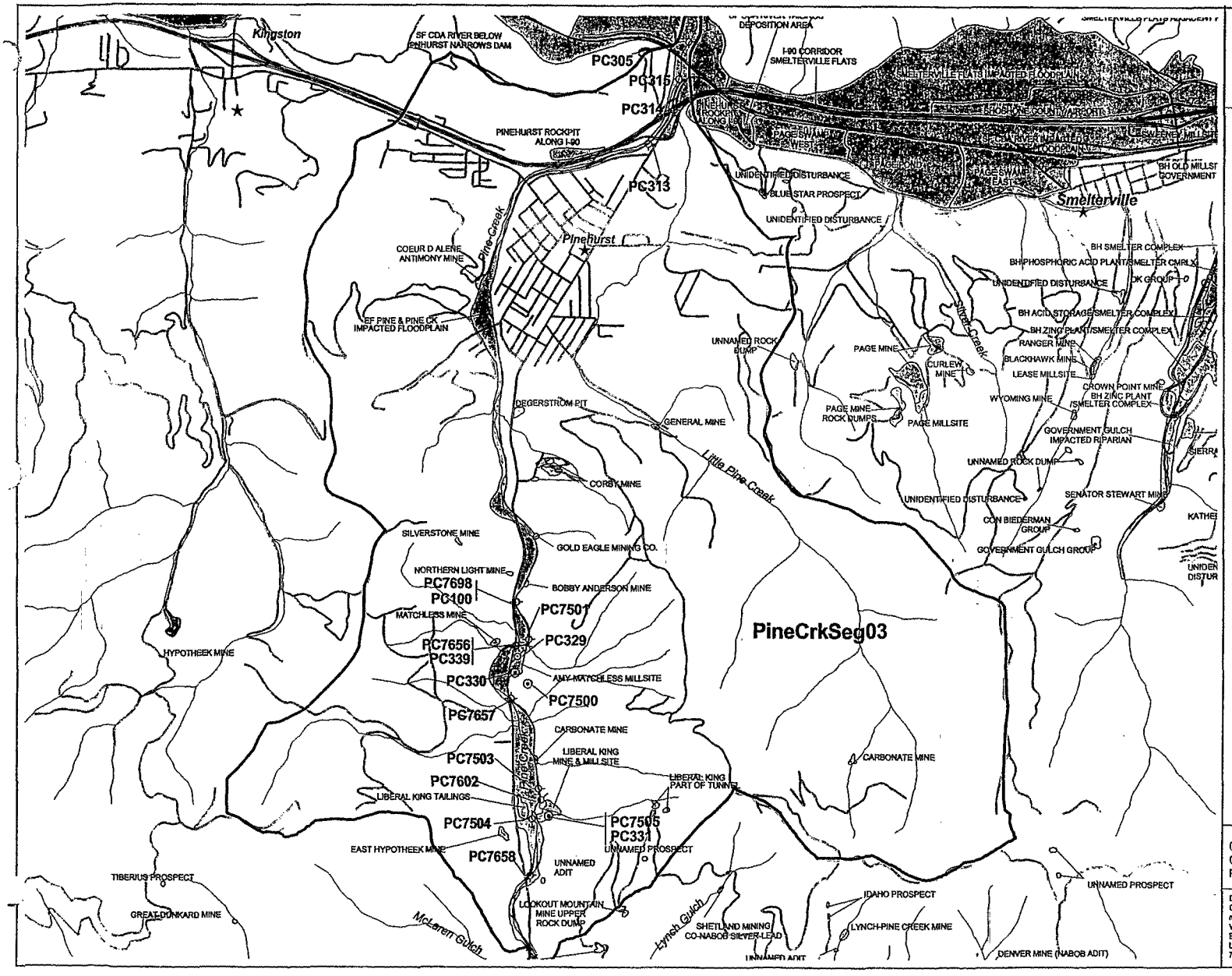
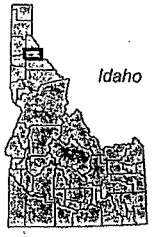


Figure 4.1-7
Pine Creek Segment PineCrkSeg03
Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name



NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:28,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
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V: PineCrkSeg03 Surface Water
E:Surfacewater
L: Final RI PineCrkSeg03 Surface Water
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: MAY 16, 2000

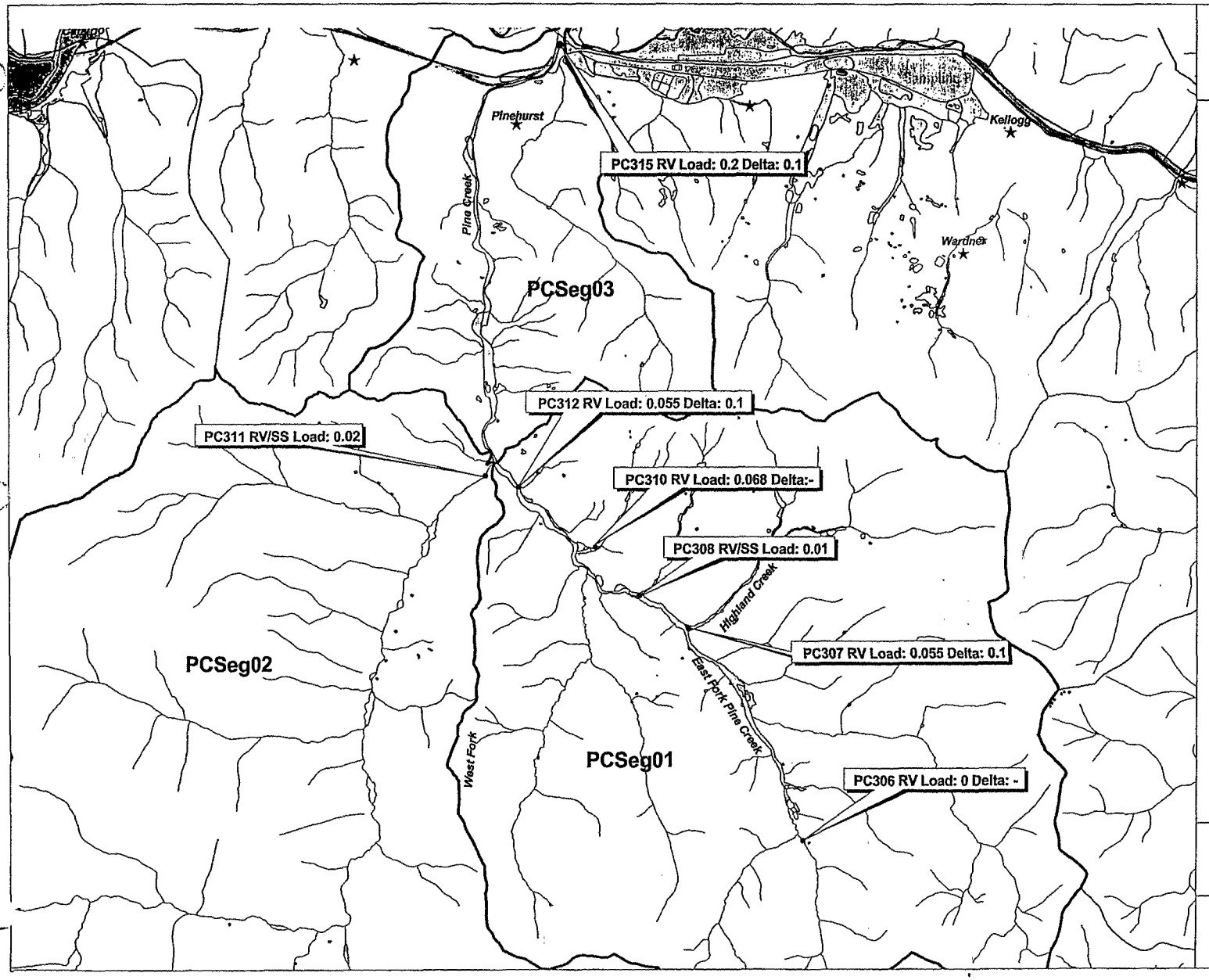

Figure 4.2-1
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from November 1997

LEGEND

Sampling Location

PC315 RV Load: 33 Delta: -1

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg (+) Pos Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Road
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.8615 05s
Generation 1
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pine creek massloading 7-12-00.apr
V:dPb Pine Creek Nov 98
E:Pine Creek
L: Final RI dPb Mass Loading Nov-97
7/18/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 18, 2001

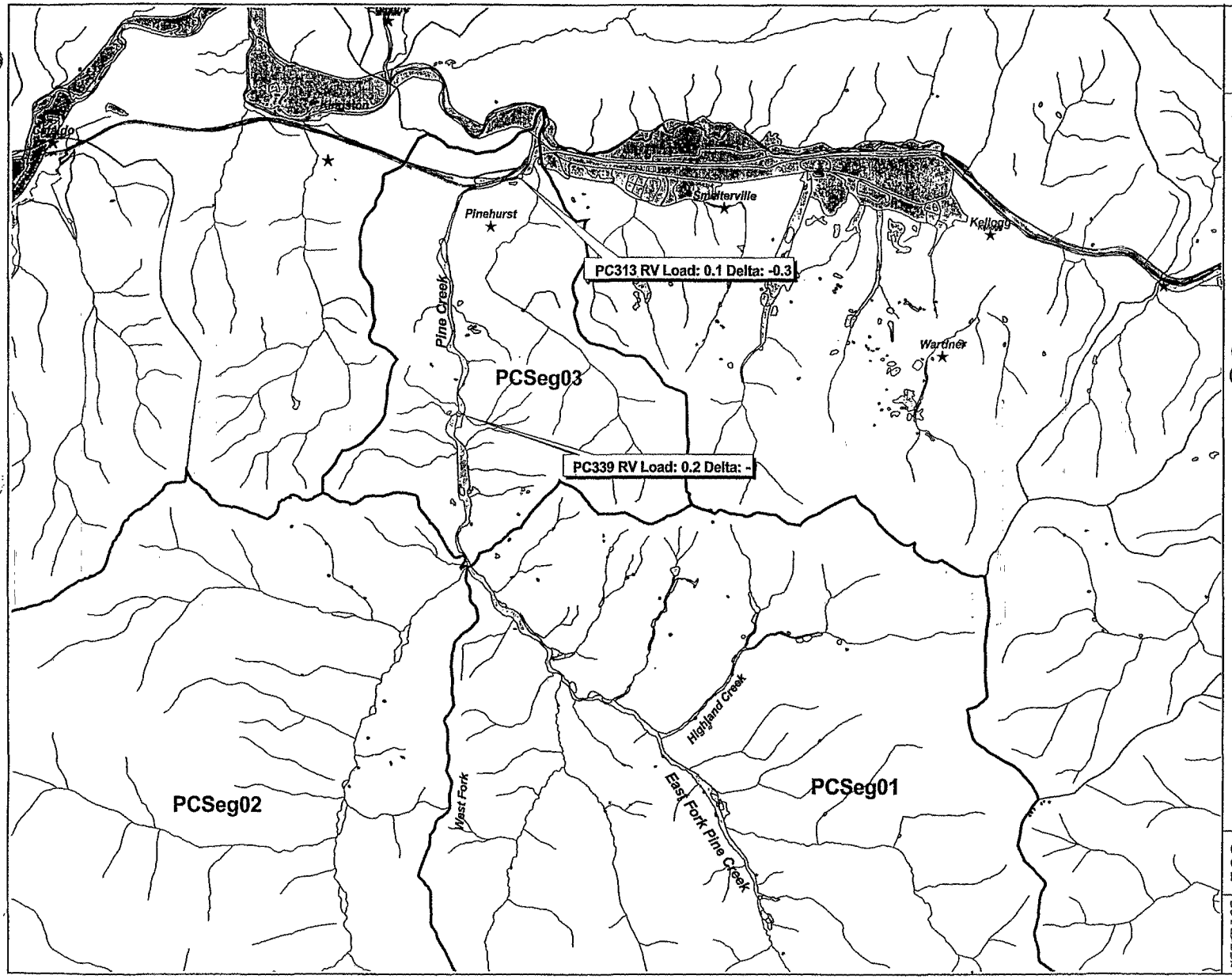

Figure 4.2-2
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from November 1998

Sampling Location

LEGEND

PC313 RV Load: 0.07 Delta: -0.3

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162900.0515.05e
Generation 1
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pinecreek mass loading 7-12-00.apr
V TP8 PINE CREEK Nov98
E PINE CREEK
L: Final RI IP8 Pine Creek Nov 98
7/15/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

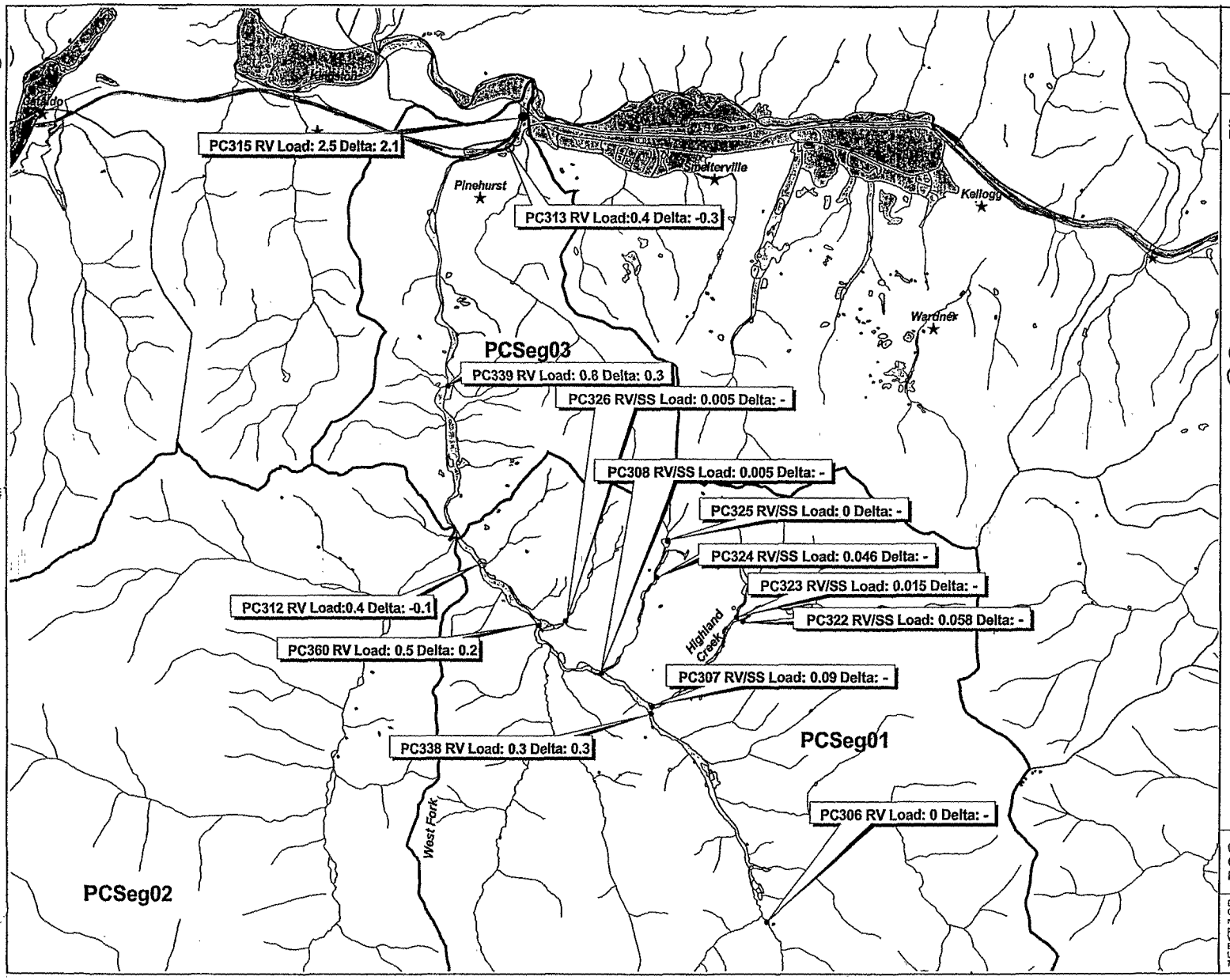

Figure 4.2-3
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from May 1998

LEGEND

Sampling Location

PC315 RV Load: 2.5 Delta: 2.1

Location Type:
RV: River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Sampling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area

Idaho
Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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V TPB PINE CREEK MAY 98
E PINE CREEK
L: Final RI IPB Mass Load May 98
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

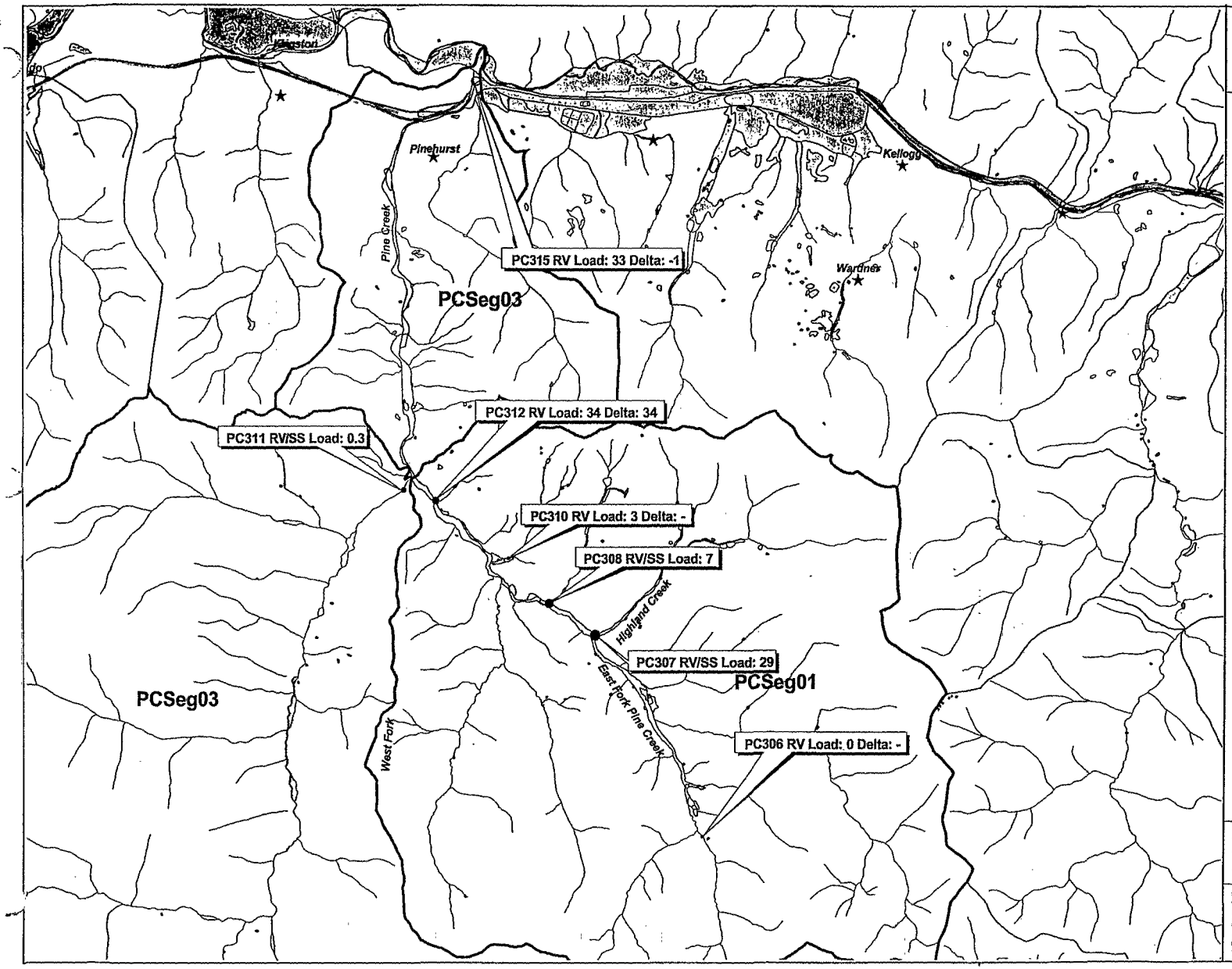


Figure 4.2-4
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results from November 1997

LEGEND

Sampling Location

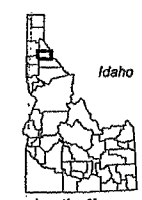
PC315 RV Load: 33 Delta: -1

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

Stream
Road
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615.05e
Generation 1
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V:dZn Pine Creek Nov 98
E:Pine Creek
L: Final RI dZn Mass Loading Nov-97
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

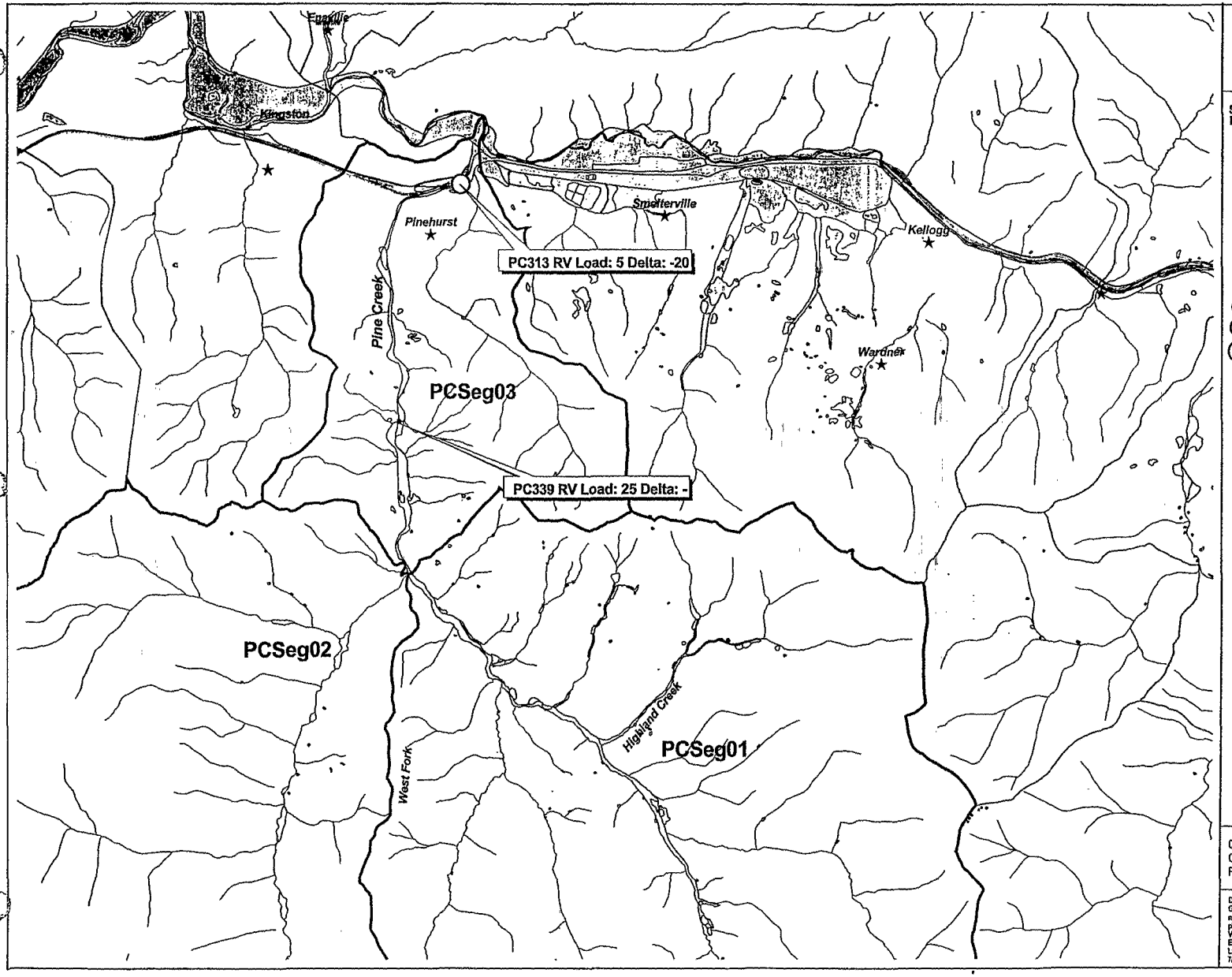


Figure 4.2-5
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results from November 1998

LEGEND

Sampling Location

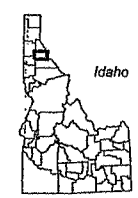
PC313 RV Load: 5 Delta: -20

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Sampling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

Stream
Road
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.6615.05e
Generation 1
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pine creek massloading 7-12-00.apr
V:dZn PC Mass Load Nov 98
E:Pine Creek
L: Final RI dZn PC Mass Load Nov-98
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

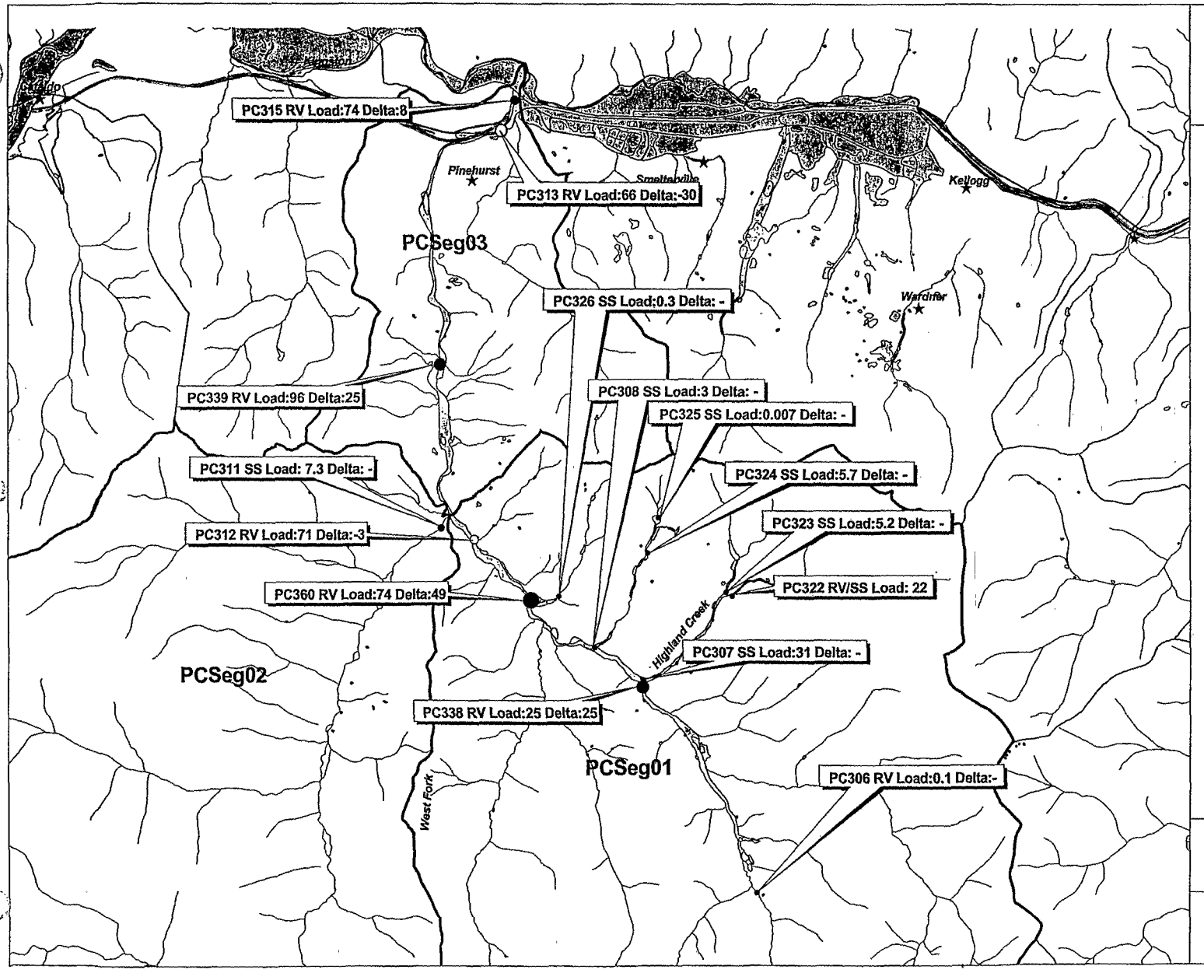

Figure 4.2-6
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1998

Sampling Location

PC315 RV Load: 2.5 Delta: 2.1

Location Type:
RV: River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Sampling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area

Idaho
Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162520.6515.05.a
Generation 1
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pinecreek mass loading 7-12-00.apr
Y Zn May98
E PINE CREEK
L Final RI dZn PC May98
8/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 16, 2001

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
BIG IT MINE	MAS029	0.22	Adit drainage Upland waste rock (intermixed tailings)	SW	1		SWD: Sb-1 SWT: Sb-1	
BLUE EAGLE MINE	MAS023	0.35	Upland waste rock (erosion potential)					
BRISTOL GROUP	MAS034	0.15	Upland waste rock					
COEUR D ALENE PREMIER	MAS033	0.20	Upland waste rock (erosion potential)					
CONSTITUTION LOWER MILLSITE & TAILINGS	MAS048	0.68	Floodplain tailings Upland tailings					
CONSTITUTION LOWER MINE & ROCK DUMP	MAS027	2.42	Floodplain waste rock					
CONSTITUTION UPPER MILLSITE (BLM land)	MAS026	1.25	Floodplain tailings Seep	GW SW	1 1	GWT: Cd-1, Cu-1, Fe-1 SWT: Cu-1, Pb-1, Zn-1	GWT: Mn-1	GWT: Zn-1
CONSTITUTION UPPER TAILINGS (non-BLM land)	MAS049	2.93	Floodplain tailings Seep	SB SD SS SW	2 2 1 1	SBT: Cd-1, Pb-1 SDT: Ag-2, As-2, Cd-2, Cu-2, Hg-2, Mn-2, Sb-2 SST: As-1, Cd-1 SWT: Cu-1, Pb-1, Zn-1	SBT: Pb-1, Zn-2 SDT: Pb-2, Zn-2 SST: Pb-1, Zn-1	
CONSTITUTION UPPER TUNNEL & ROCK DUMP	MAS050	1.50	Adit drainage Floodplain waste rock (intermixed tailings)	SW	3	SWD: Cd-1, Pb-2, Zn-2 SWT: Zn-3		
CONSTITUTION UPPER/TAILINGS REPOSITORY	MAS085	1.59	Floodplain tailings					
DENVER CK IMPACTED RIPARIAN: NO. 1	MAS043	3.11	Floodplain sediments					
DENVER CK IMPACTED RIPARIAN: NO. 2	MAS040	1.43	Floodplain sediments	SD SW	1 1	SDT: As-1, Hg-1, Zn-1 SWT: Cd-1	SDT: Pb-1	SWT: Zn-1
DENVER CK IMPACTED RIPARIAN: NO. 3	MAS041	2.43	Floodplain sediments	SW	1		SWD: Cd-1, Pb-1, Zn-1	
DENVER CK IMPACTED RIPARIAN: NO. 4	MAS042	1.13	Floodplain sediments					
DENVER CK TAILINGS PILE	MAS036	1.87	Floodplain tailings Seep	SB SD SS SW	2 2 1 2	SBT: As-2, Cd-1, Cu-1, Pb-1, Zn-1 SDT: As-2, Cd-1, Cu-2, Hg-1, Zn-1 SST: As-1, Cu-1, Zn-1 SWT: Cd-2, Cu-1	SBT: Pb-1, Zn-1 SDT: Pb-2, Zn-1 SST: Pb-1 SWT: Cu-1, Fe-1, Mn-1, Pb-1, Zn-1	SWT: Zn-1
DENVER MINE (NABOB ADIT)	MAS018	3.77	Upland waste rock (erosion potential)	SW	2	SWD: Fe-1	SWD: Mn-1	
DOUGLAS MINE & MILLSITE	MAS025	5.02	Floodplain waste rock (intermixed tailings)					
DOUGLAS MINE TAILINGS	MAS024	3.01	Floodplain tailings					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
DOUGLAS MINESITE TAILINGS REPOSITORY	MAS084	1.63	Floodplain tailings					
EF PINE & PINE CK IMPACTED FLOODPLAIN (PineCrkSeg01 & PineCrkSeg03)	MAS047	134.30	Floodplain sediments Floodplain sediments	GW SB SD SS SW	7 2 45 4 110	GWT: Cd-2, Cu-7, Mn-2, Sb-2, Zn-4 SBT: As-2, Cd-1, Cu-1, Pb-2, Zn-1 SDT: Ag-2, As-22, Cd-25, Cu-11, Fe-1, Hg-4, Pb-27, Sb-2, Zn-41 SST: As-3, Pb-3, Zn-4 SWD: Cd-8, Cu-6, Fe-2, Mn-2, Pb-48, Sb-2, Zn-42 SWT: Cd-32, Cu-2, Fe-3, Mn-1, Pb-8, Zn-24	GWT: Zn-2 SDT: As-1, Cd-1, Pb-14, Zn-1 SST: As-1, Pb-1 SWD: Cd-34, Mn-1, Pb-3, Zn-27 SWT: Zn-10	GWT: Zn-1 SDT: Pb-1 SWD: Zn-17 SWT: Zn-27
EF PINE CK ROCK PIT: NO. 1	MAS039	3.05	Floodplain waste rock					
EF PINE CK ROCK PIT: NO. 2	MAS038	3.43	Floodplain waste rock					
EF PINE CK ROCK PIT: NO. 3	MAS037	1.58	Floodplain waste rock					
HIGHLAND & RED CLOUD CK IMPACTED RIPAR	MAS046	24.61	Floodplain sediments	SW	40	SWD: Cd-37, Mn-1, Pb-24 SWT: Cd-30, Pb-1	SWD: Cd-1, Zn-40 SWT: Zn-35	
HIGHLAND CHIEF	MAS060	0.27	Upland waste rock					
HIGHLAND CK IMPACTED RIPARIAN	MAS045	3.10	Floodplain sediments Floodplain sediments	SD SW	4 5	SDT: Cd-3, Cu-4, Hg-3, Mn-1, Sb-1, Zn-1 SWD: Pb-1 SWT: Cu-3, Mn-1, Pb-3, Zn-1	SDT: As-4, Pb-3, Zn-3 SWD: Zn-1 SWT: Cd-2, Zn-1	SDT: Pb-1 SWT: Zn-2
HIGHLAND CK ROCK PIT	MAS044	0.92	Floodplain waste rock					
HIGHLAND-SURPRISE LOWER ROCK DUMP	MAS079	1.90	Floodplain waste rock	SW	1	SWD: Cu-1, Mn-1	SWD: Cd-1, Pb-1	SWD: Zn-1
HIGHLAND-SURPRISE MINE & MILLSITE	MAS078	2.51	Adit drainage Seep Upland tailings Upland tailings Upland waste rock	SW	6	SWD: Cd-3, Cu-1, Mn-3, Pb-1 SWT: Cd-4, Cu-4, Fe-2, Mn-4, Pb-1	SWD: Cd-1, Mn-2, Pb-1, Zn-4 SWT: Zn-3	SWD: Zn-1 SWT: Zn-1
HILARITY MINE	MAS014	1.28	Adit drainage Seep Upland tailings Upland waste rock					
IDAHO PROSPECT: NO. 1	MAS010	0.16	Upland waste rock					
IDAHO PROSPECT: NO. 2	MAS011	0.15	Adit drainage Upland waste rock	SW	1	SWT: Fe-1	SWD: Cd-1, Mn-1 SWT: Cd-1, Mn-1, Pb-1	SWD: Cu-1, Pb-1, Zn-1 SWT: Cu-1, Zn-1
L AND J PROSPECT	MAS032	0.27	Upland waste rock (erosion potential)					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
LITTLE PITTSBURG MINE: NO. 1	MAS016	0.97	Adit drainage Upland waste rock (erosion potential)	SW	5	SWD: Cu-2, Fe-1 SWT: Fe-1	SWD: Cd-1, Cu-1, Fe-1, Mn-2, Pb-1, Zn-1 SWT: Cd-3, Cu-2, Fe-1, Mn-3	SWD: Cd-2, Mn-2, Pb-1, Zn-3 SWT: Cu-1, Pb-1, Zn-3
LITTLE PITTSBURG MINE: NO. 2	MAS015	1.51	Adit drainage Seep Upland waste rock (erosion potential)	SW	3	SWD: Cd-3, Pb-2, Zn-2 SWT: Cu-1, Pb-1, Zn-2	SWD: Zn-1	
LON CHANEY GROUP	MAS028	0.45	Upland waste rock (erosion potential)					
LOOKOUT MOUNTAIN MINE	MAS004	0.85	Adit drainage Upland waste rock	SW	3	SWD: Cd-2, Cu-2, Zn-2 SWT: Cu-2, Zn-2		
LOOKOUT MOUNTAIN MINE UPPER ROCK DUMP	MAS067	0.36	Seep Upland waste rock					
LYNCH PINE NO.2	MAS005	0.29	Upland waste rock					
LYNCH-PINE CREEK MINE	MAS012	0.93	Adit drainage Upland waste rock (erosion potential)					
MARMION OR SF FRACTION	MAS054	0.44	Adit drainage Floodplain waste rock	SW	1	SWD: Cd-1, Mn-1, Pb-1, Zn-1 SWT: Fe-1, Mn-1	SWT: Zn-1	
NABOB 1300 LEVEL	MAS007	1.82	Adit drainage Upland waste rock	GW SW	1 3	GWT: Cu-1, Sb-1, Zn-1 SWT: Cd-3, Cu-2, Fe-1, Pb-1	SWD: Cd-2, Mn-3 SWT: Fe-1, Mn-3	SWD: Zn-2 SWT: Cu-1, Zn-3
NABOB 600 LEVEL (300 Level)	MAS013	0.42	Upland waste rock (erosion potential)					
NABOB 600 LEVEL (Crystalite)	MAS008	1.36	Upland waste rock (erosion potential)					
NABOB 600 LEVEL SHAFT	MAS035	0.30	Upland waste rock (erosion potential)					
NABOB MILLSITE	MAS083	2.81	Upland tailings Upland waste rock	SD SW	1 1	SDT: As-1, Cd-1, Cu-1, Fe-1, Pb-1, Zn-1 SWT: Cd-1, Fe-1, Mn-1	SWT: Cu-1, Pb-1, Zn-1	
NABOB TAILINGS POND	MAS006	4.10	Floodplain tailings (flotation tailings)	SB SS	1 1	SBT: As-1, Fe-1, Mn-1, Zn-1 SST: Cd-1	SBT: Pb-1 SST: As-1, Cu-1, Pb-1, Sb-1, Zn-1	
NEVADA TUNNEL & ROCK DUMP	MAS080	0.43	Upland waste rock					
NEVADA-STEWART MINE	MAS021	0.63	Adit drainage Seep Upland waste rock (erosion potential)	SW	3	SWD: Cd-2, Cu-1 SWT: Cd-1, Cu-2, Fe-1	SWD: Mn-2, Zn-1 SWT: Fe-1, Mn-2, Zn-1	SWD: Zn-2 SWT: Zn-2
OWL/FRED MINE	MAS052	0.22	Adit drainage Upland waste rock (erosion potential)					
SHETLAND MINING CO-NABOB SILVER-LEAD	MAS009	0.31	Adit drainage Upland waste rock (erosion potential)	SW	2	SWT: Cu-2, Fe-1, Mn-1, Pb-1		
SIDNEY (DENVER) 500 LEVEL	MAS017	2.61	Adit drainage Upland waste rock (erosion potential)	SW	1	SWD: Mn-1, Pb-1		SWD: Cd-1, Zn-1
SIDNEY (DENVER) 500 LEVEL ADJ ADITS	MAS069	1.89	Upland waste rock					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
SIDNEY (RED CLOUD) LOWER ROCK DUMP	MAS082	0.62	Upland waste rock				
SIDNEY (RED CLOUD) MINE/MILLSITE	MAS020	5.66	Adit drainage	SD 3 SW 8	SDT: As-3, Cd-2, Cu-3, Mn-1, Pb-1, Zn-2 SWD: Cd-1, Cu-1, Mn-2, Pb-1 SWT: Cd-4, Fe-2, Mn-1, Pb-2	SDT: Pb-2, Zn-1 SWD: Cd-2, Mn-1, Pb-3, Zn-1 SWT: Cd-1, Cu-2, Mn-1, Pb-1, Zn-2	SWD: Cd-1, Zn-2 SWT: Zn-2
SIDNEY (RED CLOUD) ROCK DUMP	MAS081	2.10	Floodplain waste rock				
SILVER BAND GROUP	MAS075	0.19	Upland waste rock				
STAR ANITMONY UPPER ADIT	MAS058	0.30	Upland waste rock				
STAR ANTIMONY LOWER ADIT	MAS019	0.35	Floodplain waste rock				
STAR ANTIMONY UPPER ROCK DUMP	MAS076	0.45	Upland waste rock				
STEUNENBERG CLAIM	MAS077	1.09	Upland waste rock				
SURPRISE MINE & UPPER ROCK DUMP	MAS022	1.68	Floodplain waste rock				
TRAPPER CREEK SILVER	MAS030	0.28	Upland waste rock (erosion potential)				
TRAPPER MINING & SMELTING COMPANY LTD.	MAS031	0.18	Upland waste rock (erosion potential)				
UNIDENTIFIED DISTURBANCE	MAS073	0.18	Upland waste rock				
UNIDENTIFIED DISTURBANCE	MAS074	0.43	Upland waste rock				
UNNAMED ADIT	MAS051	0.23	Upland waste rock				
UNNAMED ADIT	MAS055	0.24	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS057	0.17	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS059	0.28	Upland waste rock				
UNNAMED ADIT	MAS061	0.31	Upland waste rock				
UNNAMED ADIT	MAS062	0.23	Upland waste rock				
UNNAMED ADIT	MAS063	0.15	Upland waste rock				
UNNAMED ADIT	MAS068	0.16	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS072	0.33	Upland waste rock (erosion potential)				
UNNAMED ADITS	MAS053	0.45	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	MAS056	0.19	Upland waste rock				
UNNAMED PROSPECT	MAS065	0.20	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	MAS071	0.25	Upland waste rock				

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1-2
Potential Source Areas Within Pine Creek - segment PineCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BLUEBIRD PROSPECT (HANNIBAL)	TWI013	0.32	Upland waste rock				
EQUITABLE PROSPECT	TWI009	0.27	Floodplain waste rock				
GREAT DUNKARD MINE	TWI014	0.25	Floodplain waste rock				
INEZ GROUP: NO. 1	TWI005	0.30	Upland waste rock				
INEZ GROUP: NO. 2	TWI004	0.23	Upland waste rock				
INEZ GROUP: NO. 3	TWI003	0.16	Upland waste rock				
INTERNATIONAL MINE	TWI016	0.25	Upland waste rock				
KC PROSPECT	TWI012	0.16	Floodplain waste rock				
LONE PINE MINE	TWI010	0.33	Upland waste rock				
MANHATTAN MINE	TWI006	0.20	Upland waste rock (erosion potential)				
PALISADE MINE BLACKSMITH SHOP WORKINGS	TWI001	0.56	Upland waste rock				
PALISADE MINE LOWER WORKINGS	TWI002	0.24	Floodplain waste rock				
PALISADE MINE ROCK DUMP	TWI023	0.50	Upland waste rock				
PALISADE MINE SURFACE DISTURBANCE	TWI022	0.73	Upland waste rock				
SHERMAN PROSPECT	TWI015	0.32	Upland waste rock				
TIBERIUS PROSPECT	TWI017	0.27	Upland waste rock				
UNNAMED ADIT	TWI011	0.23	Upland waste rock (erosion potential)				
UNNAMED ADIT	TWI020	0.24	Upland waste rock (erosion potential)				
UNNAMED ADIT	TWI021	0.22	Upland waste rock				
UNNAMED ADIT	TWI029	0.24	Upland waste rock				
UNNAMED ADIT	TWI030	0.28	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI018	0.31	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI019	0.33	Upland waste rock				
UNNAMED PROSPECT	TWI024	0.42	Upland waste rock				
UNNAMED PROSPECT	TWI025	0.30	Upland waste rock				
UNNAMED PROSPECT	TWI026	1.38	Upland waste rock				
UNNAMED PROSPECT	TWI027	0.23	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI028	0.18	Upland waste rock				
WEST PINE CREEK DEPOSIT	TWI008	0.21	Floodplain waste rock				
WESTERN KING PROSPECT	TWI007	0.25	Upland waste rock				

Table 4.1-2
Potential Source Areas Within Pine Creek - segment PineCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1-3
Potential Source Areas Within Pine Creek - segment PineCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
AMY-MATCHLESS MILLSITE	KLW081	5.07	Adit drainage Floodplain sediments Seep	GW 2 SB 4 SS 2 SW 16	GWT: Fe-2, Mn-2, Pb-1 SBT: As-2, Cd-1, Cu-4, Fe-2, Pb-1, Zn-1 SST: As-2, Cu-1, Fe-1, Sb-2, Zn-2 SWD: Cd-12, Mn-3, Pb-4, Zn-14 SWT: Cd-1, Cu-1, Fe-1, Mn-3, Pb-1, Zn-12	GWT: Zn-2 SBT: As-1, Cd-1, Pb-3, Zn-3 SST: Pb-2 SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-3	GWT: Cu-2
BOBBY ANDERSON MINE	KLW080	0.30	Upland waste rock				
CARBONATE MINE: NO. 1	KLW085	0.60	Floodplain waste rock				
CARBONATE MINE: NO. 2	KLW082	0.34	Floodplain waste rock				
COEUR D ALENE ANTIMONY MINE	KLW072	1.04	Upland waste rock				
CORBY MINE	KLW078	1.23	Upland waste rock				
CORBY MINE	KLW105	1.59	Upland waste rock Upland waste rock				
CORBY MINE	KLW106	0.37	Mine Workings/Water, Seeps, Springs and Leachate				
DEGERSTROM PIT	KLW076	1.17	Upland waste rock				
EAST HYPOTHEEK MINE	MAS001	1.08	Upland waste rock				
GENERAL MINE	KLW077	0.46	Floodplain waste rock				
GOLD EAGLE MINING CO.	KLW079	0.40	Floodplain waste rock				
LIBERAL KING MINE & MILLSITE	MAS003	3.86	Adit drainage Seep Upland waste rock (intermixed tailings)	SW 3	SWT: Zn-3		
LIBERAL KING PART OF TUNNEL: NO. 1	KLW084	0.34	Upland waste rock				
LIBERAL KING PART OF TUNNEL: NO. 2	KLW083	0.58	Floodplain waste rock				
LIBERAL KING TAILINGS	MAS002	2.33	Floodplain tailings				
MATCHLESS MINE	KLW075	0.71	Floodplain waste rock				
NORTHERN LIGHT MINE	KLW074	0.30	Upland waste rock				
PINEHURST ROCK PIT ALONG I-90: NO. 2	KLW005	5.73	Floodplain waste rock				
SILVERSTONE MINE	KLW073	0.35	Upland waste rock				
UNNAMED ADIT	MAS064	0.25	Upland waste rock				
UNNAMED PROSPECT	MAS066	0.25	Upland waste rock				

Table 4.1-3
Potential Source Areas Within Pine Creek - segment PineCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1.4-1
Adit and Seep Data Summary

BLM ID	Source Name	Average Discharge (cfs)	Maximum Discharge (cfs)	Average Total Zinc Concentration (µg/L)	Average Total Zinc Load (lbs/day)
Adits					
MAS020	Sidney (Red Cloud)	0.018	0.089	43,700	4.2
MAS021	Nevada-Stewart	0.074	0.111	9,833	3.9
MAS007	Nabob 1300 Level	0.051	0.074	7,665	2.1
MAS078	Highland Surprise	0.038	0.04	2,853	0.58
MAS050	Constitution Upper Tunnel	0.079	0.098	328	0.14
MAS016	Little Pittsburg No. 1	0.00042	0.00042	61,400	0.14
MAS015	Little Pittsburg No. 2	0.00174	0.00179	8,150	0.076
MAS011	Idaho Prospect No. 2	0.00064	0.00064	10,500	0.036
MAS004	Lookout Mountain	0.0268	0.027	49	0.0071
MAS054	SF Fraction (Marmion)	0.0089	0.0089	111	0.0053
KLW081	Amy-Matchless	0.0043	0.00821	211	0.0049
MAS003	Liberal King	0.0046	0.00656	58	0.0014
MAS029	Big It	0.00106	0.00106	36	0.00021
MAS009	Shetland Mining Co.	0.000651	0.000825	14	0.000049
MAS012	Lynch-Pine Creek	No data	No data	15,900	No discharge data
MAS014	Hilarity	No data	No data	6,230	No discharge data
MAS017	Sidney (Denver) 500 Level	No data	No data	3,460	No discharge data
MAS052	Owl/Fred	No data	No data	452	No discharge data
MAS010	Idaho Prospect No. 1	No data	No data	No data	No data
MAS023	Blue Eagle	No data	No data	No data	No data
MAS025	Douglas	No data	No data	No data	No data
Seeps					
KLW081	Amy-Matchless	0.426	0.68	888	2.0
MAS078	Highland-Surprise	0.0106	0.0106	7,700	0.44
MAS021	Nevada-Stewart	0.0028	0.0028	2,735	0.04
MAS014	Hilarity	No data	No data	7,500	No discharge data
MAS036	Denver Cr. tailings pile	No data	No data	3,690	No discharge data
MAS003	Liberal King	No data	No data	1,430	No discharge data

Table 4.1.4-1 (Continued)
Adit and Seep Data Summary

BLM ID	Source Name	Average Discharge (cfs)	Maximum Discharge (cfs)	Average Total Zinc Concentration (µg/L)	Average Total Zinc Load (lbs/day)
MAS049	Upper Constitution (non-BLM land)	No data	No data	1,300	No discharge data
MAS015	Little Pittsburg No. 2	No data	No data	640	No discharge data
MAS026	Upper Constitution (BLM land)	No data	No data	111	No discharge data
MAS067	Lookout Mountain	No data	No data	17	No discharge data

Notes:
Data compiled from the Restorations Alternative Plan (Gearheart et al. 1999). See Appendix J.

cfs - cubic feet per second
µg/L - micrograms per liter
lbs/day - pounds per day

Table 4.2-1
Pine Creek Mass Loading

Location	Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead			Dissolved Zinc		
						Conc. (µg/L)	Load (lbs/day)	Delta[a] (lbs/day)	Conc (µg/L)	Load (lbs/day)	Delta[a] (lbs/day)
PC306	1	RV	13-Nov-97	0.8	0.0	0.13	<0.1	-	<1	<1	-
PC312	1	RV	11-Nov-97	15.3	14.5	0.68	0.1	0.1	415	34.2	34.2
PC315	3	RV	04-Nov-97	60.0	44.7	0.62	0.2	0.1	102	33.0	-1.2
PC307	1	SS	01-Nov-97	3.9	-	2.6	0.1	-	1370	29.0	-
PC 308	1	SS	01-Nov-97	0.19	-	13.2	<0.0	-	7080	7.3	-
PC310	1	SS	01-Nov-97	0.2	-	77.8	0.1	-	3430	3.0	-
PC 311	2	SS	01-Nov-97	19.9	-	0.15	<0.1	-	2.5	0.3	-
PC306	1	RV	16-May-98	5.95	-	<1	-	-	1.9	0.1	-
PC338	1	RV	15-May-98	43.7	37.8	1.3	0.3	#VALUE!	107	25.2	25.1
PC360	1	RV	01-May-98	72.5	28.8	1.4	0.5	0.2	190	74.2	49.0
PC312	1	RV	14-May-98	70.6	-1.9	1.1	0.4	-0.1	188	71.5	-2.7
PC339	3	RV	16-May-98	205	134.4	0.69	0.8	0.3	87.2	96.4	24.8
PC313	3	RV	14-May-98	198	-7.0	0.4	0.4	-0.3	62	66.2	-30.2
PC315	3	RV	14-May-98	202	4.0	2.3	2.5	2.1	68	74.0	7.9
PC307	1	SS	01-May-98	8.36	-	2	0.1	-	679	30.6	-
PC308	1	SS	01-May-98	0.185	-	5.5	<0.1	-	3000	3.0	-
PC323	1	SS	01-May-98	0.88	-	3.2	<0.1	-	1090	5.2	-
PC322	1	SS	01-May-98	7.14	-	2.8	0.1	-	561	21.6	-
PC325	1	SS	01-May-98	0.135	-	0.41	<0.1	-	3920	2.9	-
PC324	1	SS	01-May-98	0.27	-	31.9	<0.1	-	9.7	0.0	-
PC326	1	SS	01-May-98	0.07	-	13.6	<0.1	-	728	0.3	-
PC311	2	WF	01-May-98	136	-	0.2	0.1	-	10	7.3	-
PC339	3	RV	19-Nov-98	33	-103.0	1	0.2		139	24.7	
PC313	3	RV	16-Nov-98	9.332	-23.7	1.4	0.1	0.1	96.8	4.9	-19.9

Table 4.2-1 (Continued)
Pine Creek Mass Loading

[a]The Delta value reported at a sample location is the difference between Mass load at that location and the next upstream Sample location, except for side streams and adits which are the maas load at that location.

Notes:
- : Mass Load or Delta Not Calculated
RV: River Sample
SS: Samples Collected in Side Stream off the Main Stream Channel (Including East Fork)
WF: Samples Collected in West Fork Pine Creek
CFS: Cubic feet per Second
µg/L: Micrograms per liter
lbs/day: pounds per day

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Pine Creek Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for each segment, as presented above in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in Pine Creek is presented in Section 5.4.

5.1 INTRODUCTION

Pine Creek contributes significant quantities of cadmium, lead, zinc, and other metals to the South Fork. The lowest and highest dissolved cadmium and zinc and total lead loadings measured during six sampling events (May 1991; October 1991; November 1997; May 1998; November 1998; and May 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

Segment PineCrkSeg01 contains the headwaters of the East Fork of Pine Creek up to its confluence with the main stem of Pine Creek (Figure 4.1-1). The BLM identified 78 source areas in this segment. Sampling of surface water indicates that metals concentrations are greater than ambient water quality criteria (AWQC).

Segment PineCrkSeg02 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork (Figure 4.1-4). The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped prospects or mines. No tailings deposits are present. Sampling of surface water indicates that metals concentrations in surface water are rarely greater than AWQC.

Segment PineCrkSeg03 begins at the confluence of the East Fork with the main stem of Pine Creek and continues to the confluence of Pine Creek with the South Fork Coeur d'Alene River

(Figure 4.1-5). The BLM identified 23 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC.

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2. Data and associated calculations are included in Appendix C.

Data were evaluated for three separate sampling locations. Only sampling locations with 10 or more individual data points for each parameter of interest were evaluated. In the Pine Creek watershed, the three sampling locations, in order from upstream in the East Fork Pine Creek (East Fork) to the mouth of Pine Creek are PC307, PC308, and PC305. The three sampling locations are shown on Figure 5.2-1. The first sampling location, PC307, is located at the confluence of Highland Creek and the East Fork. Sampling location PC308 is located approximately one-half mile downstream from PC307 at the confluence of Denver Creek with the East Fork. The two sampling locations previously mentioned are in segment PineCrkSeg01. The last sampling location evaluated (PC305) is near the confluence of Pine Creek with the South Fork Coeur d'Alene River (PineCrkSeg03).

River stretches bracketed by sampling locations are designated as reaches. For example, the portion of Pine Creek lying between sampling locations PC307 and PC308 is called a reach. Accordingly, there are two reaches encompassed by the three sampling locations.

5.2.1 Estimated Discharge

An example of the lognormal distribution of discharge data at sampling location PC305 at the mouth of Pine Creek is shown in Figure 5.2-2. Data from sampling location PC305 are used throughout this discussion for consistency of presentation and, additionally, because it lies near the mouth of Pine Creek. Further, a relatively large data set was available. In Figure 5.2-2, the discharge in cubic feet per second (cfs) is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a parameter (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative

distribution function is plotted versus the normal standard variate in Figure 5.2-3. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-2, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-3. For example, for a discharge of 100 cfs, the normal standard variate is approximately 0.2 (Figure 5.2-2). Looking on Figure 5.2-3, this value corresponds to a cumulative probability of approximately 0.58; therefore, approximately 58 percent of the time, discharges at this location will be 100 cfs or less.

As shown in Figure 5.2-2, there is a good fit of the lognormal regression line (solid line in Figure 5.2-2) to the data. This goodness of fit, as evidenced by a high coefficient of determination ($r^2 = 0.98$) (significant at $\alpha < 0.0001$), supports the assumption that discharges are lognormally distributed. The dotted line represents the true (ideal) lognormal distribution having the same mean (200) and coefficient of variation (1.88) as the actual data. The expected value, or average discharge rate, for Pine Creek at sampling location PC305 is 215 cfs. Expected values for discharge at all three sampling locations are summarized in Table 5.2-1.

The probability distribution function (PDF) shown in Figure 5.2-2 is a predictive tool that can be used to estimate the expected discharge and provide a quantitative estimate of the probability that the observed discharge will not exceed a given value. Conversely, one can find the estimated discharge rate having a specified probability of exceedance or non-exceedance by the observed discharge.

Estimated gains or losses in discharge (EV) and the coefficients of variation (CV) for reaches on Pine Creek are listed in Table 5.2-2.

One of the reaches (between PC307 and PC308) loses an estimated 4.8 cfs. The gaining reach (between PC308 and PC305) gains, approximately, an estimated 214 cfs. Gains in discharge occur mainly because of tributary inflows and high slopes that enhance overland flow.

5.2.2 Estimated Zinc, Lead, and Cadmium Concentrations and Mass Loading

Dissolved cadmium and zinc, and total lead concentrations and loads were evaluated using the probabilistic model at the three sampling locations (two reaches) that contained a minimum of ten data points.

5.2.2.1 Individual Sampling Locations

To illustrate the lognormal distribution of dissolved zinc and cadmium and total lead concentrations and dissolved zinc, total lead, and dissolved cadmium loading at sampling location PC305 in Pine Creek, Figures 5.2-4 through 5.2-9 are provided. The high r-squared values (r^2) for the concentrations and loads when plotted lognormally attest to the fact that the data follow a lognormal distribution. For dissolved concentrations, the r-squared values for zinc, and cadmium were 0.88 and 0.95, respectively. The r-squared value for the total lead concentration was 0.98. Corresponding values for dissolved zinc and cadmium, and total lead loads were 0.98, 0.95, and 0.92, respectively.

To assist in interpreting and placing the results in context, screening levels, expected values (EV), and total maximum daily loads (TMDLs) are shown on the figures where applicable. The TMDLs are given at the 10th, 50th, and 90th percentiles when the scale permitted. Often, it was necessary to multiply the TMDL by a scalar to fit it on the graph. The TMDLs used were those presented in the Technical Support Document of August 2000 (USEPA 2000). Strictly speaking, TMDLs for non-point sources are for dissolved loads. However, the TMDL for total lead load was multiplied by a value [called a translator (USEPA 2000), which gives the ratio of the total to dissolved loads] to convert the dissolved lead TMDL load to a total lead load. The purpose of this exercise was to provide a reference value and point of discussion for lead because of the importance of the total lead load. Often, most of the lead will be in the particulate, as opposed to dissolved, form. Because a high percentage of zinc and cadmium loads are in the dissolved form, zinc and cadmium were compared to their respective dissolved TMDL loading capacities.

The screening level for dissolved cadmium in surface waters is 0.38 µg/l. Several cadmium measurements at PC305 were above this screening level. None of the measured cadmium concentrations exceeded 10 times the screening level (Figure 5.2-4). The estimated dissolved cadmium concentration of approximately 0.54 µg/l is slightly above the screening level.

All total lead concentrations are less than the screening level (15 µg/l) except for one data point (Figure 5.2-5). The estimated expected lead concentration (approximately 4.6 µg/l) is also less than the screening level.

Almost all dissolved zinc concentrations (Figure 5.2-6) measured at sampling location PC305 on Pine Creek fall between the screening level and 10 times the screening level of 42 µg/l. The estimated dissolved zinc concentration (112 µg/l) exceeds the screening level for zinc.

The 90th percentile value of the TMDL for the dissolved cadmium load at the mouth of Pine Creek is 0.771 pounds/day. This value was exceeded by the majority of the data points (Figure 5.2-7). The estimated value of 5.38 pounds/day is approximately seven times the 90th percentile TMDL for the dissolved cadmium load.

The 90th percentile TMDL for total lead (see previous comments on TMDL adjustment for lead) at the mouth of Pine Creek (1.13 pounds/day) was exceeded by the majority of the plotted measurements (Figure 5.2-8). The estimated total lead load at the mouth of Pine Creek is approximately 12 pounds/day. The estimated expected value exceeds by more than 10 times the 90th percentile value for Pine Creek.

As indicated on Figure 5.2-9, many measurements of dissolved zinc loading exceeded the 90th percentile TMDL (67.4 pounds/day) for the dissolved zinc load at the mouth of Pine Creek. A few of the measured values exceeded 10 times the 90th percentile TMDL for zinc. The estimated zinc load at PC305 (90.2 pounds/day) exceeds the 90th percentile TMDL.

Figures similar to Figures 5.2-4 to 5.2-9 were developed for each of the three sampling locations. The results of these and additional analyses are presented in Appendix C. Data in Appendix C were used to compute estimated expected values and coefficients of variation for dissolved and total zinc, lead, and cadmium concentrations and loads in the two reaches of Pine Creek and the East Fork. The resulting computations are presented in Tables 5.2-3 to 5.2-8. The calculations were performed in the same manner as described in the discharge section (Section 5.2.1).

The expected values of dissolved and total zinc concentrations and loads were relatively high, especially dissolved and total concentrations, at the first sampling location (PC307). Total and dissolved concentrations decrease in the last reach. Dissolved and total loads increase in the last reach. These trends are discussed reach by reach within the segments.

Dissolved and total lead concentrations decrease in the last reach. Dissolved and total lead loads decrease in the first reach and increase in the last reach. Changes in the estimated concentrations and loadings are further discussed in the reach by reach evaluation.

Estimated values of dissolved and total cadmium concentrations increase in the first reach and decrease in the second reach. Conversely, estimated values of dissolved and total cadmium loads decrease in the first reach and increase in the second reach. Estimated dissolved and total cadmium concentrations and loads are discussed in the reach by reach analysis.

5.2.2.1.1 Segment PineCrkSeg01. Segment PineCrkSeg01 comprises the East Fork and tributaries. This segment contains most of the potential source areas in the watershed. Concentrations of dissolved metals exceed screening levels by up to approximately 10-fold at the downstream portion of this segment. Zinc loading occurs on the order of tens of pounds per day. Excavation and removal of mining wastes on BLM lands have taken place in this segment. The excavated material was relocated to the Central Impoundment Area near Kellogg. At several of the mines and mills where work was performed by the BLM, mining wastes remain on private land. At certain locations, these remaining mining wastes are being eroded to the creek during high flow or are in imminent danger of being eroded.

Two sampling locations (PC307 and PC308) lying within this segment were analyzed probabilistically. These sampling locations are situated on the East Fork at the confluences of Highland Creek (PC307) and Denver Creek (PC308) with the East Fork.

At PC307, dissolved zinc concentrations (estimated value of approximately 974 µg/l) already exceed screening levels for dissolved zinc in surface waters (42 µg/l) by 23-fold. Estimated dissolved zinc loads at PC307 (approximately 26 pounds/day) do not exceed the 90th percentile TMDL for dissolved zinc loads (67.4 pounds/day at the mouth of Pine Creek).

At PC307, the estimated value of the total lead concentration (4.5 µg/l) is lower than the corresponding screening level (15 µg/l). The total estimated lead load at PC307 (approximately 0.2 pounds/day) does not exceed the 90th percentile TMDL for lead (1.13 pounds/day).

The estimated value of the dissolved cadmium concentration (approximately 2.6 µg/l) at PC307 exceeded the screening level for dissolved cadmium (0.38 µg/l). The estimated value for the dissolved cadmium load (approximately 0.07 pounds/day) did not exceed the 90th percentile TMDL (0.771 pounds/day) for the dissolved cadmium load at the mouth of Pine Creek.

Accordingly, upstream sources contribute metal concentrations and loads at PC307 that exceed screening levels but do not exceed the corresponding loading capacities at the mouth of Pine Creek. Potential contributors to metal concentrations and loadings observed at PC307 include the Constitution Mine Complex, the Owl/Fred Mine, the Douglas Mine Tailings and the Star Antimony Adit and Rock Dump.

Zinc, lead, and cadmium behaved similarly within this reach (between PC307 and PC308) in that, for all three metals, dissolved and total metal concentrations increased while loads decreased. Dissolved zinc concentrations increased dramatically (by approximately 3,400 µg/l). The decreased metal load is commensurate with the decreased discharge. Discharge decreased by an

estimated 4.8 cfs in this reach falling from an estimated 5.6 to 0.8 cfs. The percentage decrease in discharge is greater than the percentage increase in concentration, which resulted in decreased loading. The Denver Mine adit, the Pittsburgh Mine, and the Hilarity Mine are potential contributors to the dramatically increased concentrations within this reach.

Based on modeling results, the percentages of zinc, lead, and cadmium loads thought to be in the dissolved phase are, approximately, 100 percent, 50 percent, and 100 percent, respectively, at the last sampling location (PC308) within this segment.

Estimated total loads contributed by segment PineCrkSeg01 are minimally (downstream to PC308) thought to be approximately 18.5 pounds/day (zinc), approximately 0.04 pounds/day (lead), and approximately 0.05 pounds/day (cadmium).

5.2.2.1.2 Segment PineCrkSeg02. Segment PineCrkSeg02 includes upper Pine Creek and tributaries. No tailings deposits are found in this segment but a number of potential sources exist. Releases of metals to the creek are minimal and only minimal impacts from this segment are anticipated.

5.2.2.1.3 Segment PineCrkSeg03. Segment PineCrkSeg03 of the Pine Creek watershed includes lower Pine Creek from its confluence with the East Fork to the South Fork Coeur d'Alene River to its mouth. There are a number of potential sources of mining wastes. As with segment PineCrkSeg01, some excavation and waste removals have occurred; however, some removals from BLM land did not include adjacent private land, and waste remains in place with threat of ongoing erosion to the creek. Concentrations of dissolved metals are lower in this segment of Pine Creek than in segment PineCrkSeg01 and loading from this segment to the South Fork of the Coeur d'Alene River is approximately the same as loading at the upper end of this segment.

Between PC308 in segment PineCrkSeg01 and PC305 in segment PineCrkSeg03, estimated dissolved zinc, lead and cadmium concentrations decreased while dissolved and total loads for these same elements increased. For example, dissolved zinc concentrations decreased by an estimated 4,300 μg/l while the estimated dissolved zinc load increased by approximately 72 pounds/day. Discharge in this reach increased by over 200 cfs. Several tributary creeks, including Pine Creek, contribute to the increased discharge. The significant increase in discharge results in increased loading and decreased concentrations. Water contributing to the loading (e.g., from upper Pine Creek) has lower metal concentrations and fewer potential sources than water from the East Fork.

Estimated total lead concentrations increased in this reach (between PC308 and PC305). Increased discharges appear to result in increased particulate loading. Because lead tends to associate strongly with the particulate phase, increased particulate loads bring about increased total lead concentrations. Potential sources in this reach contributing to the increased metal loading include the Nabob Mine complex, Denver Creek tailings pile, Liberal King tailings, the Matchless Mine, and the Coeur d'Alene Antimony Mine.

At the mouth of Pine Creek (PC305), the estimated dissolved zinc concentration exceeds the screening level of 42 µg/l. The estimated dissolved cadmium concentration of approximately 0.54 µg/l is slightly above the screening level of 0.38 µg/l. Dissolved zinc and cadmium loads and the total lead load surpass their corresponding 90th percentile TMDLs.

Probabilistic modeling indicates that the estimated percentages of the total metal loads found in the dissolved form are 92 percent dissolved for zinc, 44 percent dissolved for lead, and 93 percent dissolved for cadmium (Appendix C). The USGS had suggested (Woods 2000) that the total lead may be underestimated because of improper sampling techniques.

5.2.2.1.4 Concentrations Versus Discharge. The following discussion is based on evaluation of probabilistic modeling data for the mouth of Pine Creek (PC305) (Appendix C). There is an increase in dissolved zinc concentrations with increased discharge that is significant at $\alpha = < 0.003$ (α is the probability the correlation is due to chance). Increased zinc concentration with increased discharge is atypical for zinc. As one would expect, given that the majority of the zinc is in the dissolved phase, there is also an increase in total zinc concentrations with increased discharge rates ($\alpha = < 0.0005$). Total lead concentrations increased with increasing discharge ($\alpha < 0.03$). Similarly to zinc, estimated values of dissolved ($\alpha < 0.0001$) cadmium concentrations also indicated increased concentrations with increased discharge at the mouth of Pine Creek.

The regressions permit estimation of dissolved zinc, lead, and cadmium concentrations at various discharge rates. Similar regressions were developed at the other sampling locations. The remaining two sampling locations exhibit decreases in dissolved zinc and cadmium concentrations with increasing discharge rates (Appendix C). Estimated total lead concentrations increase when discharge increases. Increased total lead concentrations with increased discharge are a consequence of the correlation between discharge and suspended sediments and suspended sediments with lead.

5.3 SEDIMENT FATE AND TRANSPORT

Sediment transport processes were discussed in detail in Section 3. Brief summaries of sediment transport processes active in the watershed are presented in this section, followed by descriptions of sediment sources and transport processes observed in each segment.

5.3.1 Sediment Transport Processes

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movement incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing exposes soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling, sliding or hopping on the channel bed (Dunne and Leopold 1978).

Sediment transport (particulate metal loading) occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et al 1992). High-flow periods usually occur in the spring as a result of precipitation and snowmelt but can occur in midwinter for the same reasons. Physical erosion of riverbanks and channels during high-flow events causes particulate forms of metals to reenter the river and be transported. There is a propensity for increased erosion during high-flow events and following high flow events when river banks are saturated and the river stage decreases and a propensity for sediment deposition as river stage decreases. Upon entering Pine Creek, dissolved and particulate metals are transported downstream. In general, where the creek widens into floodplains there is a tendency for surface water to discharge dissolved metals to groundwater and deposit suspended sediment onto the streambed.

As suspended or bedload particles are transported by the river system, there is a possibility that metals will desorb from the sediments and enter the river in the dissolved phase. Furthermore, metals may enter the river from riverbank porewater. During high flow events, riverbanks and adjacent floodplain areas store water. The stored pore water can increase in concentration as metals desorb from sediments or as precipitated solid phases and minerals dissolve. As the waters subside, these dissolved metals reenter the river system and are transported.

Sediment derived in Pine Creek is transported to the South Fork. Likely sediment sources in Pine Creek include mining wastes and tailings, rock debris situated adjacent to channels, mobilization of channel bed sediment, and bank erosion. Based on USGS sediment transport and stream discharge data, approximately 2,900 tons of sediment was transported past the USGS gage station on Pine Creek during water year 1999. With a drainage area of approximately 77 square miles, the total suspended sediment yield for water year 1999 was approximately 12 tons per year per square mile. Of that, approximately 7 tons was sand and 5 tons was fines. A total of approximately 900 tons of suspended sediment was transported past the Pine Creek gage in water year 1999. Annual bedload sediment yield was approximately 26 tons per year per square mile for Pine Creek in water year 1999 for a total of about 2,000 tons.

Suspended sediment and bedload samples were not analyzed for total metals; therefore mass loading was estimated from total and dissolved surface water data as described in Section 5.2.

5.3.2 Segment Descriptions

Segment PineCrkSeg01 has approximately 28,000 feet (5.3 miles) of mapped channel. Through this section, Pine Creek flows through a valley bottom typically 200 to 300 feet wide. In areas, the channel appears to be confined by hillslopes. Channel slope varies from 1 to 8 percent. In general the valley bottom is unvegetated and consists of river gravel. Evidence of relict channels and migration are abundant through this segment. Several cuts, mines and tailings deposits are situated adjacent to the channel within this segment. Likely sediment sources in this segment are apparently from the cuts, mines, and tailings deposits, lateral migration, and channel bed remobilization. Metals concentrations in soil and sediment samples exceeded screening levels for eight of the ten COPCs. Concentrations of arsenic, lead, and zinc exceeded 10x the screening level.

Segment PineCrkSeg2 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork. Aerial photographs were not available for review of this segment; therefore, detailed channel descriptions were not generated for this report. The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped

prospects or mines. No tailings deposits are present and this segment is thought not to be a significant contributor of mine-waste impacted sediment to the Pine Creek Watershed. The BLM has excavated and removed mining wastes in this segment.

Segment PineCrkSeg03 has approximately 27,000 feet (5.1 miles) of mapped channel. Channel slope ranges from 0.5 to 1.5 percent. Likely sediment sources in segment PineCrkSeg03 are mine tailings and wastes, channel bed remobilization, minor bank erosion, lateral migration and possibly rock debris piles adjacent to the stream. Soil and sediment metals concentrations exceeded screening levels, especially cadmium, lead, and zinc. Metals concentrations in soil and sediment samples exceeded screening levels for seven of the ten COPCs.

5.3.3 Summary of Sediment Transport

Approximately 2,900 tons of sediment was transported from Pine Creek to the South Fork in water year 1999. Sediment sources occur in segments PineCrkSeg01 and PineCrkSeg03 and include channel bed remobilization, mine tailings and wastes, minor bank erosion, lateral migration and rock debris piles adjacent to the stream. Though suspended and bedload sediment samples were not collected and analyzed for metals, suspended and bedload sediment concentrations may be represented by metals concentrations reported for soil and sediment samples collected in Pine Creek. As presented in Section 4.1, Nature and Extent, metals concentrations in soil and sediment samples exceeded screening levels, especially for antimony, arsenic, cadmium, lead, and zinc.

5.4 SUMMARY OF FATE AND TRANSPORT IN PINE CREEK

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading to Pine Creek. Sediment transport was evaluated using USGS suspended and bedload sediment discharge data and measured soil and sediment data. Results are summarized in this section.

Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal PDFs at three separate sampling locations in Pine Creek. The data were also standardized location by location and PDFs were developed from the aggregated data for Pine Creek as a whole. Only results for cadmium, lead, and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends in concentrations and mass loading with changing discharge rates. The percentages of

dissolved and particulate forms of metals were computed from the estimated expected values predicted by the model.

Results of the probabilistic modeling indicate:

- The screening level for dissolved zinc (42 µg/l) is exceeded at all three sampling locations. At sampling location PC308, the estimated expected dissolved concentration exceeded the screening level by more than 100-fold. The 90th percentile TMDL for dissolved zinc loads (67.4 pounds/day) is exceeded at sampling locations PC308 and PC305.

- The screening level for total lead concentrations is not exceeded at any of the sampling locations. The total lead load exceeds the lead TMDL at sampling location PC305, located at the mouth of Pine Creek.

- The screening level for dissolved cadmium was exceeded at all three sampling locations. The estimated cadmium load exceeded the 90th percentile TMDL for dissolved cadmium loads at the mouth of Pine Creek.

- Dissolved zinc and cadmium and total lead concentrations increased with increasing discharge.

- Potential major source areas identified in each reach are listed in Table 5.4-1. Time-critical removal actions conducted by the Bureau of Land Management (BLM) in 1996-1997 include removal of tailings from Amy-Matchless millsite, Liberal King millsite, and the Denver tailings. Additional actions have been proposed or are ongoing at the Amy-Matchless millsite, the Liberal King millsite, the Nabob millsite, the Denver Creek tailings, the Sidney millsite (on Red Cloud Creek), the Highland Surprise millsite, and the Upper Constitution millsite (BLM 1998).

Rehabilitation has been conducted or is ongoing at the major potential metals loading sources. Monitoring should be conducted to assess the effectiveness of the removal actions; therefore, no sites have been identified for detailed analysis/mapping in the FS at this time.

To illustrate the observed trends of estimated expected values throughout the watershed, estimated expected values for cadmium, lead, and zinc concentrations and mass loading are shown in Figures 5.4-1 through 5.4-6. To illustrate the relationship between discharge, concentration, and

mass loading, estimated expected values for these variables at each sampling location are plotted together for cadmium, lead, and zinc in Figures 5.4-7 through 5.4-9, respectively.

Bureau of Land Management (BLM). 1998. *Information Sheet No. 3 Pine Creek Mill Sites.* Executive Summary of the Final Engineering Evaluation/Cost Analysis Report. Shoshone County, Idaho. August 1998.

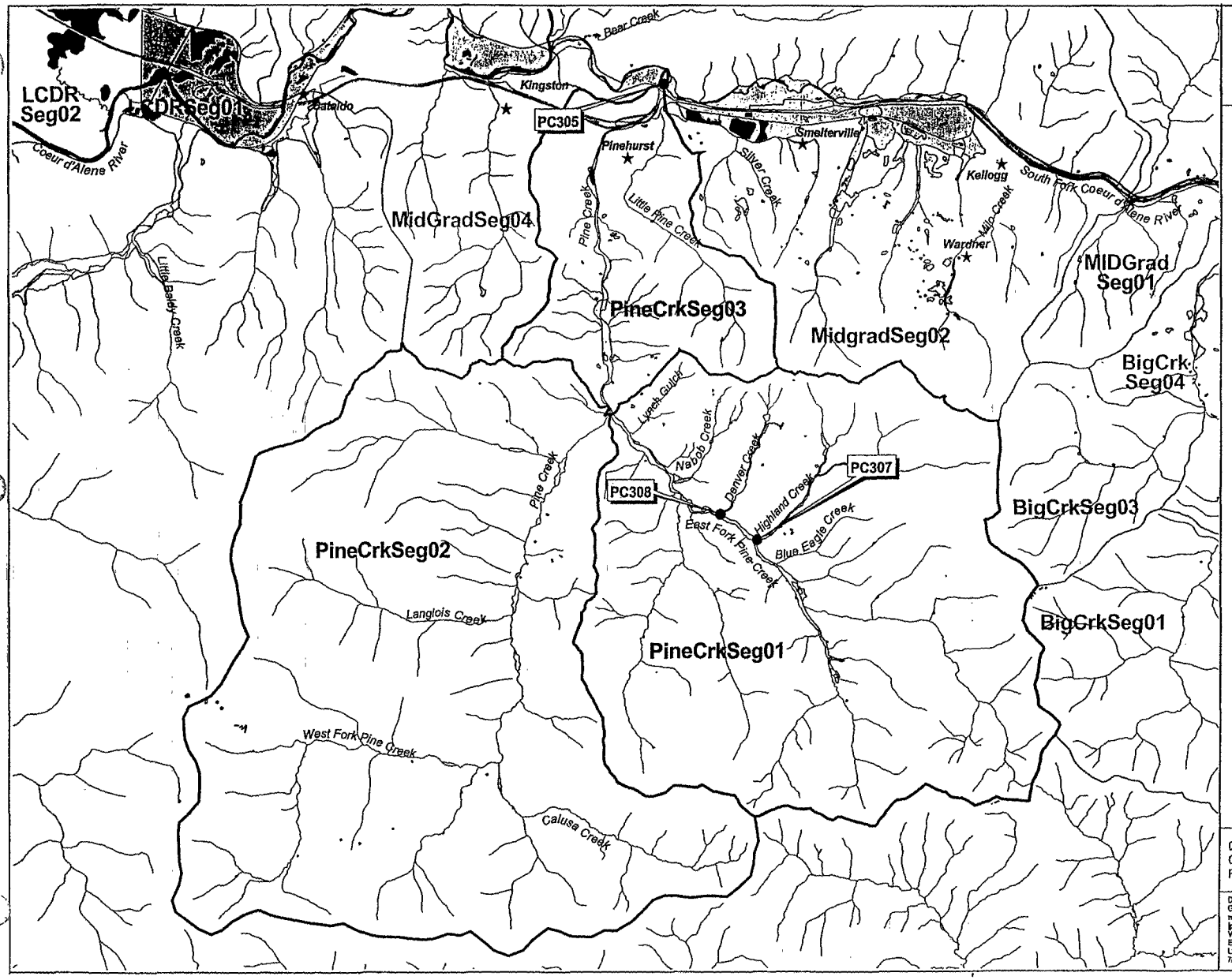
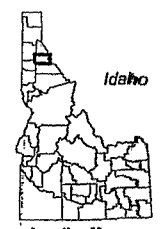


Figure 5.2-1
Pine Creek Watershed
Sampling Locations Evaluated in Probabilistic Modeling

LEGEND

- Sampling Location
- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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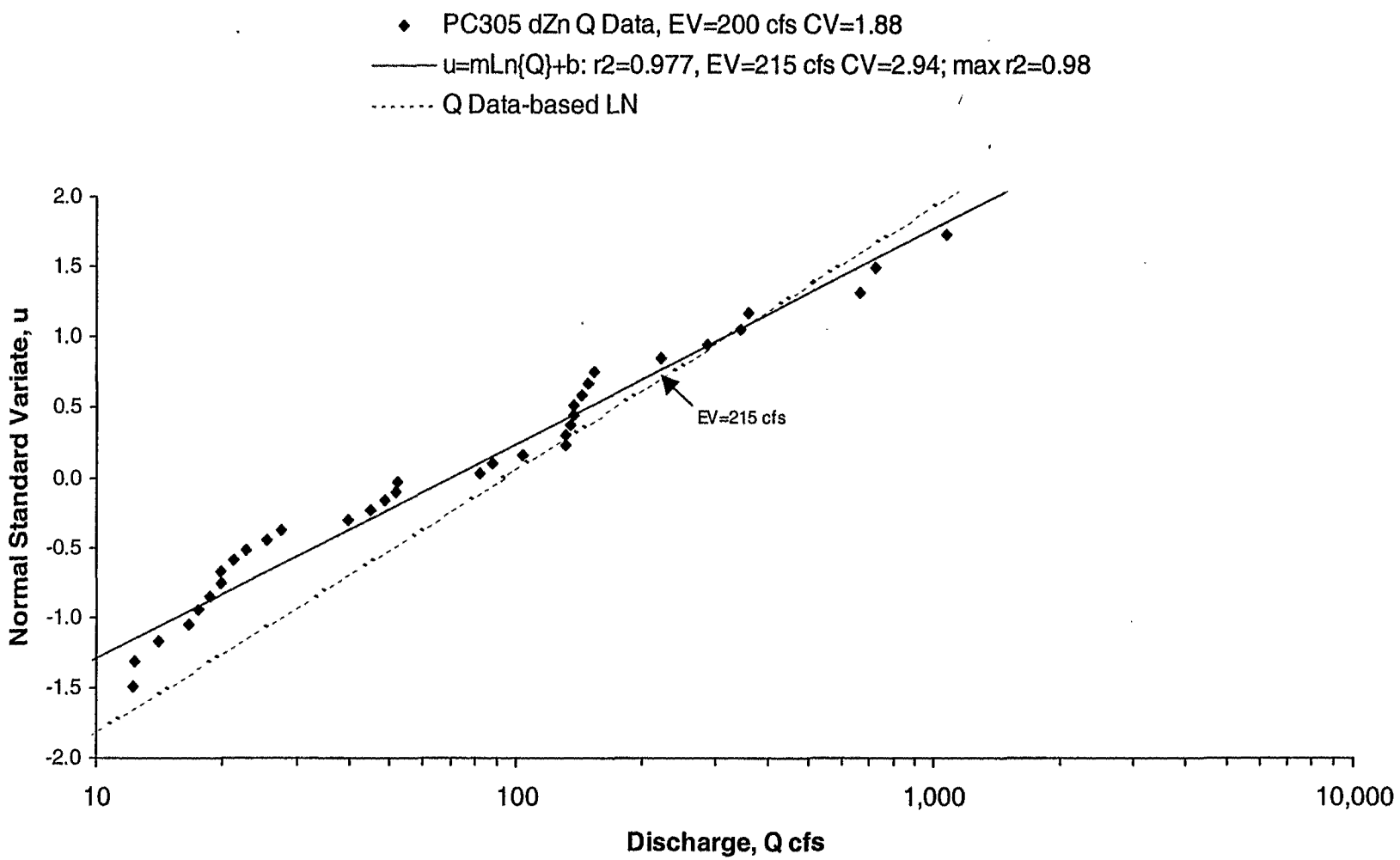
\pine_creek_ev7-13.apr
V:\Zn Mass Loading
E:\Zn
L: Final RI Sample Locate
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

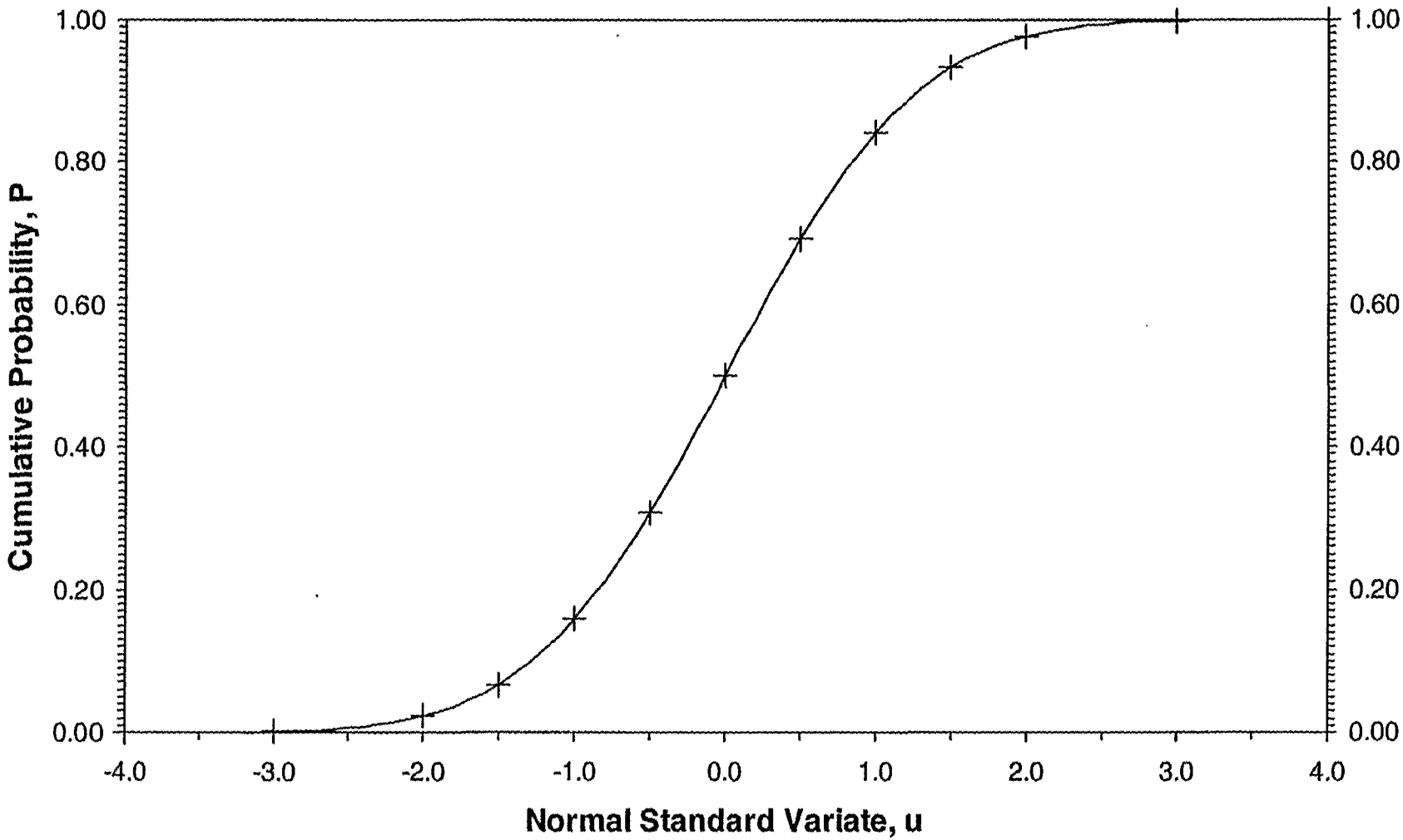
Date of Plot: JULY 13, 2001

Probabilistic Modeling Results for Discharge at PC305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-2

Cumulative Probability Values Corresponding to Normal Standard Variate Values



EPA REGION 10

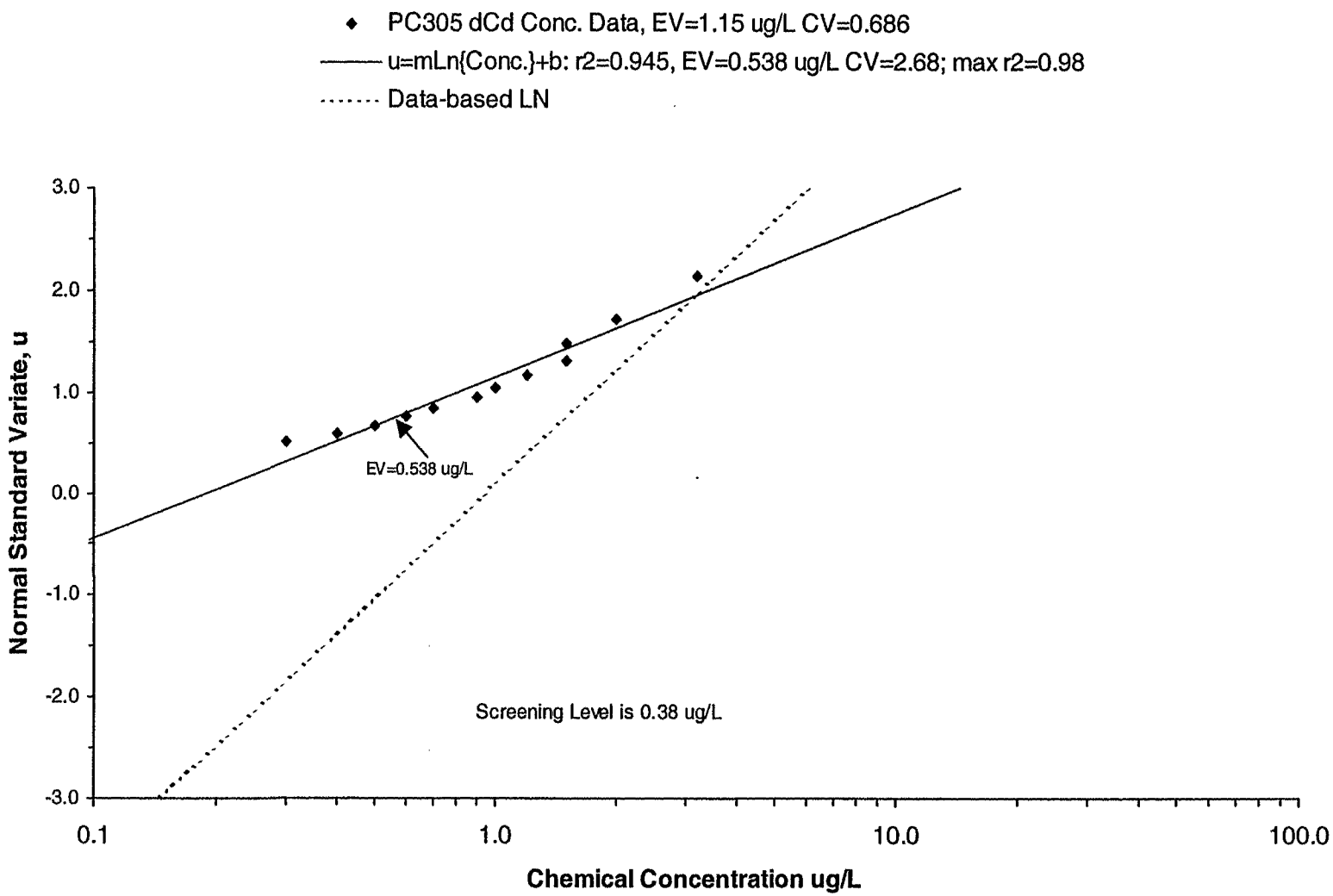
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

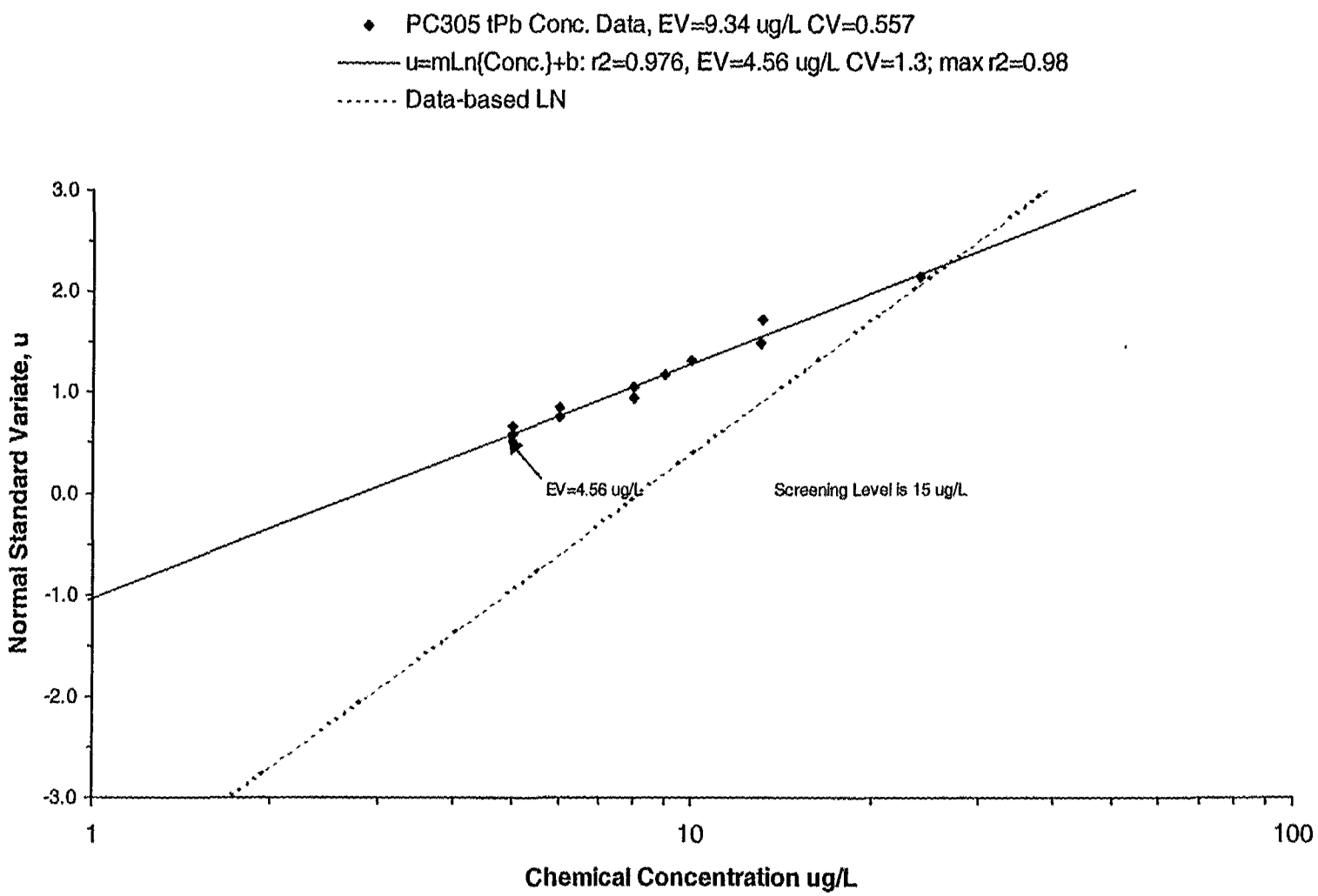
Figure 5.2-3

Probabilistic Modeling Results for Dissolved Cadmium Concentrations at PC305



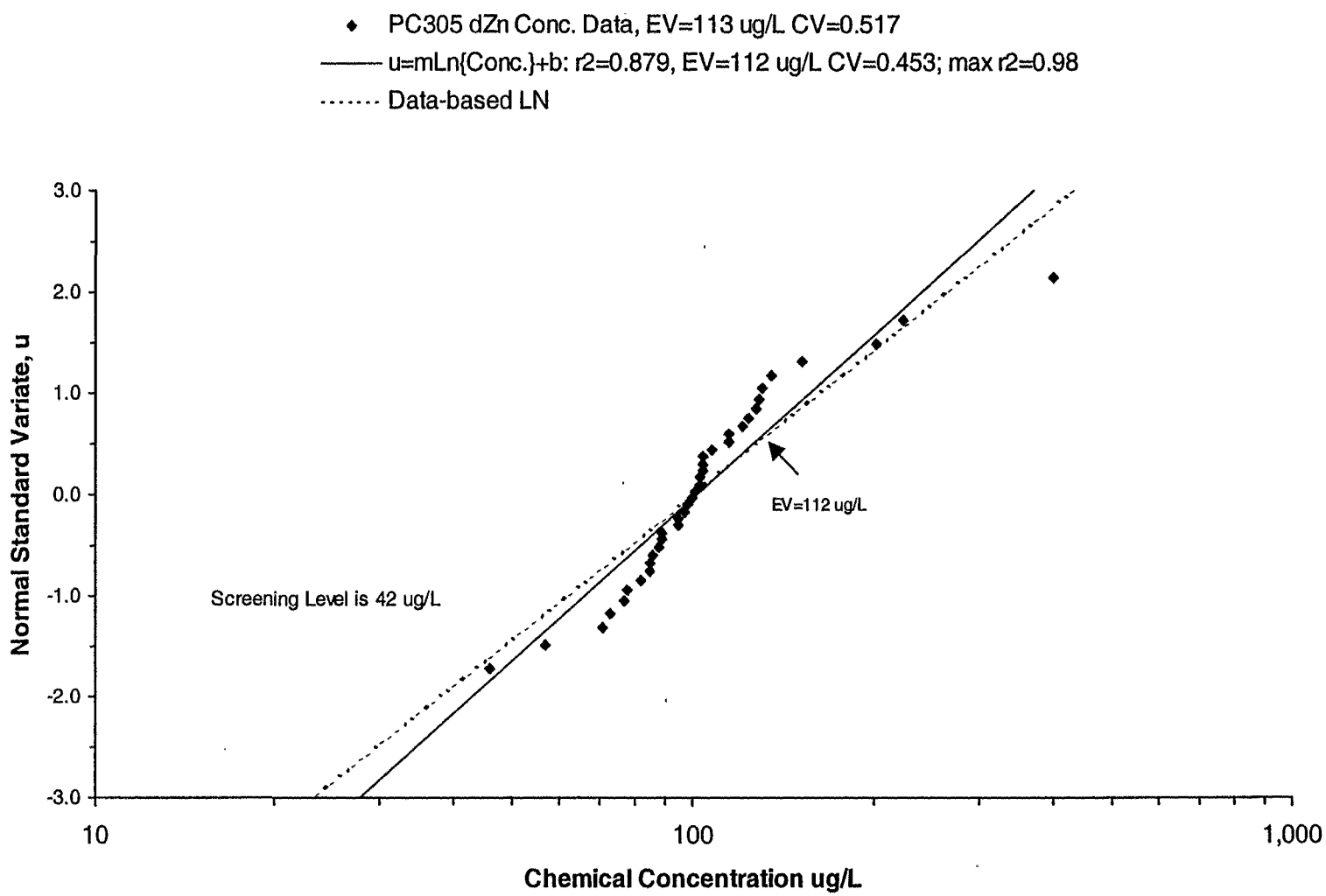
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-4

Probabilistic Modeling Results for Total Lead Concentrations at PC305



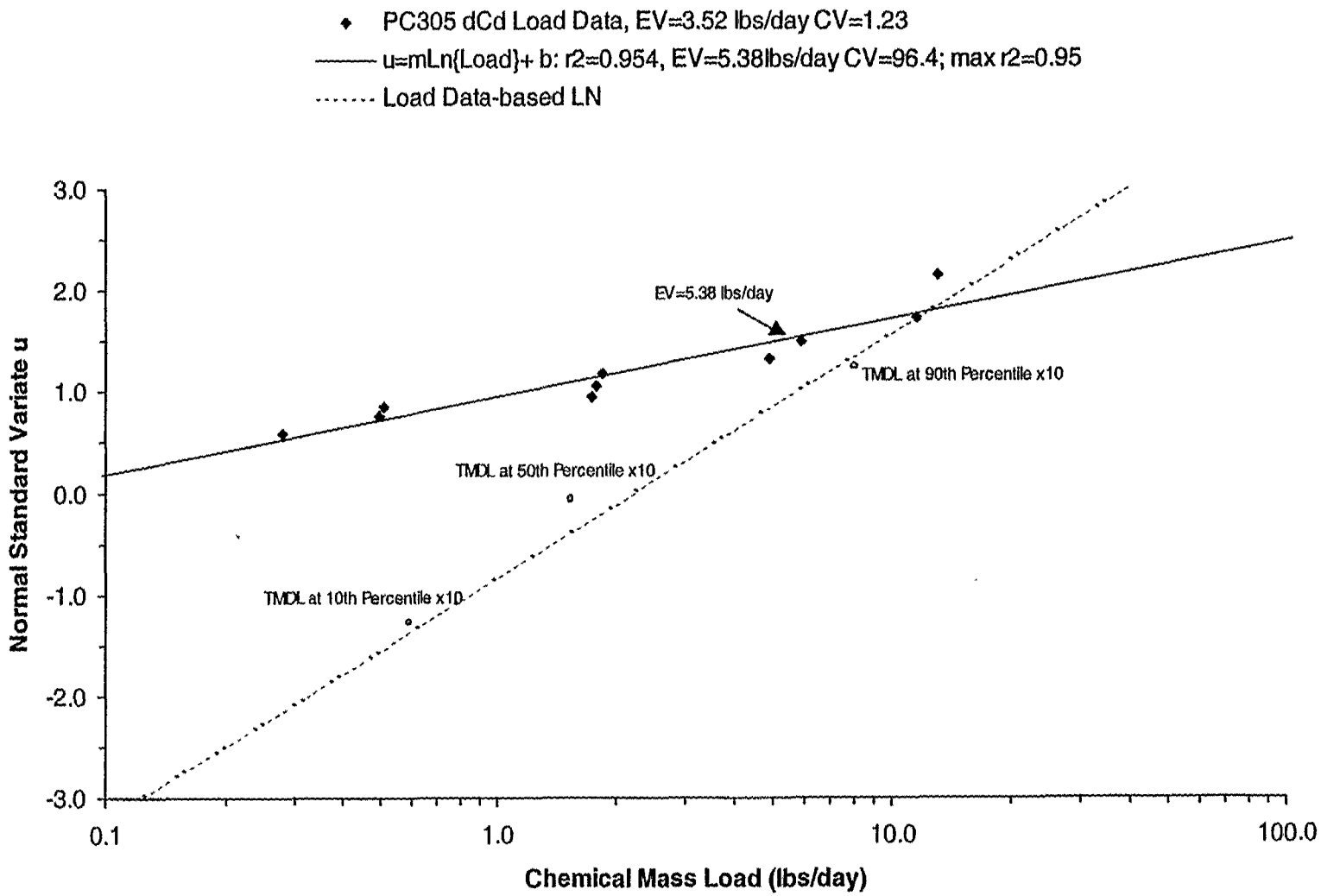
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-5

Probabilistic Modeling Results for Dissolved Zinc Concentrations at PC305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-6

Probabilistic Modeling Results for Dissolved Cadmium Mass Loading at PC305



EPA REGION

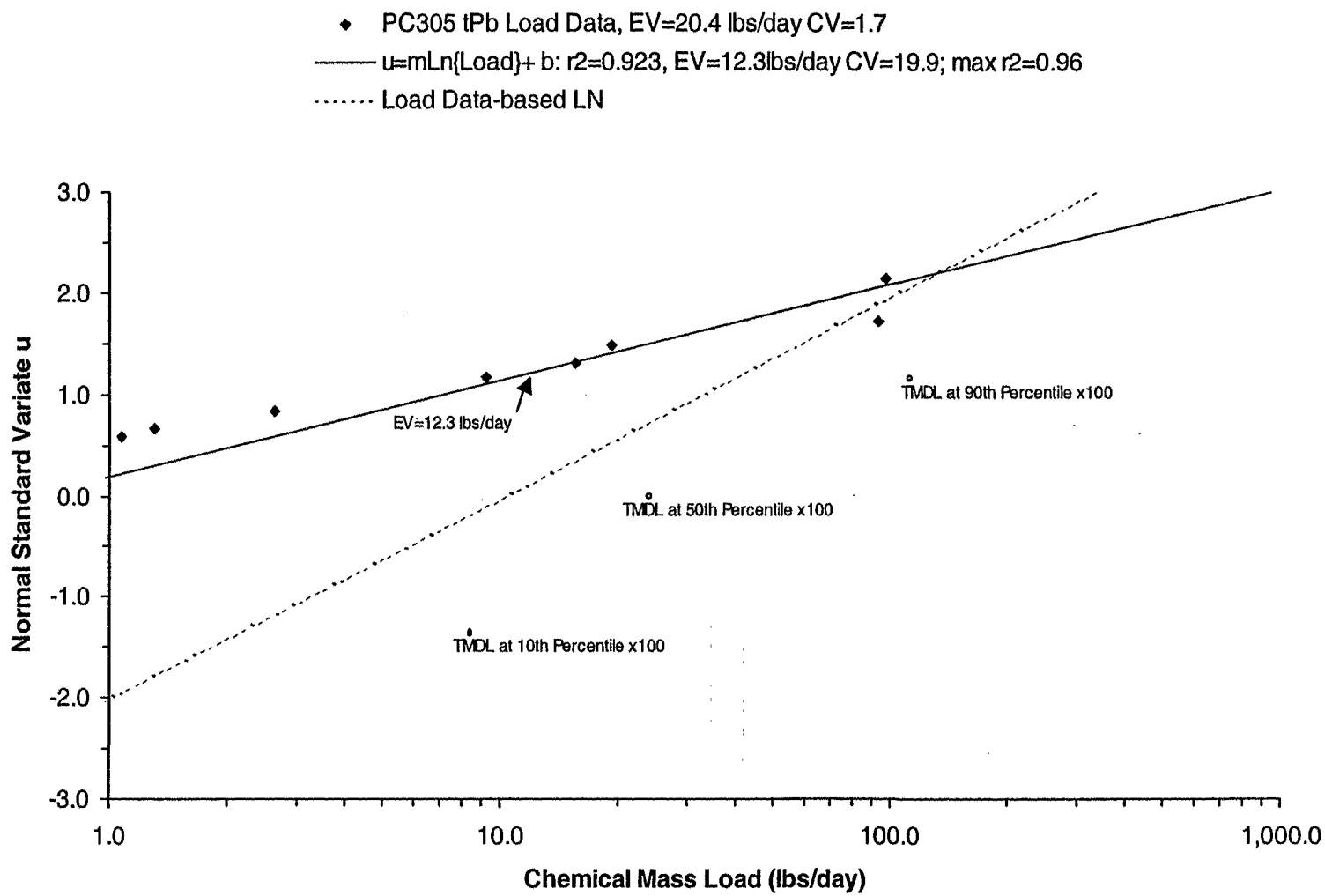
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

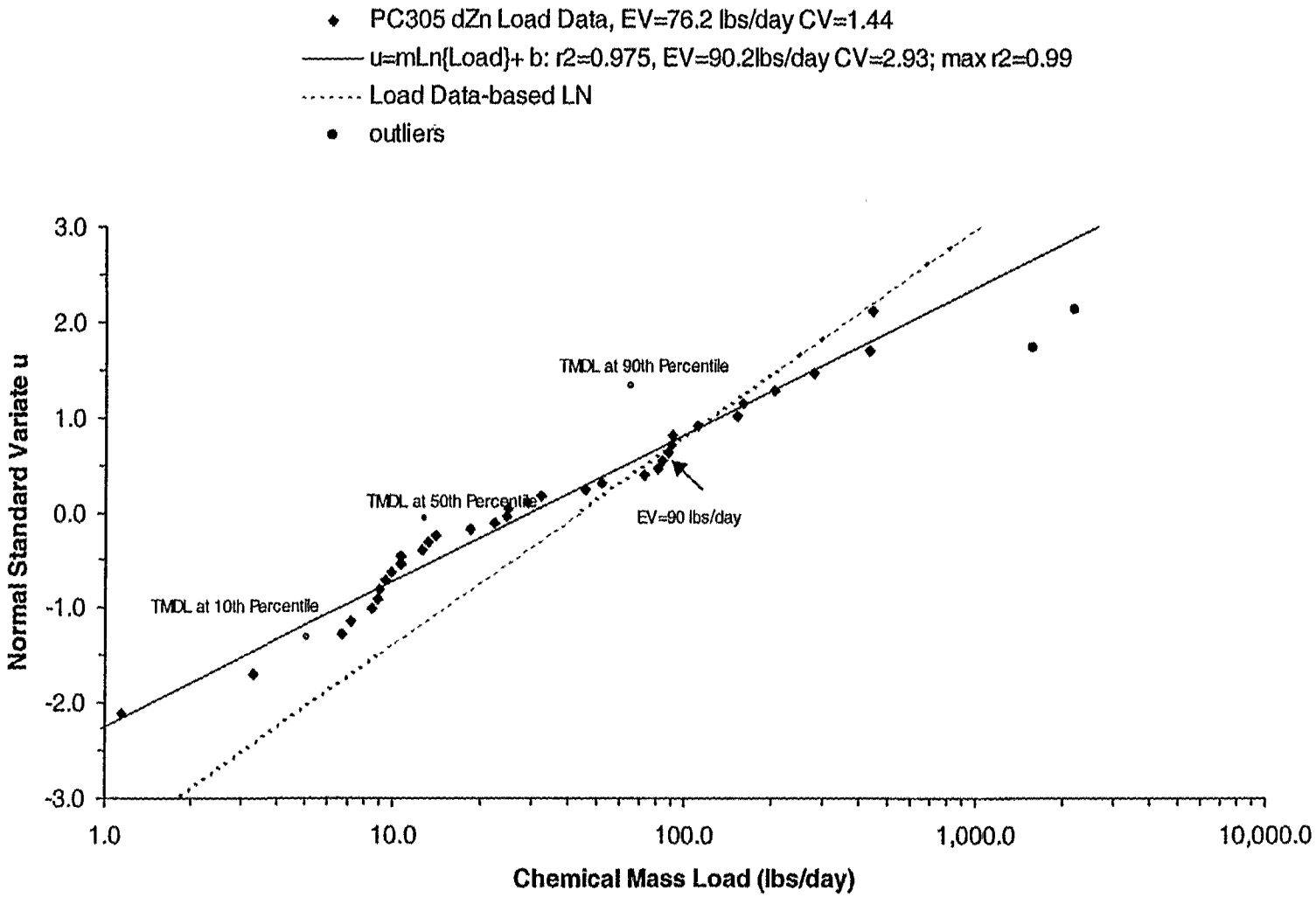
Figure 5.2-7

Probabilistic Modeling Results for Total Lead Mass Loading at PC305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-8

Probabilistic Modeling Results for Dissolved Zinc Mass Loading at PC305



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.2-9

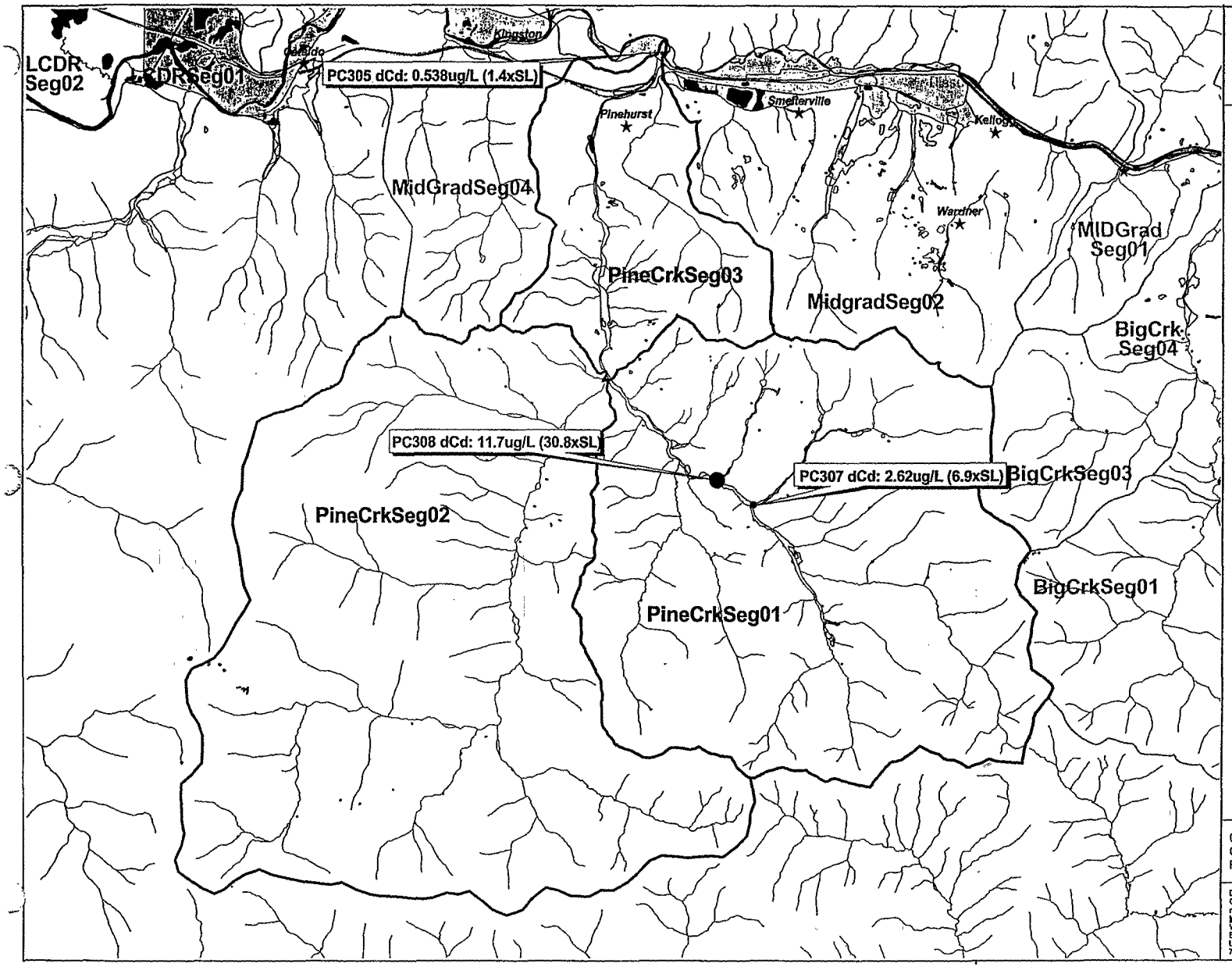


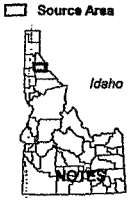
Figure 5.4-1
Pine Creek Watershed
Estimated Expected Values for
Dissolved Cadmium Concentrations

LEGEND

Sampling Location
Concentration
PC307 dCd: 2.62ug/L (6.9xSL)
Analyte
Screening Level is 0.38ug/L

Range of Dissolved Cadmium Concentrations in ug/L
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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V:dCd PC concentrations
E:dCd
L: Final RI dCd Concentrations
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone. North American Datum 1983

Date of Plot: July 17, 2001

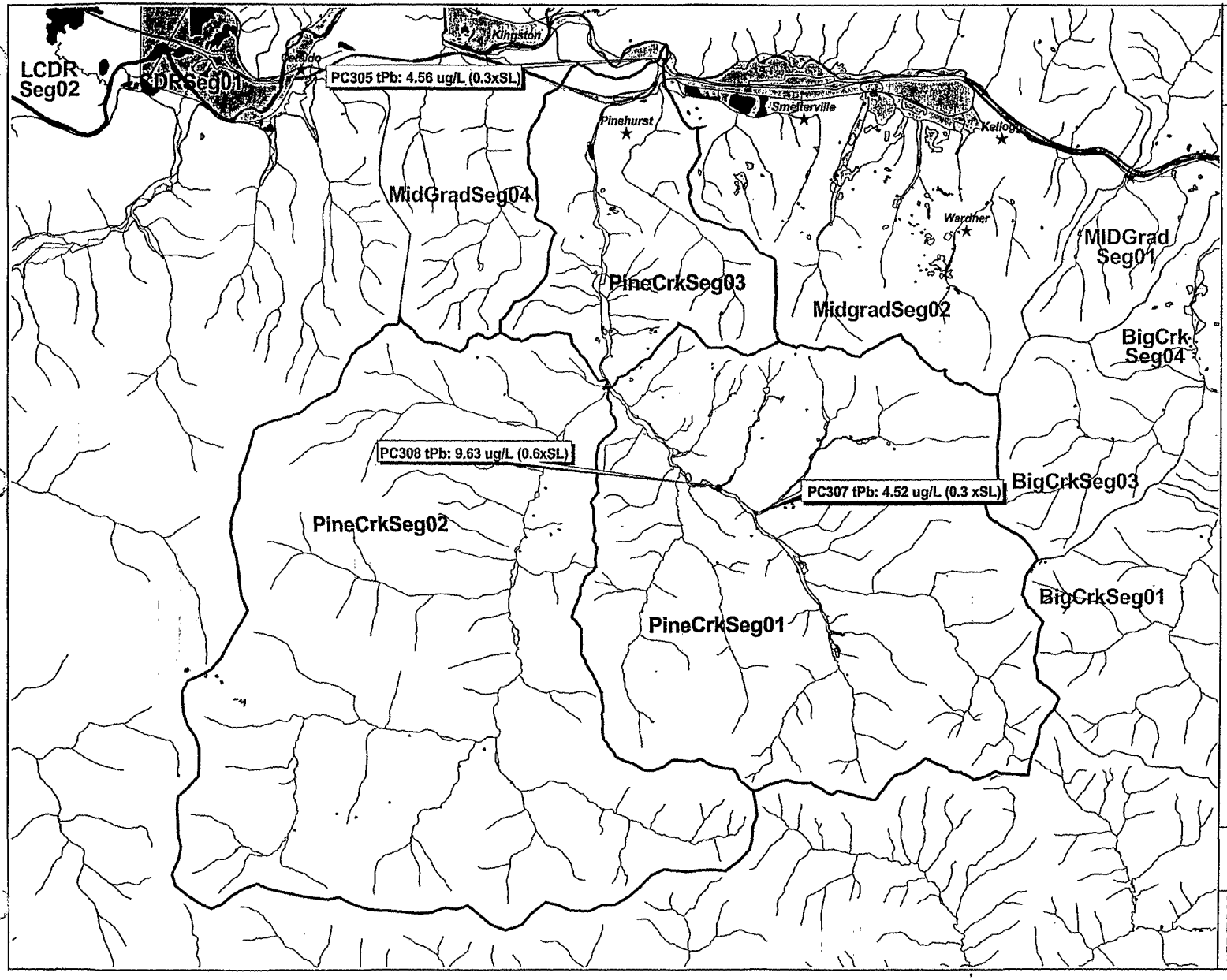

Figure 5.4-2
Pine Creek Watershed
Estimated Expected Values for
Total Lead Concentrations

LEGEND

Sampling Location — Concentration

PC307 tPb: 4.52ug/L (0.3xSL)

Analyte — Screening Level is 15 ug/L

Range of Total Lead Concentrations in ug/L

- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100
- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615.05.a
Generation 1
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pine_creek_ev7-13.apr
V:\Pb concentrations
E:\Pb
L:\ Final RI \Pb Concentrations
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Pict: July 16, 2001

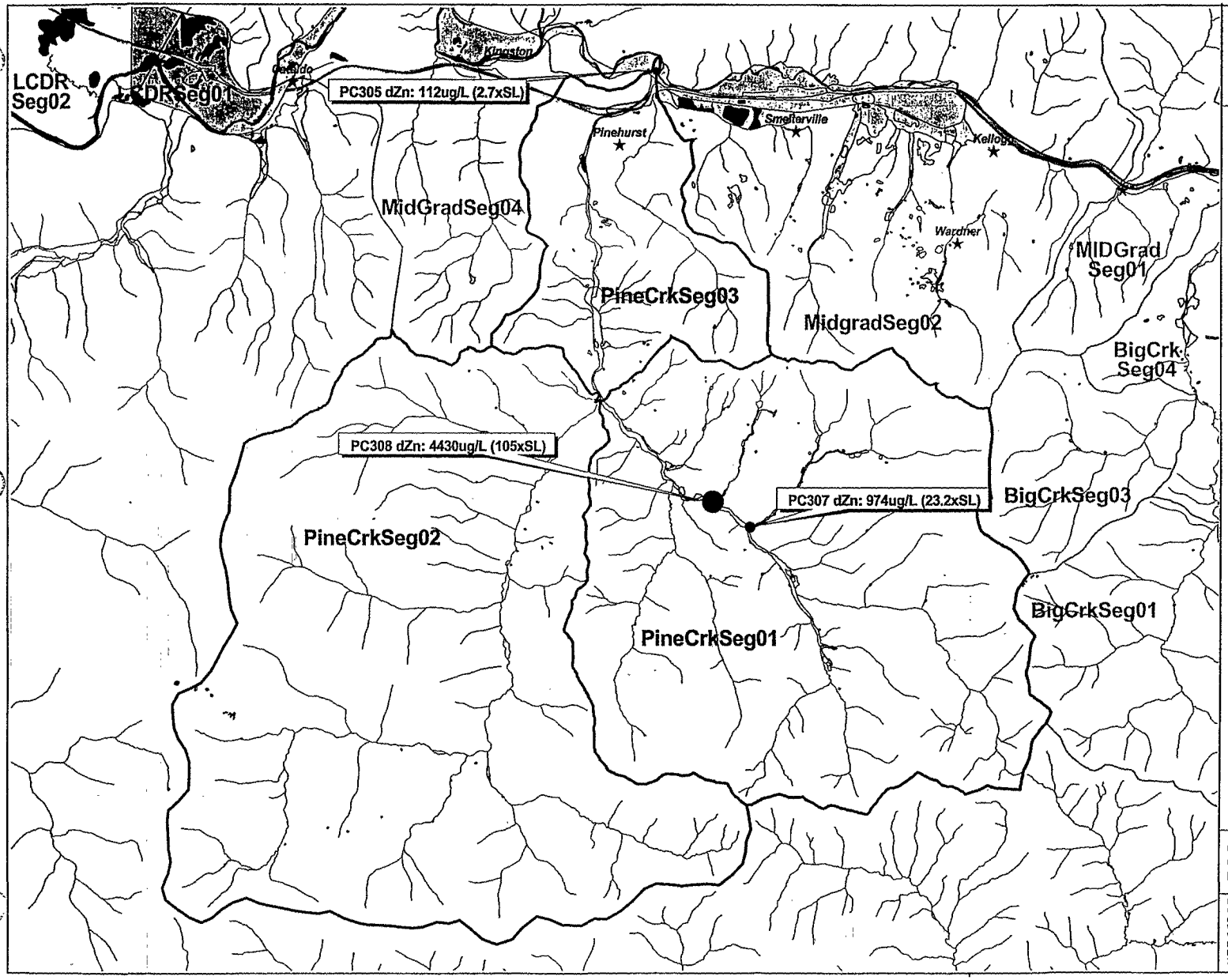

Figure 5.4-3
Pine Creek Watershed
Estimated Expected Values for Dissolved Zinc Concentrations

LEGEND

Sampling Location — Concentration

PC307 dZn: 974ug/L (23.2xSL)

Analyte — Screening Level is 42 ug/L

Range of Dissolved Zinc Concentrations in ug/L
- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

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N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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Generation 1
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Vn\dZn concentrations
E:\dZn
L: Final RI dZn concentrations
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

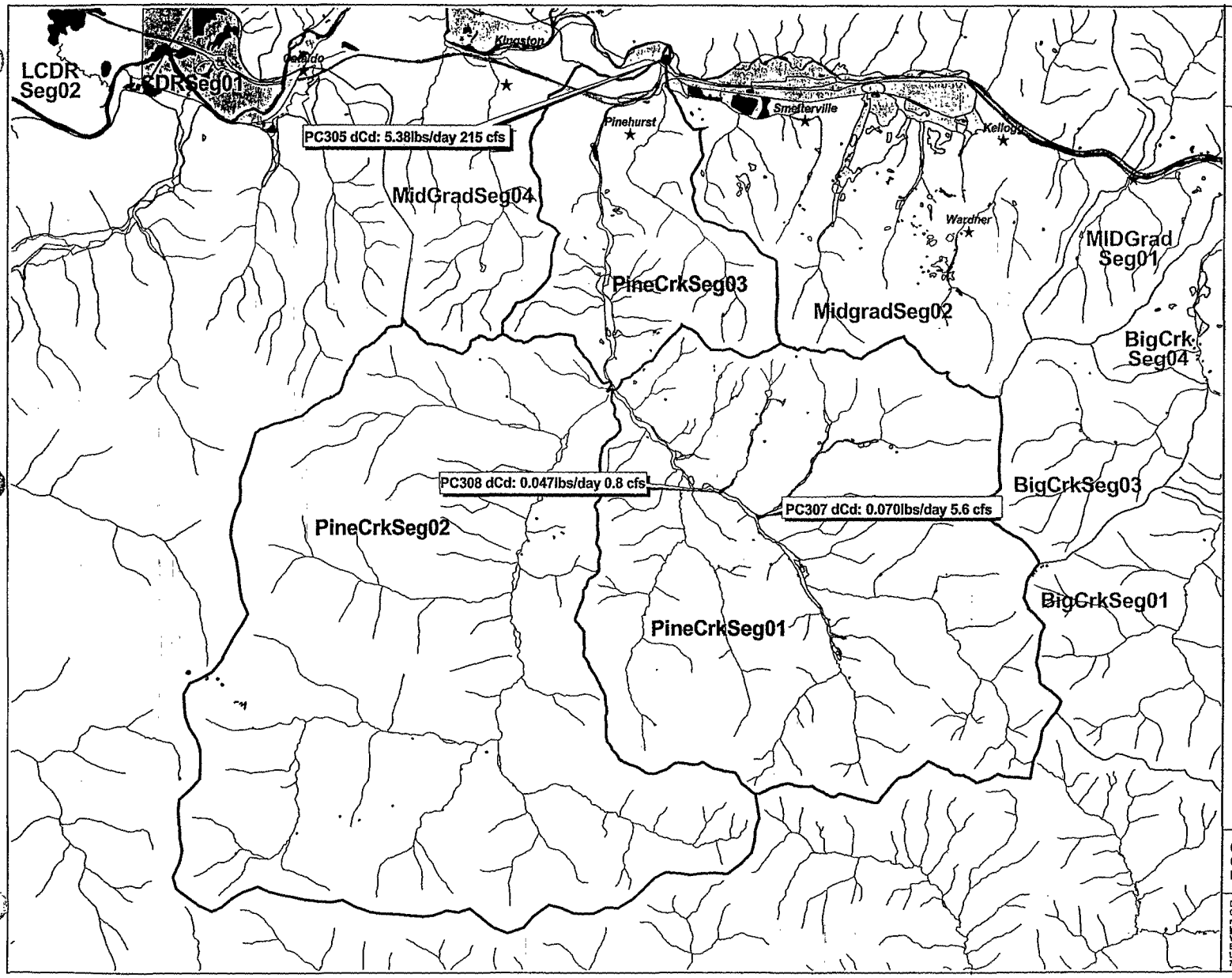

Figure 5.4-4
Pine Creek Watershed
Estimated Expected Values for
Dissolved Cadmium Mass Loading

LEGEND

Sampling Location
Mass Load
PC307 dCd: 0.1lbs/day 5.6 cfs
Analyte
Flow in Cubic Feet per Second

Range of Total Cadmium Mass Loading in lbs/day
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000
0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8615.05e
Generation 1
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pine_creek_ev7-13.apr
V:\Cd Mass Loading
E:\Cd
L: Final RI dCd Mass Loading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

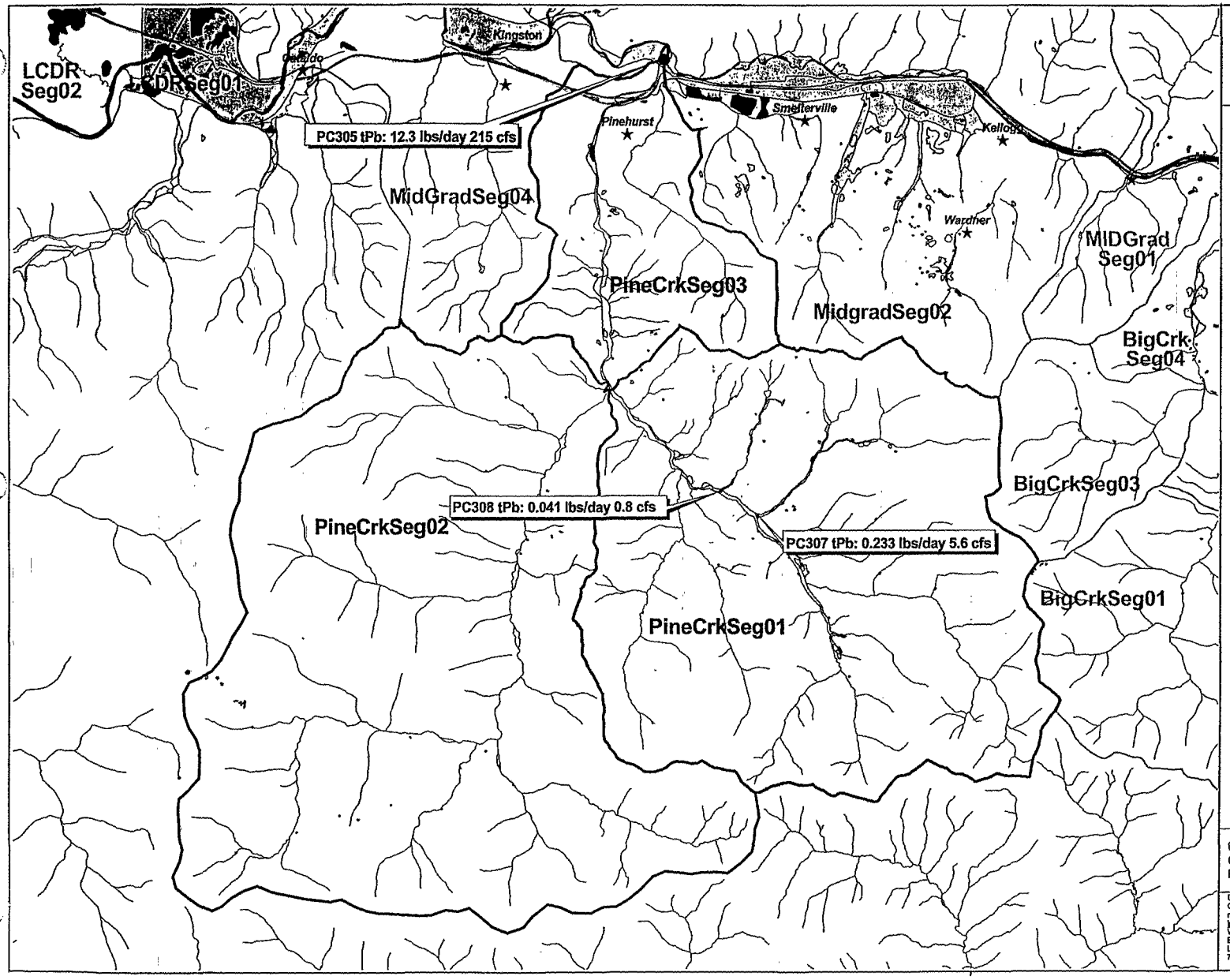

Figure 5.4-5
Pine Creek Watershed
Estimated Expected Values for
Total Lead Mass Loading

LEGEND

Sampling Location

Mass Load

PC307 tPb: 0.2lbs/day 5.6 cfs

Analyte

Flow measured in Cubic Feet per Second

Range of Total Lead Mass Loading in lbs/day

- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100

Stream

Interstate 90

City

Pine Creek Watershed

Pine Creek Segment

River Segment

Lake/River

Source Area

Location Map

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05e
Generation 1
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V:\Pb massloading
E:\Pb
L: Final RI \Pb Massloading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

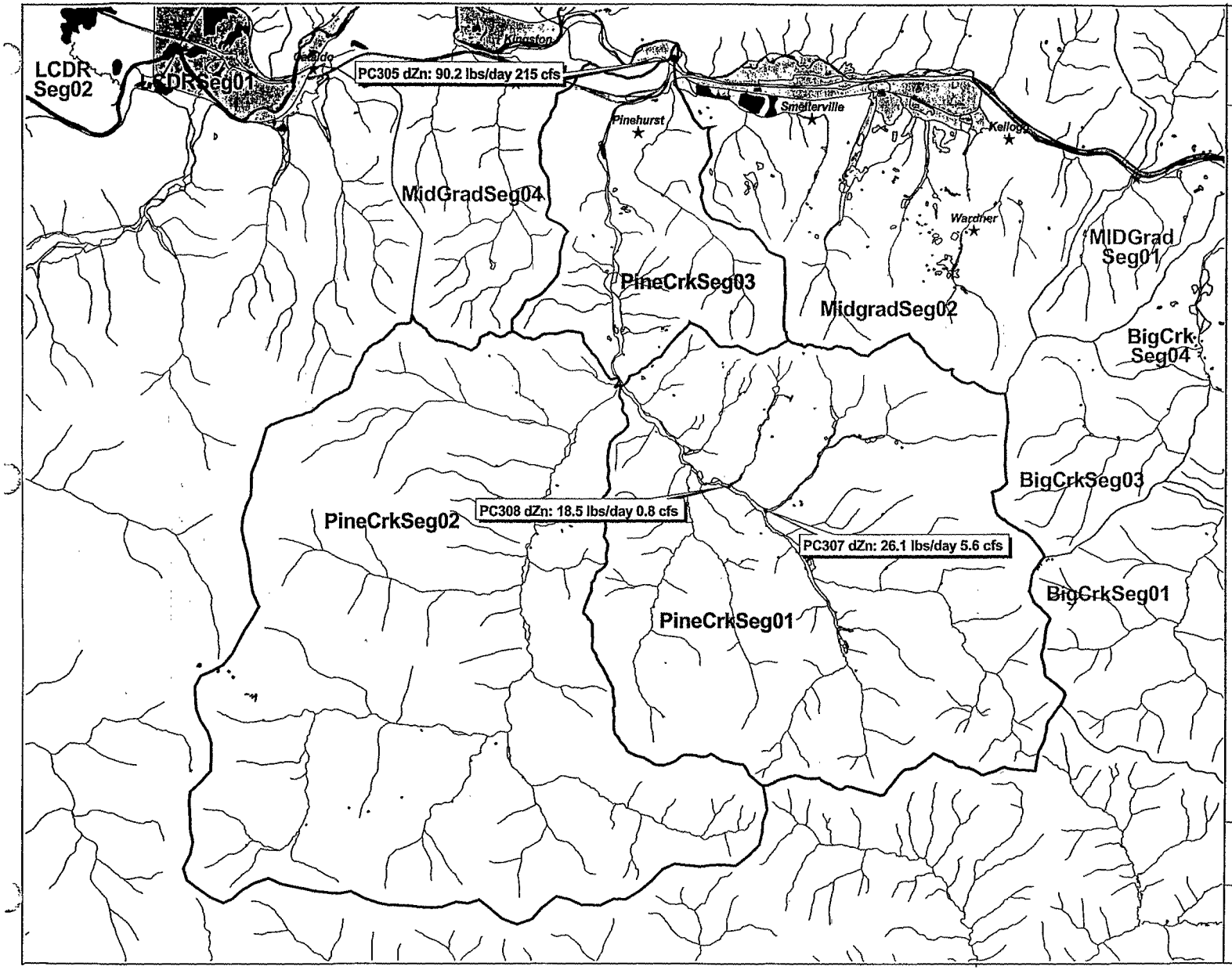


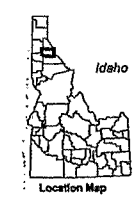
Figure 5.4-6
Pine Creek Watershed
Estimated Expected Values for
Dissolved Zinc Mass Loading

LEGEND

Sampling Location
Mass Load
PC307 dZn: 26.1lbs/day 5.6cfs
Analyte
Flow measured in Cubic Feet per Second

Range of Total Zinc Mass Loading in lbs/day
- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

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N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4182500.8615.05a
Generation 1
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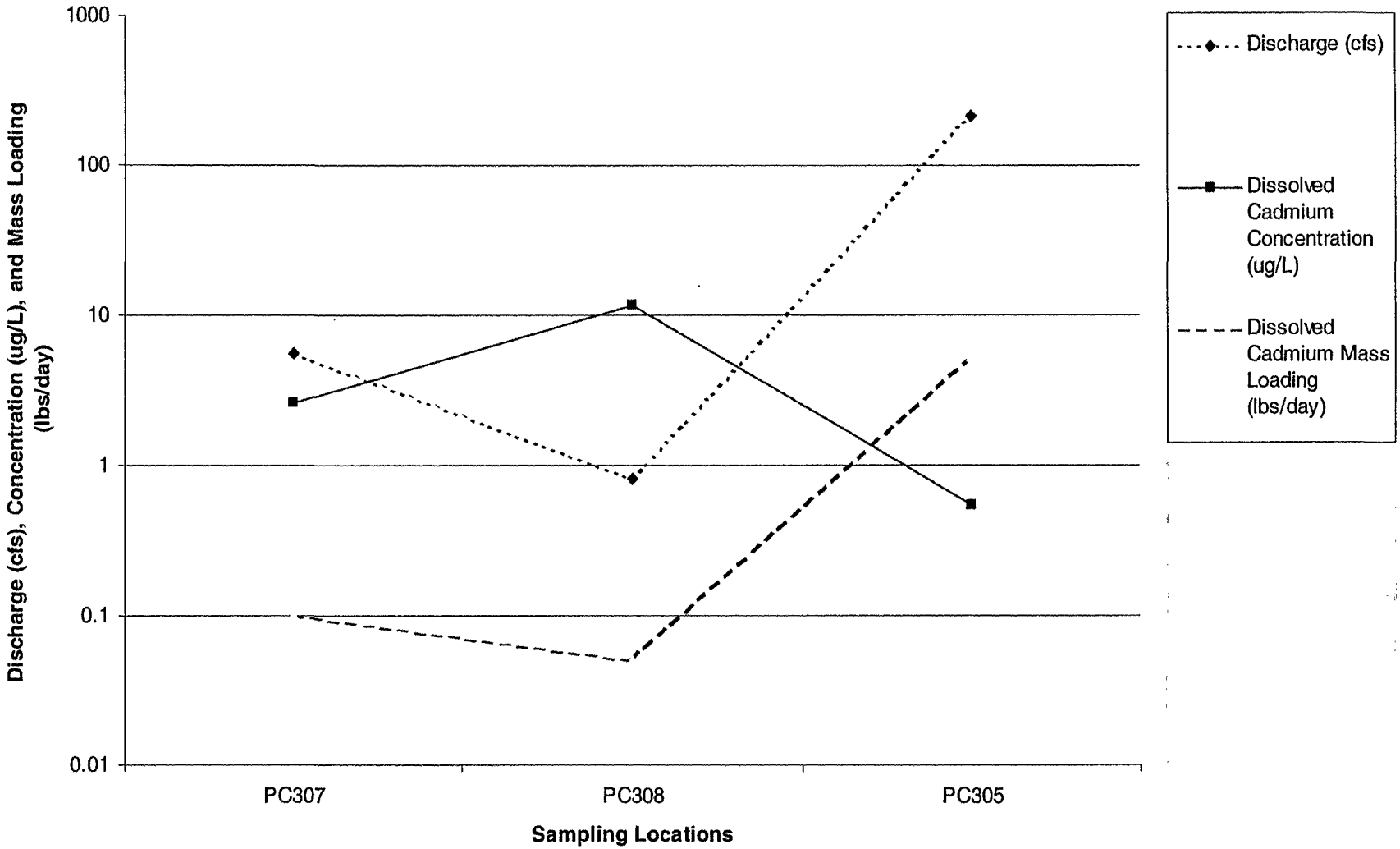
V:\Zn Mass Loading
E:\Zn
L: Final RI dZn Mass Loading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

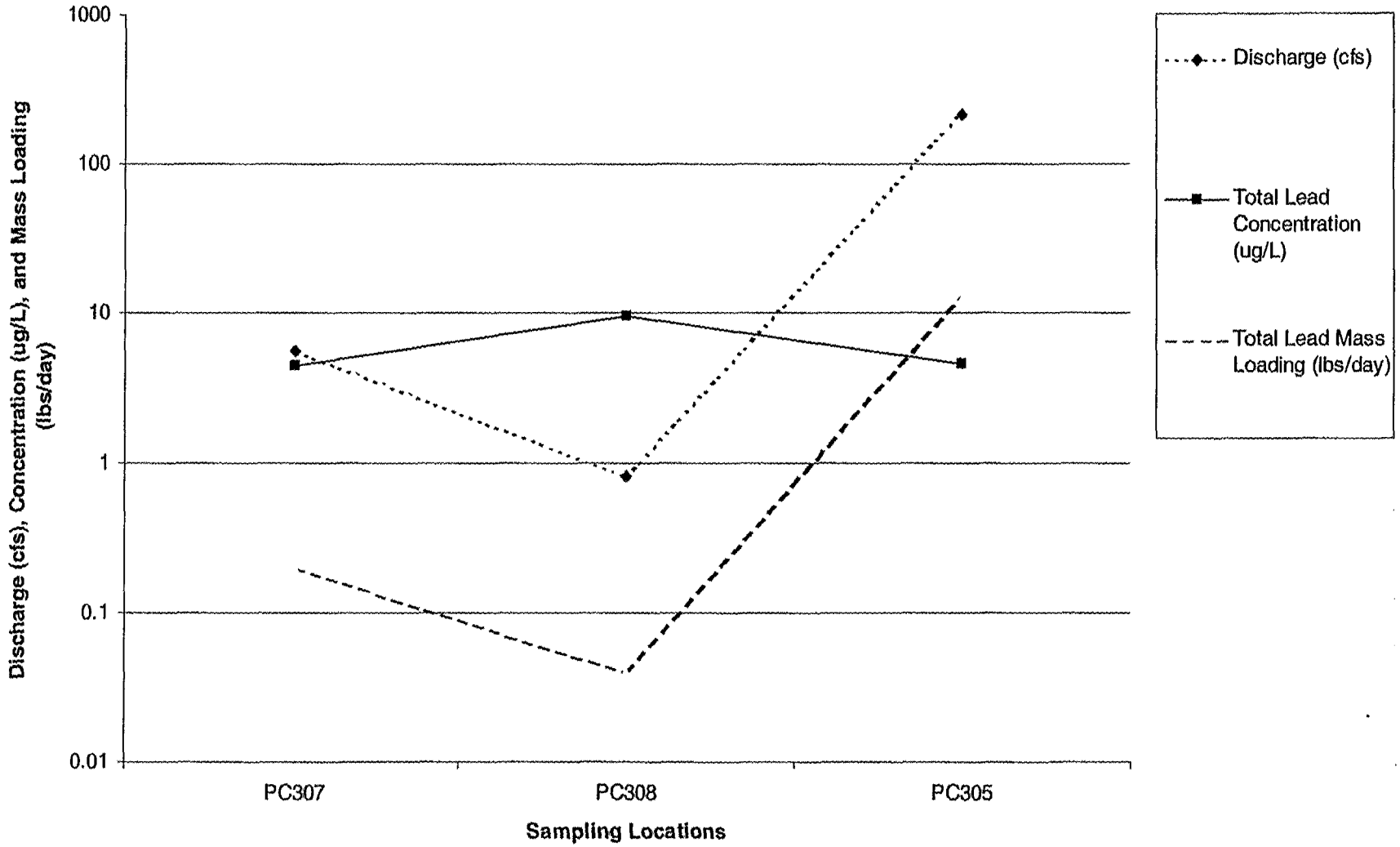
Date of Plot: July 16, 2001

Estimated Expected Values for Discharge, Dissolved Cadmium Concentrations, and Dissolved Cadmium Mass Loading



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.4-7

Estimated Expected Values for Discharge, Total Lead Concentrations, and Total Lead Mass Loading



EPA REGION 10

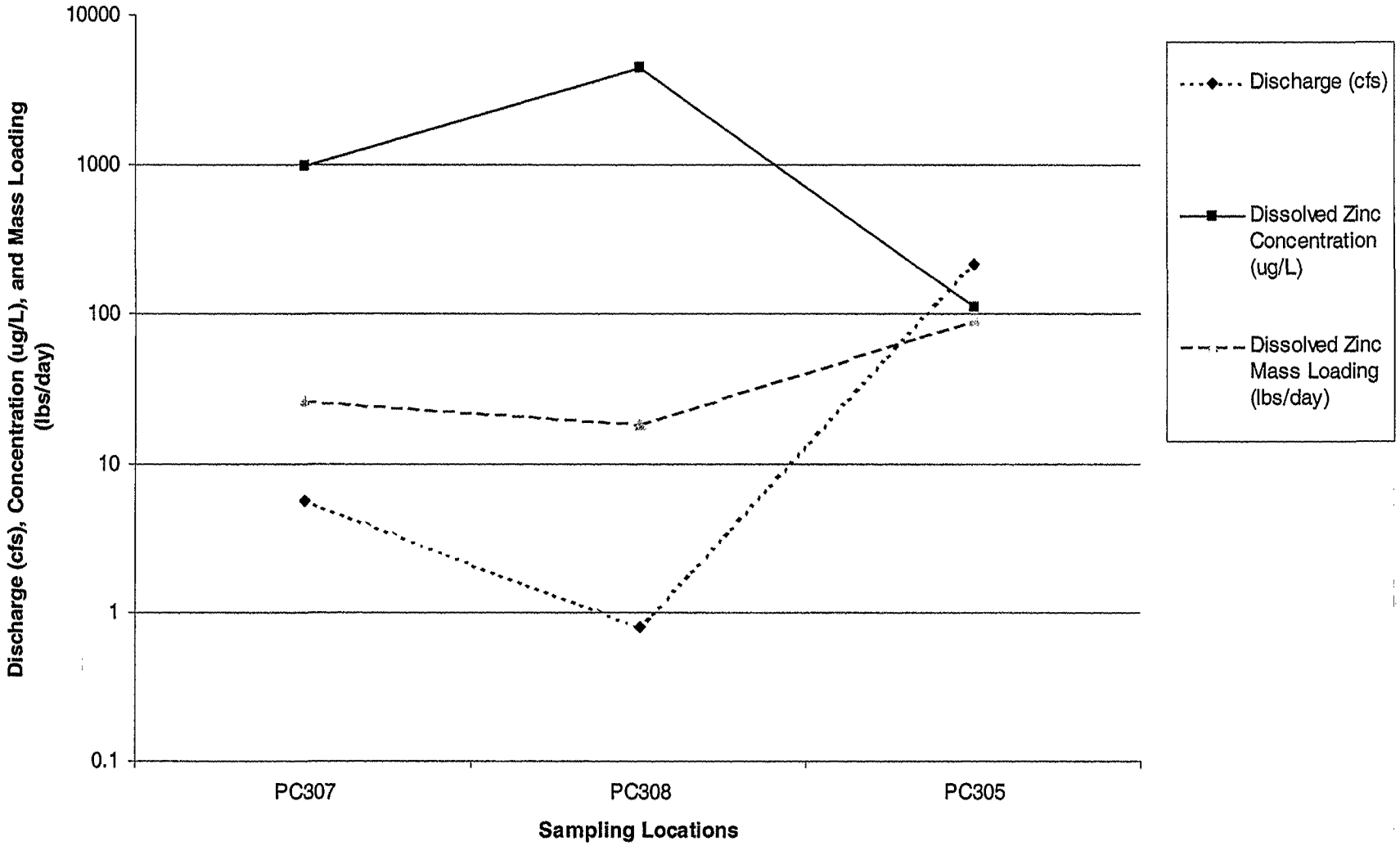
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.4-8

Estimated Expected Values for Discharge, Dissolved Zinc Concentrations, and Dissolved Zinc Mass Loading



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 5.4-9

Table 5.1-1
Low and High Instantaneous Metal Loading Values for Six Sampling Events From May 1991 to May 1999

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.01	40.2
Total Lead	0.016	20,131
Dissolved Lead	0.05	274
Dissolved Zinc	0.27	5,806

Table 5.2-1
Summary of Estimated Expected Values for Metals Concentrations and Mass Loading[a]

Sampling Location	Concentration (µg/l)			Mass Loading (pounds/day)			Discharge (cfs)
	Dissolved Cadmium	Total Lead	Dissolved Zinc	Dissolved Cadmium	Total Lead	Dissolved Zinc	
Screening Level or TMDL[b]	0.38	15	42	0.771	1.13	67.4	NA
PC307	**2.62** (0.211)	4.52 (1.19)	**974** (0.237)	0.070 (1.18)	0.233 (7.51)	26.1 (1.21)	5.6 (1.38)
PC308	**11.7** (0.273)	9.63 (0.535)	**4,430** (0.269)	0.047 (0.923)	0.041 (1.36)	18.5 (0.991)	0.8 (0.94)
PC305	**0.538** (2.68)	4.56 (1.3)	**112** (0.45)	**5.38** (96.4)	**12.3** (19.9)	**90.2** (2.93)	215 (2.94)

[a]Summary tables with all modeling results are included in Appendix C.
[b]TMDLs listed are the 90th percentile.
NA Not applicable
Values in parentheses are coefficients of variation (cv)
cfs - cubic feet per second
Bold - indicates exceedance of screening level or TMDL

Table 5.2-2
Estimated Gains or Losses in Discharge in the Pine Creek Watershed

Reach - between location Xi and Xj (# of samples)	Estimated expected value of gain or loss (EV[X]) in discharge, cfs	Coefficient of variation (CV) for reach (pxi,xj = 0.9)
PC307 (39) to PC308	-4.8	1.5
PC308 (33) to PC305 (38)	214.2	2.9

Table 5.2-3
Estimated Gains or Losses for Dissolved Zinc Concentrations (µg/l) and Dissolved Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the concentration of dissolved zinc (µg/l)	Estimated coefficient of variation (CV) for the dissolved zinc (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved zinc load (#/day)	Estimated coefficient of variation (CV) for the dissolved zinc load (pxi,xj = 0.9)
PC307 (39) to PC308	3,456	0.3	-7.6	2.2
PC308 (33) to PC305 (38)	-4,318	0.3	71.7	3.5

Table 5.2-4
Estimated Gains or Losses for Total Lead Concentrations (µg/l) and Total Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the total concentration of lead (µg/l)	Estimated Coefficient of variation (CV) for total lead concentrations	Estimated expected value of gain or loss in the total lead load (#/day)	Estimated coefficient of variation (CV) for the total lead load
PC307 (39) to PC308	5.11	0.5	-0.192	8.9
PC308 (33) to PC305 (38)	-5.07	0.5	12.26	20.0

Table 5.2-5
Estimated Gains or Losses for Dissolved Cadmium Concentrations (µg/l) and Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the concentration of dissolved cadmium (µg/l)	Estimated coefficient of variation (CV) for the dissolved cadmium (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved cadmium load (#/day)	Estimated coefficient of variation (CV) for the dissolved cadmium load (pxi,xj = 0.9)
PC307 (39) to PC308	9.08	0.3	-0.022	2.1
PC308 (33) to PC305 (38)	-11.16	0.2	5.33	97.2

Table 5.4-1
Potential Major Source Areas in Pine Creek Watershed

Reach	Location Description	Associated Source Areas
Upstream of PC307	Upstream of the confluence of Highland Creek and the East Fork	Constitution Mine Complex and Tailings Douglas Mine Tailings Pile
PC307 to PC308	The confluence of Highland Creek and the East Fork to the confluence of Denver Creek with the East Fork	Denver Mine Adit Pittsburgh Mine Hilarity Mine
PC308 to PC305	The confluence of Denver Creek with the East Fork to the confluence of Pine Creek with the South Fork Coeur d'Alene River	Nabob Mine Complex Denver Creek Tailings Pile Liberal King Tailings Pile and Millsite Amy-Matchless Mine and Millsite Coeur d'Alene Antimony Mine

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ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
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			Idaho Department of Environmental Quality. 1998. E-mail from Glen Pettit October 6, 1998 Subject: DEQ Water Quality Data Files Attached: 1998 trend Samples.xls, 1997 trend Samples.xls

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Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
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10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
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Data Source References[a]	Data Source Name	Data Source Description	Reference
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13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
17	USGS Spokane River Basin Sediment Samples	Surface Sediment Samples Collected by USGS in the Spokane River Basin	Environmental Protection Agency. 1999. Data Validation Memorandum and Attached Table from Laura Castrilli to Mary Jane Nearman dated June 9, 1999. Subject: Coeur d'Alene (Bunker Hill) Spokane River Basin Surface Sample Samples, USGS Metals Analysis, <63 um fraction, Data Validation, Samples SRH7-SRH30
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
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22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
28	USGS National Water Quality Assessment database	Surface water data for sampling location NF50 at Enaville, Idaho	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur d'Alene River At Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are shown in the data summary tables in the "Ref" column.

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PC7554	TL	13	07/25/1994	0	437	523	82.6	1430	19900	7690	846	0.53	56.1	4410
PC7560	TL	13	07/22/1994	0	10	152	0.09 U	105	45300	4710	37.4	2.8	9.9	1010
PC7583	TL	13	07/22/1994	0	17.2	139	30.7	67.1	22100	4930	1080	0.57	9.5	8990
PC7638	GS	13	07/18/1994	0	8.7	30.9	0.73	64.3	32700	1710	1060	0.58	2	894
PC7639	GS	13	07/18/1994	0	9.6	26.6	1.3	79.7	25100	2790	1020	0.43	4.6	535
PC7640	GS	13	07/19/1994	0	2.9	62.5	1.1	39.2	24300	963	929	0.4	1.7	633
PC7641	GS	13	07/19/1994	0	0.23 U	15.7	0.96	13.4	27500	183	1940	0.12	0.17	254
Subsurface Soil (mg/kg)														
PC7554	TL	13	07/25/1994	10	23.9	173	8.5	33.3	128000	6960	8990	4.4	10.4	1370
PC7560	TL	13	07/22/1994	0.8	12.1	181	34.7	197	63400	4170	1550	4.3	8.5	16800
PC7560	TL	13	07/22/1994	2.6	8	29.8	0.09 U	0.06 U	34000	847	207	2.5	0.76	408
PC7583	TL	13	07/22/1994	0.75	3.1	20.1	9.5	22.6	20600	1990	1070	2.7	3.2	3460
PC7583	TL	13	07/22/1994	1.5	10.1	18.3	10.4	55.2	20000	1300	222	1	4.8	3780
Sediment (mg/kg)														
PC7610	RV	13	07/15/1994	0	18.04 U	48.3	10.1	126	22400	802	1290	0.15 U	1.6	1160
PC7611	SP	13	07/15/1994	0	13.76 U	26.7	5.7	38.4	45800	241	492	0.11 U	0.92 U	1780
PC7612	RV	13	07/15/1994	0	12.96 U	7.4	1.4	17.9	13200	278	594	0.11 U	0.86 U	596
PC7613	RV	13	07/15/1994	0	17.39 U	14.1	0.98 U	42.4	19400	1190	564	0.18	1.16 U	926
PC7614	SP	13	07/15/1994	0	25.75 U	242	1.46 U	47.1	26100	1410	193	0.38	1.72 U	770
PC7615	WL	13	07/15/1994	0	28.78 U	83.5	15.5	125	35100	3260	411	0.84	4.1	2610
PC7616	WL	13	07/15/1994	0	28.37 U	106	1.61 U	48.3	7960	776	16.1	0.24 U	2.3	807
PC7617	RV	13	07/15/1994	0	14.72 U	15.6	0.83 U	21.8	18800	450	608	0.12 U	0.98 U	1040
PC7618	RV	13	07/15/1994	0	18.9 U	21.8	0.96 U	30.4	20500	808	731	0.18	1.13 U	1140
PC7619	RV	13	07/15/1994	0	14.92 U	18.5	2.6	31.6	13900	426	566	0.13	0.99 U	829
PC7620	RV	13	07/15/1994	0	14.85 U	89.6	11	32.4	39300	1320	1210	0.12 U	1	1960
PC7621	RV	13	07/15/1994	0	35.61 U	81.6	14.4	284	24100	1940	1270	0.3 U	3.5	3580
PC7622	RV	13	07/15/1994	0	46.15 U	15.9	2.61 U	63.7	32800	192	1190	0.38 U	3.07 U	388
PC7623	SP	13	07/16/1994	0	14.7	42.1	18.2	117	22900	* 5510	1080	1.2	12.2	6930
PC7624	RV	13	07/16/1994	0	11.7	80.4	6.6	55.5	23200	4240	1280	0.66	7.9	2960
PC7625	RV	13	07/16/1994	0	10.8	59.4	10.8	51.9	21800	4310	1400	0.99	7.4	4080
PC7627	SP	13	07/16/1994	0	46.33 U	262	13.7	118	21100	2240	1130	0.39 U	3.1	3790
PC7628	SP	13	07/16/1994	0	17.22 U	192	10.3	164	16700	2670	1340	0.39	2.8	3500
PC7629	SP	13	07/16/1994	0	28.6 U	206	10.2	83	28800	* 6680	110	0.94	2	2970
PC7630	RV	13	07/16/1994	0	3.9	236	0.56	67.4	39000	1160	440	1.6	1	1000

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Sediment (mg/kg)														
PC7631	RV	13	07/16/1994	0	1.45 U	2.3 U	0.48 U	31.4	19600	72.4	619	0.61 U	0.61 U	161
PC821	TP	2	12/12/1997	0	0.99 J	38.6 J	3.71 J	42.3 J	28000 J	520 J	629 J	0.0836 J	1.51 J	875 J
PC821	TP	2	12/12/1997	1.5	0.938 J	9.5 J	1.99	20.3	17000	612	549 J	0.0487 U	1.36 J	558
PC823	TP	2	12/12/1997	0	0.931 J	12.1 J	2.4 J	50.2	23600	279	378 J	0.0488 U	1.23 J	658
PC824	TP	2	12/12/1997	0.5	1 J	8.32 J	1.71	36.4	20200	514	553 J	0.0515 U	1.42 J	497
PC824	TP	2	12/12/1997	3	0.975 J	16.8 J	1.84	26.7	17800	447	319 J	0.0536 J	1.1 J	478
PC826	TP	2	12/12/1997	0	1.03 J									
PC826	TP	2	12/12/1997	0		56.5 J	2.75	39.4	21800	920	953 J	0.206	2.27	704
PC826	TP	2	12/12/1997	1	2.57 UJ	63.6 J	1.84 J	43	23400	707	435 J	0.223	3.54	562
PC829	TP	2	12/12/1997	0	0.973 J	13.2 J	1.96 J	21.2	21600	334	346 J	0.0509 U	1.1 J	520
PC830	TP	2	12/12/1997	0	0.908 J	15.3 J	5.88	25	20300	390	547 J	0.0752 J	1.68 J	1280
PC830	TP	2	12/12/1997	1	1.04 J	32.4 J	6.97	33	22300	396	859 J	0.0546 U	1.52 J	639
PC832	TP	2	12/12/1997	0	1.01 J	18.5 J	2.01	24.6	17600	551	502 J	0.0772 J	1.47 J	680
PC832	TP	2	12/12/1997	1	0.983 J	7.84 J	1.78	23.1	16000	412	450 J	0.1	1.19 J	606
PC834	TP	2	12/13/1997	0	1.01 J	16.5 J	2.33	28.4	19100	446	408 J	0.0524 U	1.15 J	801
PC835	TP	2	12/13/1997	0.5	0.919 J	19 J	1.82 J	22.7	20100	357	392 J	0.0792 J	1.1 J	637
PC835	TP	2	12/13/1997	2.5	1.02 J	14.7 J	1.72	29.2	20700	449	462 J	0.0533 U	1.5 J	609
PC837	TP	2	12/13/1997	0	0.996 J	12.7 J	2.83	38.2			644 J			1030
PC837	TP	2	12/13/1997	0					16300	746		0.149	2.23	
PC837	TP	2	12/13/1997	2.5	3.01 UJ	36.8 J	5.79 J	137 J	50900 J	880	771	0.121	3.11	1240 J
PC840	TP	2	12/13/1997	0	1.01 J	13.2 J	4.4 J	27.5 J	17700 J	690	959	0.0756 J	1.43 J	1020 J
PC840	TP	2	12/13/1997	2.5	0.997 J	10.1 J	2.03 J	16.8 J	14800 J	636	440	0.0522 U	1.3 J	693 J
PC842	TP	2	12/13/1997	0	0.987 J	5.46 J	3.11 J	9.84 J	9890 J	384	254	0.0536 U	1.4 J	1090 J
PC843	TP	2	12/13/1997	0.5	9.21 UJ	6.33 J	2.37 J	30.3 J	11100 J	646	552	0.0941 J	26.6	728 J
PC843	TP	2	12/13/1997	2.5	0.923 J	5.33 J	1.42 J	11.3 J	8480 J	564	437	0.0521 J	0.719 J	587 J
PC845	TP	2	12/13/1997	0	0.897 J	4.95 J	1.33 J		14600 J	204	233	0.0497 U	0.824 J	319 J
PC846	TP	2	12/13/1997	0.5	1.05 J	21.3 J	7.21 J	25.5 J	15300 J	608	999	0.121	1.65 J	1720 J
PC846	TP	2	12/13/1997	2.5	1.05 J	17.1 J	2.85 J	13.7 J	9470 J	198	228	0.0608 J	0.822 J	762 J
PC848	TP	2	12/14/1997	0.5	1.02 J	5.39 J		14.6 J		11.1		0.0502 U		30.1 J
PC848	TP	2	12/14/1997	0.5			0.354 J		13500 J		907		0.68 J	
PC848	TP	2	12/14/1997	2.5	1.03 J	5.74 J	0.416 J	12.3 J	14500 J	14.7	679	0.0579 U	0.559 J	30.4 J
PC851	TP	2	12/14/1997	0	0.917 J	1.34 UJ	0.113 J	6.58 J	6270 J	5.16	608	0.0459 U	0.203 J	10 J
PC852	TP	2	12/14/1997	0.5	0.938 J	2.04 UJ	0.19 J	10.1 J	7280 J	6.31	361	0.0541 U	0.175 J	17.4 J
PC852	TP	2	12/14/1997	2.5	1 J	2.65 UJ	0.259 J	14 J	9180 J	10.8	686	0.0562 U	0.366 J	23.1 J
Groundwater - Total Metals (ug/l)														
PC7595	[illegible]	13	07/27/1994		7.2	2 U	97.8	[illegible]5.2	5 U	1 U	10.8	0.2 U	0.4 U	[illegible] 10200

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Groundwater - Total Metals (ug/l)														
PC7596	MW	13	07/27/1994		2.3	2 U	5.2	1.7	5 U	1 U	22.7	0.2 U	0.4 U	1950
PC7597	MW	13	07/27/1994		6.2	2 U	0.3 U	3.4	41.9	1 U	25.1	0.2 U	0.4 U	103
PC7598	MW	13	07/27/1994		7.7	2 U	1	3.7	47.5	1.2	9.3	0.2 U	0.4 U	322
PC7599	MW	13	07/27/1994		6.3	4	0.3 U	2.7	5 U	1 U	162	0.2 U	0.4 U	224
PC7600	MW	13	07/27/1994		2.1	2 U	10.9	2.3	5 U	2.5	80.2	0.2 U	0.4 U	* 3840
PC7601	MW	13	07/29/1994		3	1 U	11.2	5.5	358	11.3	1390	0.2 U	0.4 U	* 4860
Surface Water - Total Metals (ug/l)														
PC306	RV	2	11/13/1997		0.05 U		0.069 U	0.06 U	5 U		1 U	0.1 U	0.22 U	9.3 U
PC306	RV	2	11/13/1997			0.17				0.13 J				
PC306	RV	18	05/23/1999						20 U	1	2			
PC306	RV	3	05/16/1998		0.2 U	0.2 U		0.4 U	21.5 U	0.1 U	0.4 U	0.2 U		1.1 U
PC307	RV	2	11/13/1997		0.56 U	0.65	3	0.73 J	68.6 J	2.6	1.4 J	0.1 U	0.22 U	1460
PC307	RV	7	10/29/1993				3			7				1270
PC307	RV	7	12/01/1993				2.9			6				1270
PC307	RV	7	12/21/1993				2.8			2.5 U				1210
PC307	RV	7	01/21/1994				2.9			2.5 U				1160
PC307	RV	7	02/17/1994				2.6			2.5 U				1220
PC307	RV	7	03/08/1994				2.1			10				940
PC307	RV	7	03/23/1994				2.4			5 J				955
PC307	RV	7	04/08/1994				2.1			2.5 U				893
PC307	RV	7	04/18/1994				1.9			10				593
PC307	RV	7	05/06/1994				2.3			2.5 U				773
PC307	RV	7	05/20/1994				2.5			2.5 U				813
PC307	RV	7	06/09/1994				2.8			2.5 U				1000
PC307	RV	7	06/24/1994				3.3			2.5 U				1010
PC307	RV	7	07/22/1994				3.2			2.5 U				773
PC307	RV	7	08/18/1994				2.9			2.5 U				980
PC307	RV	7	09/26/1994				3.5			6				1080
PC307	RV	7	10/05/1994				3.1			19				1060
PC307	RV	7	11/16/1994				2.6			5 J				1180
PC307	RV	7	01/10/1995				2.2			10				1040
PC307	RV	7	02/09/1995				2.4			7				876
PC307	RV	7	03/07/1995				2.2			7				978
PC307	RV	7	03/23/1995				2.5			6				778
PC307	RV	7	04/14/1995				3.9			5 J				970
PC307	RV	7	04/25/1995				2.1			2.5 U				828

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC307	RV	7	05/10/1995				1.4			2.5 U				582
PC307	RV	7	05/24/1995				2.2			5 J				647
PC307	RV	7	06/12/1995				2			2.5 U				682
PC307	RV	7	06/27/1995				1.9			5 J				680
PC307	RV	7	07/12/1995				2.2			2.5 U				840
PC307	RV	7	07/25/1995				2.6			9				817
PC307	RV	7	08/14/1995				2.8			2.5 U				930
PC307	RV	7	09/13/1995				2.8			5 J				888
PC307	RV	3	05/15/1998		0.5 U	1 U	1.8	3 U	20 U	2	5 U	0.2 U	0.3 U	696
PC308	RV	2	11/13/1997		0.37 U	0.19	17	1 J	21 U	13.2	1 U	0.1 U	0.22 U	* 7150
PC308	RV	7	10/29/1993				13.3			9				* 5770
PC308	RV	7	12/01/1993				13.2			7				* 5280
PC308	RV	7	12/21/1993				16.1			19				* 6370
PC308	RV	7	01/21/1994				10			5 J				* 5370
PC308	RV	7	02/17/1994				9.8			6				* 4600
PC308	RV	7	03/08/1994				10			6				* 3900
PC308	RV	7	03/23/1994				8.3			12				* 3190
PC308	RV	7	04/08/1994				6.9			5 J				3000
PC308	RV	7	04/18/1994				9			2.5 U				2860
PC308	RV	7	05/03/1994				9.8			6				* 3140
PC308	RV	7	05/19/1994				11			5 J				* 3580
PC308	RV	7	06/09/1994				13			7				* 4000
PC308	RV	7	06/24/1994				14			6				* 4460
PC308	RV	7	07/22/1994				15			17				* 4430
PC308	RV	7	11/16/1994				19			8				* 7260
PC308	RV	7	01/10/1995				11			15				* 4260
PC308	RV	7	02/09/1995				7.7			7				* 3260
PC308	RV	7	03/22/1995				7.2			17				2820
PC308	RV	7	04/14/1995				8.4			9				* 3730
PC308	RV	7	04/25/1995				7.4			7				* 3490
PC308	RV	7	05/10/1995				9			9				* 3680
PC308	RV	7	05/24/1995				10			12				* 3940
PC308	RV	7	06/12/1995				11			14				* 3990
PC308	RV	7	06/27/1995				12			20				* 4260
PC308	RV	7	07/12/1995				11			7				* 4130
PC308	RV	7	07/25/1995				14			10				* 4070
PC308	RV	7	08/14/1995				15			7				* 4720

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC308	RV	7	09/13/1995				15			10				* 4830
PC308	RV	3	05/15/1998		0.55	1 U	9.6	3 U	20 U	5.5	5 U	0.2 U	0.3 U	* 3100
PC309	RV	2	11/12/1997		0.94 U	0.16 U	0.069 U	0.22 J	9.6 U	0.33 J	1 U	0.1 U	0.22 U	12.9 U
PC309	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PC310	RV	2	11/12/1997		3.9 J	8.1 J	5.5	* 191	7130	77.8	704	0.1 U	0.22 J	* 5190
PC312	RV	2	11/11/1997		1.3 U	0.16 U	1.8	0.49 J	6.1 U	0.68	1 U	0.1 U	0.22 U	423
PC312	RV	3	05/14/1998		0.5	2 U	0.7	2 U	20 U	1.1	5 U	0.2 U	0.2 U	179
PC322	RV	3	05/15/1998		0.5 U	1 U	1.2	3 U	20 U			0.2 UJ	0.3 U	
PC322	RV	3	05/15/1998							2.8	10.3			569
PC323	RV	3	05/15/1998		0.5 U	1 U	3	3 U	20 U	5.1	5 U	0.2 UJ	0.3 U	1110
PC324	RV	3	05/17/1998		1.2 U	0.2 U	8.9 J	1.3 J	41.1 J	31.9		0.2 U		
PC325	RV	3	05/17/1998		0.089 U	0.23 U	0.041 U	0.44 U	25.4 J	0.41 J	0.9 J	0.16 U	0.042 U	10.8 J
PC326	RV	3	05/18/1998		0.76	1 U	3	3 U	38.2 U	13.6	5 U	0.2 U	0.3 U	732
PC332	AD	2	11/14/1997		0.66 U	3.3	1.3	6.3	27.1 U	0.83	3.3 J	0.1 U	0.22 UJ	61.5 J
PC332	AD	3	05/10/1998		0.2 U	3.1 J	1 J	4.7 J	234	0.6 U	1.4 J	0.2 U	0.4 U	44.9
PC333	AD	2	11/14/1997		0.27 U	0.7 J	0.069 U	3.8	544	37.1	77.7	0.1 U	0.22 U	21.2 UJ
PC333	AD	3	05/10/1998			0.3 J		1.1 J	175 J	9.1	10 J	0.2 U		6.7 J
PC334	AD	2	11/14/1997		0.18 U	0.69 J	29.2	* 568	969	649	1240	0.1 U	0.22 U	* 10500 J
PC335	AD	2	11/14/1997		0.52 U	1.6 J	0.27 J	0.75 U	3350	1.7	922	0.1 U	0.22 U	* 10800 J
PC335	AD	3	05/10/1998			0.8 J	0.5 J	3.7 J	1250 J	1.6 J	750	0.2 U		* 9120
PC336	AD	2	11/14/1997		0.57 U	3.2	3.4	1.7 J	412	10.7	162	0.1 U	0.22 U	1480 J
PC336	AD	3	05/10/1998		0.1 U	1.9 J	3.3 J	1.5 J	396 J	3 J	215	0.2 U		2190
PC338	RV	3	05/15/1998		0.5 U	1 U	0.36	3 U	20 U	1.3	5 U	0.2 UJ	0.3 U	117
PC340	AD	2	11/15/1997		0.23 U	0.99 J	0.8	2.4 J	277	36.2	11.3	0.1 U	0.22 U	278 J
PC340	AD	3	05/11/1998		0.2 U	2 U	0.5	2 U	48	5.4	5 U	0.2 U	0.2 U	161
PC341	AD	2	11/15/1997			0.24 J	22.8		62.8 U			0.1 U	0.22 U	* 14000 J
PC341	AD	2	11/15/1997		0.15 U			11.6		2.4	803			
PC341	AD	3	05/11/1998		0.2 U	2 U	108	38	527	5.7	2560	0.2 U	0.2 U	* 65400
PC343	AD	2	11/15/1997		0.41 U	0.87 J	7.6	2 J	734	8.5	985	0.1 U	0.22 U	* 11600 J
PC343	AD	3	05/11/1998		0.2 U	2 U	8.2	4	90	0.6	813	0.2 U	0.2 U	* 8100
PC344	AD	2	11/16/1997		241	36.9	0.069 U	0.37 J	142	0.76	15.8	0.1 U	0.22 U	35.6 U
PC348	AD	2	11/16/1997		0.24 U	0.39 J	0.71	0.21 J	10 U	4.1	1.1 J	0.1 U	0.22 U	212
PC348	AD	3	05/10/1998			0.3 J	0.3 UJ	0.4 U	5.6 J	2.7 J	0.4 UJ	0.2 U		75.7
PC348	AD	3	05/10/1998					0.6 J	20.3 J	3.5	0.6 J			102
PC351	AD	2	11/16/1997		1.7 U	0.39 J	0.7	0.56 J	640	6.8	70.9	0.1 U	0.22 U	312
PC352	SP	2	11/16/1997		0.72 U	1.4 J	2.2	1.5 J	143	11.2	8.3 J	0.1 U	0.22 U	2160
PC360	RV	3	05/15/1998		0.5 U	1 U	0.6	3 U	20 U	1.4	5 U	0.2 U	0.3 U	190

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC375	SP	3	05/12/1998		0.5 U	1 U	16.5	4.6	47.2	40.7	74.6	0.2 U	0.3 U	* 6210
PC400	AD	3	05/11/1998		0.2 U	3	190	* 149	5520	* 2160	2610	0.2 U	10.7	* 61400
PC7506	RV	13	07/15/1994		1 U	2 U	0.3 U	2.2	176	10.6	0.1 U	0.2 U	0.4 U	333
PC7507	RV	13	07/15/1994		1 U	11.7	7.9	57.9	875	254	78.8	0.2 U	0.4 U	2760
PC7508	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	97.9	1.9	0.1 U	0.2 U	0.4 U	343
PC7509	AD	13	07/15/1994		1 U	2 U	6.7	0.3 U	55.2	15.8	0.1 U	0.2 U	0.4 U	1140
PC7510	AD	13	07/15/1994		1 U	3	5.6	0.3 U	4250	119	178	0.2 U	0.4 U	* 3530
PC7511	SP	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	2.4	0.1 U	0.2 U	0.4 U	523
PC7512	RV	13	07/15/1994		1 U	6.9	17.6	13.5	23100	157	502	0.2 U	0.4 U	2160
PC7513	RV	13	07/15/1994		1 U	2 U	12	3.3	5 U	8.6	9.6	0.2 U	0.4 U	* 3690
PC7514	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	57.3	1.6	0.1 U	0.2 U	0.4 U	386
PC7515	RV	13	07/15/1994		1 U	2 U	17	0.3 U	5 U	2.3	0.1 U	0.2 U	0.4 U	* 4780
PC7516	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	2.8	0.1 U	0.2 U	0.4 U	528
PC7517	RV	13	07/15/1994		1 U	2 U	4.4	0.3 U	90.6	3.5	0.1 U	0.2 U	0.4 U	1440
PC7518	RV	13	07/15/1994		1 U	2 U	5.8	0.3 U	5 U	4.4	0.1 U	0.2 U	0.4 U	1500
PC7519	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	21.2
PC7520	AD	2	11/15/1997		1.2 U	0.61 J	10	11.9	330	141	45.9	0.1 U	0.22 U	* 5630 J
PC7520	AD	13	07/15/1994		1 U	2 U	19	0.3 U	73.7	22.6	53.1	0.2 U	0.4 U	* 5110
PC7520	AD	3	05/10/1998		1.2 U	1.7 J	167	30.7	590 J	163	732	0.2 U	0.1 U	0.9 U
PC7521	RV	13	07/16/1994		1 U	2 U	0.3 U	0.3 U	180	46.5	11.3	0.2 U	0.4 U	469
PC7522	SP	13	07/16/1994		1 U	2 U	33.5	8.2	5 U	43.8	57.4	0.2 U	0.4 U	* 12000
PC7523	SP	13	07/16/1994		1 U	2 U	40.6	7.4	169	70	6.6	0.2 U	0.4 U	* 13000
PC7524	RV	13	07/16/1994		1 U	2 U	0.3 U	1.5	5 U	1.9	0.1 U	0.2 U	0.4 U	47
PC7525	RV	13	07/16/1994		1 U	2 U	0.3 U	1.4	5 U	1.1	0.1 U	0.2 U	0.4 U	14.3
PC7526	AD	13	07/16/1994		1 U	2 U	2.9	2.1	220	4.2	203	0.2 U	0.4 U	1690
PC7527	RV	13	07/16/1994		1 U	2 U	3.1	0.3 U	5 U	15.9	3.3	0.2 U	0.4 U	606
PC7528	RV	13	07/16/1994		1 U	2 U	0.3 U	2.6	198	44.2	8.8	0.2 U	0.4 U	247
PC7529	RV	13	07/16/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	14.6
PC7603	SP	13	07/16/1994		1 U	2 U	3.6	1.7	5 U	3	0.1 U	0.2 U	0.4 U	1300
PC7604	RV	13	07/16/1994		1 U	2 U	0.3 U	3.5	412	92.6	15.5	0.2 U	0.4 U	280
PC7605	RV	13	07/16/1994		1 U	2 U	0.3 U	3.8	186	67.9	1.9	0.2 U	0.4 U	111
Surface Water - Dissolved Metals (ug/l)														
PC306	RV	2	11/13/1997		0.5 U	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	2 U
PC306	RV	18	05/23/1999				1 U		10 U	1 U	1 U			3 9
PC306	RV	3	05/16/1998			0.2 U		0.4 U	15 4 UJ	0.1 U	6.5 J	0.2 UJ		1.9 UJ
PC307		2	11/13/1997		0.53	0.71	3.24	0.54	10 U	1.76	1	0.2 U	0.03 U	1370

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC307	RV	7	10/29/1993				3.1			3 J				1280
PC307	RV	7	12/01/1993				2.9			1.5 U				1240
PC307	RV	7	12/21/1993				2.8			5				1230
PC307	RV	7	01/21/1994				3.1			1.5 U				1120
PC307	RV	7	02/17/1994				2.8			1.5 U				1270
PC307	RV	7	03/08/1994				2.2			1.5 U				960
PC307	RV	7	03/23/1994				2.5			1.5 U				966
PC307	RV	7	04/08/1994				2.2			3 J				949
PC307	RV	7	04/18/1994				1.8			1.5 U				578
PC307	RV	7	05/06/1994				2.5			3 J				786
PC307	RV	7	05/20/1994				2.3			1.5 U				824
PC307	RV	7	06/09/1994				3.2			1.5 U				1010
PC307	RV	7	06/24/1994				3.5			4				1040
PC307	RV	7	07/22/1994				3.2			1.5 U				804
PC307	RV	7	08/18/1994				3			2.5 J				1010
PC307	RV	7	09/26/1994				3.3			3 J				1120
PC307	RV	7	10/05/1994				3.2			3 J				1110
PC307	RV	7	11/16/1994				3.1			1.5 U				1240
PC307	RV	7	01/10/1995				2.5			4				1040
PC307	RV	7	02/09/1995				2.1			1.5 U				894
PC307	RV	7	03/07/1995				2.5			4				969
PC307	RV	7	03/23/1995				2.5			4				813
PC307	RV	7	04/14/1995				2.4			1.5 U				948
PC307	RV	7	04/25/1995				2.1			3 J				864
PC307	RV	7	05/10/1995				1.6			1.5 U				577
PC307	RV	7	05/24/1995				2.1			4				652
PC307	RV	7	06/12/1995				1.8			4				687
PC307	RV	7	06/27/1995				1.9			4				690
PC307	RV	7	07/12/1995				2.3			1.5 U				861
PC307	RV	7	07/25/1995				2.6			1.5 U				833
PC307	RV	7	08/14/1995				2.8			3 J				943
PC307	RV	7	09/13/1995				3			3 J				927
PC307	RV	3	05/15/1998		0.5 U	1 U	1.9	3 U	20 U	1.2	5 U	0.2 U	0.3 U	679
PC308	RV	2	11/13/1997		0.5 U	0.18	18.3	1.3	10 U	14.4	1 U	0.2 U	0.03 U	* 7080
PC308	RV	7	10/29/1993				15.2			5				* 5850
PC308	RV	7	12/01/1993				14.5			4				* 5200
PC308	RV	7	12/21/1993				14.2			4				* 6490

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC308	RV	7	01/21/1994				11			4				* 5320
PC308	RV	7	02/17/1994				9.9			3 J				* 4660
PC308	RV	7	03/08/1994				10			6				3910
PC308	RV	7	03/23/1994				8.4			5				3240
PC308	RV	7	04/08/1994				7.3			4				3190
PC308	RV	7	04/18/1994				9.5			4				2970
PC308	RV	7	05/03/1994				10.5			5				3230
PC308	RV	7	05/19/1994				11			4				3670
PC308	RV	7	06/09/1994				12			4				4120
PC308	RV	7	06/24/1994				14			6				* 4560
PC308	RV	7	07/22/1994				15			6				* 4450
PC308	RV	7	11/16/1994				18			5				* 7410
PC308	RV	7	01/10/1995				10			12				* 4320
PC308	RV	7	02/09/1995				8			1.5 U				3270
PC308	RV	7	03/22/1995				7.3			5				2850
PC308	RV	7	04/14/1995				8			7				3680
PC308	RV	7	04/25/1995				7.7			5				3580
PC308	RV	7	05/10/1995				9.6			7				3530
PC308	RV	7	05/24/1995				10			5				4010
PC308	RV	7	06/12/1995				11			8				* 4280
PC308	RV	7	06/27/1995				13			7				* 4220
PC308	RV	7	07/12/1995				12			6				4170
PC308	RV	7	07/25/1995				14			9				4120
PC308	RV	7	08/14/1995				15			6				* 4860
PC308	RV	7	09/13/1995				16			8				* 4980
PC308	RV	3	05/15/1998		0.54	1 U	10	3 U	20 U	4.4	5 U	0.2 U	0.3 U	3000
PC309	RV	2	11/12/1997		0.79	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	4.7
PC309	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PC310	RV	2	11/12/1997								251	0.2 U		
PC312	RV	2	11/11/1997		1.1	0.25	1.78	0.56	10 U	0.61	1 U	0.2 U	0.03 U	415
PC312	RV	3	05/14/1998		0.5	2 U	0.7	2 U	20 U	0.7	5 U	0.2 U	0.2 U	188
PC322	RV	3	05/15/1998		0.5 U	1 U	1.3	3 U	20 U	1.5		0.2 UJ	0.3 U	
PC322	RV	3	05/15/1998								10.3			561
PC323	RV	3	05/15/1998		0.5 U	1 U	3.1	3 U	20 U	3.2	5 U	0.2 UJ	0.3 U	1090
PC324	RV	3	05/17/1998		1 U	0.2 U	10 J	1.5 J		30.9		0.2 UJ		
PC325	RV	3	05/17/1998		0.15 U	0.23 U	0.041 U	0.44 U	29.1 J	0.44 J	0.92 J	0.16 U	0.042 UJ	9.7 J
PC326	RV	3	05/18/1998		0.6	1 U	3	3 U	20 U	5.7	5 U	0.2 U	0.3 U	728

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC332	AD	2	11/14/1997		0.54	3.6	1.37	5.43	10 U	0.41	1.8	0.2 U	0.03 U	57
PC332	AD	3	05/10/1998			2.7 J	0.8 J	3.2 J	171 J	0.8 UJ	0.7 J	0.2 U		39.4
PC333	AD	2	11/14/1997		0.5 U	0.27	0.04 U	0.52	10	0.58	4	0.2 U	0.03 U	4.6
PC333	AD	3	05/10/1998			0.2 U		0.5 J	107 J	1 UJ	0.2 U	0.2 U		5.1 J
PC334	AD	2	11/14/1997		0.5 U	0.29	30.5	* 548	649	* 640	1340	0.2 U	0.03 U	* 11100
PC335	AD	2	11/14/1997		0.5 U	0.49	0.44	0.5 U	15	0.31	930	0.2 U	0.03 U	* 10700
PC335	AD	3	05/10/1998			0.3 J	0.5 UJ	3.3 J	543 J	1.1 U	688	0.2 U		* 8720
PC336	AD	2	11/14/1997		0.5 U	0.91	0.83	0.26	10 U	0.17	143	0.2 U	0.03 U	1250
PC336	AD	3	05/10/1998			0.8 J	0.6 J	0.8 J	215 J	0.1 U	198	0.2 U		2010
PC338	RV	3	05/15/1998		0.5 U	1 U	0.38	3 U	20 U	0.95	5 U	0.2 U	0.3 U	107
PC340	AD	2	11/15/1997		0.5 U	0.31	0.9	0.78	22.4	5.83	7.67	0.2 U	0.03 U	288
PC340	AD	3	05/11/1998		0.2 U	2 U	0.4	2 U	20 U	2.2	5 U	0.2 U	0.2 U	167
PC341	AD	2	11/15/1997		0.5 U	0.33	24.7	10.9	10 U			0.2 U	0.03 U	
PC341	AD	2	11/15/1997							0.98	833			* 13300
PC341	AD	3	05/11/1998		0.2 U	2 U	* 107	15.8	20 U	0.4	* 2530	0.2 U	0.2 U	* 63600
PC343	AD	2	11/15/1997		0.5 U	0.36	7.35	0.5	10 U	0.13	951	0.2 U	0.03 U	* 10100
PC343	AD	3	05/11/1998		0.2 U	2 U	8	3	31	0.2 U	850	0.2 U	0.2 U	* 8310
PC344	AD	2	11/16/1997		267	33.1	0.02 U	0.42	10 U	0.93	8.9	0.2 U	0.03 U	15.2
PC348	AD	2	11/16/1997		0.5 U	0.24	0.88	0.35	10 U	3.89	1.1	0.2 U	0.03 U	214
PC348	AD	3	05/10/1998			0.3 J	0.4 UJ	0.4 U	20.8 J	2.9 J	0.4 U	0.2 U		116
PC351	AD	2	11/16/1997		1.7	0.22	0.6	0.35	357	3.99	71.3	0.2 U	0.03 U	311
PC352	SP	2	11/16/1997		0.65	0.64	2.43	0.83	10 U	1.01	1.4	0.2 U	0.03 U	2050
PC360	RV	3	05/15/1998		0.5 U	1 U	0.64	3 U	20 U	0.7	5 U	0.2 U	0.3 U	185
PC375	SP	3	05/12/1998		0.5 U	1 U	17.3	4.3	20 U	29.6	75	0.2 U	0.3 U	* 6090
PC400	AD	3	05/11/1998		0.2 U	2 U	* 187	135	4220	* 2150	* 2590	0.2 U	0.2 U	* 62300
PC7520	AD	2	11/15/1997		0.61	0.1	10.8	1.6	10 U	19.3	39	0.2 U	0.03 U	* 4850
PC7520	AD	3	05/10/1998		0.4 U	0.6 J	* 135 J	15.3 J	213 J	20 J	588	0.2 U		9.1 U
PC7642	RV	13	—			4 U	0.6 U	0.6 U	59	0.308	0.2 U			10
PC7642	RV	13	03/01/1993			4 U	0.6 U	3.5	115	0.311	0.2 U			5.2
PC7642	RV	13	08/01/1993				0.6 U	3	11	2 U	0.2 U			13
PC7643	RV	13	—			4 U	13	0.6 U	8.8	4	0.2 U			* 6060
PC7643	RV	13	03/01/1993			4 U	14	3.5	76.4	14.8	6.9			* 5540
PC7643	RV	13	08/01/1993			4 U	15.6	3	10 U	4.3	0.2 U			* 5110
PC7644	RV	13	—			4 U	0.6 U	0.6 U	6	0.382	1.2			14
PC7644	RV	13	03/01/1993			4 U	0.6 U	0.6 U	11	0.131	0.2 U			5.7
PC7644	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			7.4
PC7645	RV	13	—			4 U	0.6 U	0.6 U	24.7	3.65	5.8			364

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC7645	RV	13	03/01/1993			4 U	0.6 U	2.2	15	1.26	3.3			194
PC7645	RV	13	08/01/1993			4 U	0.6 U	4.7	5.8	2	3.2			424
PC7646	RV	13	---			4 U	0.6 U	0.6 U	2.5	0.984	0.2 U			1250
PC7646	RV	13	03/01/1993			4 U	2.6	3.1		3.8	9.7			1250
PC7646	RV	13	08/01/1993			4 U	3.6	0.6 U		1.4	0.2 U			1200
PC7647	RV	13	---			4 U	0.6 U	0.6 U	17	0.08	0.2 U			5.8
PC7647	RV	13	03/01/1993			4 U	0.6 U	0.6 U	14	0.1	0.2 U			8.6
PC7647	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			11
PC7649	RV	13	---			4 U	0.6 U	0.6 U	13	0.772	0.2 U			518
PC7649	RV	13	03/01/1993			4 U	0.6 U	4.6	18	1.58	1.1			389
PC7649	RV	13	08/01/1993			4 U	2.2	0.6 U	10 U	2 U	0.2 U			373
PC7650	RV	13	---			4 U	0.6 U	0.6 U	14	1.02	1.2			558
PC7650	RV	13	03/01/1993			4 U	0.6 U	2.2	22	1.41	1.9			378
PC7650	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			491
PC7651	RV	13	---			4 U	0.6 U	0.6 U	10 U	1.44	1.3			774
PC7651	RV	13	03/01/1993			4 U	0.6 U	3.1	16	3.07	2.4			657
PC7651	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			561
PC7652	RV	13	---			4 U	0.6 U	0.6 U	10 U	1.12	0.2 U			536
PC7652	RV	13	03/01/1993			4 U	0.6 U	0.6 U	15	2.38	1.4			359
PC7652	RV	13	08/01/1993			4 U	0.6 U	7.2	6	1.4	0.2 U			562
PC7653	RV	13	---			4 U	0.6 U	0.6 U	10 U	1.27	0.2 U			185
PC7653	RV	13	03/01/1993			4 U	0.6 U	0.6 U	8.8	1.55	0.2 U			141
PC7653	RV	13	08/01/1993				0.6 U	5.7	10 U	2 U	3.2			128
PC7654	RV	13	---			4 U	0.6 U	0.6 U	10 U	1.67	0.2 U			197
PC7654	RV	13	03/01/1993			4 U	0.6 U	0.6 U	4.6	1.5	0.2 U			199
PC7654	RV	13	08/01/1993			4 U	0.6 U	0.6 U	4.4	1.7	0.2 U			137
PC7655	RV	13	---			4 U	0.6 U	0.6 U	10 U	0.12	0.2 U			5.5
PC7655	RV	13	03/01/1993			4 U	0.6 U	0.6 U	2.5	0.094	0.2 U			3.8
PC7655	RV	13	08/01/1993			4 U	0.6 U	0.6 U		2 U	0.2 U			5.1
PC7659	SP	13	06/01/1993			4 U	0.6 U	0.6 U	37.7	2 U	0.2 U			6.5
PC7660	SP	13	06/01/1993			4.52	0.6 U	0.6 U	11700	11.7	1060			1010
PC7661	SP	13	06/01/1993			4 U	0.6 U	0.6 U	1120	2 U	467			0.6 U
PC7662	SP	13	06/01/1993			4 U	0.6 U	0.6 U	48.4	1.5	3.8			777
PC7663	SP	13	06/01/1993			4 U	0.6 U	0.6 U	479	1.7	4.2			8.8
PC7664	SP	13	06/01/1993			4 U	0.6 U	0.6 U	18	2 U	2.5			4.2
PC7665	SP	13	06/01/1993			0.98	4.1	0.6 U	81.5	3.11	22			3640
PC7666	SP	13	06/01/1993			4 U	4.2	0.6 U	10 U	1.5	0.2 U			2000

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC7667	RV	13	06/01/1993			4 U	32.7	4.2	20.6	39.8	118			* 12900
PC7668	RV	13	06/01/1993			4 U	3.6	19.5	25.6	7.71	7.83			776
PC7669	RV	13	06/01/1993			4 U	11	0.6 U	9.7	23.7	10.3			4070
PC7670	RV	13	06/01/1993			4 U	6.8	0.6 U	11	46.3	2.2			1870
PC7671	RV	13	06/01/1993			4 U	2.4	0.6 U	16	3.11	4.6			1200
PC7672	RV	13	06/01/1993			4 U	0.6 U	0.6 U	6.1	1.8	7.21			539
PC7673	RV	13	06/01/1993			4 U	0.6 U	0.6 U		1.8	6.98			445
PC7674	RV	13	06/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			0.6 U
PC7675	RV	13	06/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			33.8
PC7676	RV	13	06/01/1993			4 U	2.8	0.6 U	20.8	5.42	5.75			1330
PC7677	RV	13	06/01/1993			4 U	9.1	0.6 U			2.1			3260
PC7678	AD	13	08/01/1993			3.1	0.6 U	3.5	10 U	2 U	0.2 U			61
PC7679	AD	13	08/01/1993			4 U	0.6 U	0.6 U	11	1.5	7.86			683
PC7680	AD	13	08/01/1993			4 U	* 46.6	0.6 U	10 U	7.43	62			* 26200
PC7681	AD	13	08/01/1993			2.3	* 226	138	5460	* 2560	* 3070			* 73600
PC7684	AD	13	08/01/1993			4 U	24.3	1.5	7.5	16.9	132			* 8450
PC7685	AD	13	08/01/1993			0.9	1	10	403	1.4	833			* 9950
PC7686	AD	13	08/01/1993			4 U	0.6 U	0.6 U	8.1	2 U	315			2650
PC7687	AD	13	08/01/1993			4 U	0.6 U	0.6 U	3490	2 U	608			12
PC7689	AD	13	08/01/1993			4 U	0.6 U	0.6 U	1160	7.93	147			389
PC7691	AD	13	08/01/1993			4 U	* 61.8	* 1070	1050	* 822	1390			* 16300
PC7693	SP	13	08/01/1993			2.3	0.6 U	0.6 U	10 U	2 U	0.2 U			28.3
PC7694	SP	13	08/01/1993			4 U	2.5	0.6 U	7.6	1.9	216			2070
PC7695	SP	13	08/01/1993			4 U	0.6 U	0.6 U	284	2 U	118			16
PC7696	SP	13	08/01/1993				2.7		4.1		9.05			918
PC7697	SP	13	08/01/1993			4 U	12	4	57.7	7.34	9.61			* 5130

Data Summary Table
Pine Creek - segment PineCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC311	RV	2	11/12/1997		0.1 U	0.16 U	0.069 U	0.52 J	9.4 U	0.15 J	2.3 J	0.1 U	0.22 U	13.2 U
PC311	RV	18	05/23/1999						40 U					
PC311	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20	0.2 U	5 U	0.2 U	0.2 U	10 U
Surface Water - Dissolved Metals (ug/l)														
PC311	RV	2	11/12/1997		0.5 U	0.11	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	2.5
PC311	RV	18	05/23/1999				1 U		10	1 U	1 U			1 U
PC311	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
PC7648	RV	13	—			4 U	0.6 U	0.6 U	17	0.367	0.2 U			12
PC7648	RV	13	03/01/1993			4 U	0.6 U	0.6 U	18	0.18	0.2 U			7.7
PC7648	RV	13	08/01/1993			4 U	0.6 U	5.2	10 U	2 U	0.2 U			11

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PC7531	TL	13	07/21/1994	0	59.7	56.6	0.09 U	97.2	44300	7720	509	0.9	11.3	660
PC7539	TL	13	07/21/1994	0	55.2	72.8	0.08 U	162	71300	8260	472	2.2	10.1	715
PC7548	TL	13	07/22/1994	0	6	347	0.09 U	57.6	39600	2880	93	0.89	5.1	780
PC7632	GS	13	07/18/1994	0	5.4	48.4	4	55	33400	825	818	0.36	1.3	1030
PC7633	GS	13	07/18/1994	0	0.24 U	18.4	3	16.5	16600	422	697	0.11	0.72	544
PC7634	GS	13	07/18/1994	0	0.3 U	14.4	1.9	18.7	17400	381	872	0.34	0.45	395
PC7635	GS	13	07/18/1994	0	11.1	220	0.09 U	45	29700	4320	169	2	11.8	364
PC7636	GS	13	07/19/1994	0	5.5	78	2.9	52.6	23000	1500	1070	0.7	2.3	657
PC7637	GS	13	07/19/1994	0	0.24 U	9.2	0.08 U	5.8	19600	140	435	0.1 U	0.1 U	64.8
Subsurface Soil (mg/kg)														
PC7531	TL	13	07/21/1994	0.33	9.4	98.2	122	165	68900	2590	818	1.7	4	9530
PC7531	TL	13	07/21/1994	4	16.8	39.1	9	101	17400	973	913	0.23	0.96	3100
PC7539	TL	13	07/21/1994	0.5	20.6	227	49.2	311	103000	4290	988	4.6	7.7	16900
PC7539	TL	13	07/21/1994	2.5	0.3 U	17.6	7	779	12100	1760	90.1	0.27	1.7	2510
PC7548	TL	13	07/22/1994	1.6	4.2	160	43.3	580	13100	331	18.6	0.14	0.76	1460
PC7548	TL	13	07/22/1994	2.5	0.25 U	30.5	0.08 U	24.9	40600	543	57.8	0.35	0.27	113
Sediment (mg/kg)														
PC7606	RV	13	07/14/1994	0	18.49 U	47.7	1.1	41.6	21200	738	321	0.15 U	1.23 U	270
PC7608	RV	13	07/15/1994	0	14.17 U	26.6	1.7	25.5	18900	304	569	0.13	0.94 U	357
PC7609	RV	13	07/15/1994	0	12.82 U	25.4	1.1	17.7	15600	211	623	0.11 U	0.85 U	370
PC806	TP	2	12/11/1997	0	29 J	11.1 J	1.02 J	12.7 J	10100 J	163 J	604 J	0.0533 U	0.393 J	187 J
PC806	TP	2	12/11/1997	1	1.29 UJ	8.97 J	0.822 J	17.6 J	20200 J	91.5 J	241 J	0.0481 U	0.631 J	267 J
PC808	TP	2	12/11/1997	0.5	31.8 J	34.4 J	0.959 J	31.9 J	24200 J	249 J	424 J	0.0562 U	0.937 J	452 J
PC808	TP	2	12/11/1997	2.5	11 UJ	34.6 J	0.84 J	20.2 J	17700 J	181 J	348 J	0.054 U	0.708 J	303 J
PC810	TP	2	12/11/1997	0	19.6 J	60.6 J	0.417 J	13.2 J	14400 J	83.9 J	319 J	0.051 U	0.447 J	182 J
PC811	TP	2	12/11/1997	0.5	1.01 J	10.8 J	1.25 J	17.2 J	13600 J	228 J	338 J	0.05 U	0.673 J	393 J
PC812	TP	2	12/11/1997	0	0.93 J	2.95 J	0.55 J	10.2 J	12300 J	24.8 J	223 J	0.0478 U	0.344 J	211 J
PC813	TP	2	12/11/1997	0.5	0.963 J	2.95 J	0.581 J	16.7 J	16000 J	183 J	355 J	0.0499 U	0.511 J	237 J
PC813	TP	2	12/11/1997	2.5	0.95 J	5.7 J	0.38 J	10.1 J	9620 J	73.2 J	127 J	0.0502 U	0.691 J	128 J
PC815	TP	2	12/11/1997	0.5			0.82 J	10.1 J	9170 J	108 J	739 J	0.0494 U	0.439 J	
PC815	TP	2	12/11/1997	0.5	0.92 J	2.79 J								235 J
PC815	TP	2	12/11/1997	2.5	0.976 J	5.01 J	0.529 J	10.6 J	11300 J	121 J	238 J	0.053 U	0.417 J	216 J
PC818	TP	2	12/12/1997	1	0.983 J	19 J	1.11 J	23.4 J	18000 J	290 J	412 J	0.055 U	0.869 J	357 J
PC818	TP	2	12/12/1997	4	0.946 J	7.44 J	0.808 J	14.5 J	14300 J	163 J	453 J	0.0491 U	0.612 J	239 J

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Sediment (mg/kg)														
PC820	TP	2	12/12/1997	0	1.01 J	5.98 J	0.912 J	18.3 J	15600 J	134 J	420 J	0.052 U	0.665 J	320 J
PC854	HA	2	12/15/1997	0	2.04 U									
PC855	HA	2	12/15/1997	0		15.5 J	0.982 J	26.6	13100	217	449 J	0.0605 J	0.765 J	341 J
PC856	HA	2	12/15/1997	0	1.02 U	16.6 J	1.14	22.9	17900	218	438 J	0.0582 J	0.993 J	404 J
PC857	HA	2	12/15/1997	0	0.949 U	13.4 J	0.809 J	14.6	17100	143	316 J	0.0478 J	0.678 J	262 J
PC858	HA	2	12/15/1997	0.17	0.98 U	8.34 J	0.738 J	16.4	17600	111	271 J	0.0507 J	0.626 J	310 J
Groundwater - Total Metals (ug/l)														
PC101	PW	11	12/02/1998		1 U	1 U	1 U	6.2	56.5 J	3.2	5 U	0.2 U	5 U	26.2
PC432	MW	23	12/03/1999	58	7.7	1 J	0.52 J	5 U	463	0.73 J	20.1	0.2 U	5 U	134
PC432	MW	23	12/03/1999	17	7.4	1 U	0.53 J	5 U	25 U	0.5 U	5 U	0.2 U	5 U	151
PC7590	MW	13	07/27/1994		1 U	2 U	0.3 U	* 134	1800	14.2	262	0.2 U	0.4 U	2370
PC7591	MW	13	07/18/1994		1 U	2 U	0.3 U	6.8	5 U	1 U	5.4	0.2 U	0.4 U	108
PC7592	MW	13	07/27/1994		1 U	2 U	0.3 U	* 166	2080	16.6	244	0.2 U	0.4 U	2420
PC7593	MW	13	07/27/1994		1.6	2 U	1.4	1.6	5 U	1 U	2	0.2 U	0.4 U	98.2
PC7594	MW	13	07/27/1994		2.5	2 U	0.3 U	1.2	5 U	1 U	2.3	0.2 U	0.4 U	121
Groundwater - Dissolved Metals (ug/l)														
PC101	PW	11	12/02/1998		1 U	1 U	1 U	5 U	50 U	1 U	5.7 J	0.2 U	5 U	26.5
PC432	MW	23	12/03/1999	58	7.8	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	110
PC432	MW	23	12/03/1999	17	7.6	1 U	0.53 J	5 U	25 U	0.5 U	5 U	0.2 U	5 U	160
SF138	MW	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		50
SF138	MW	6	10/12/1997		50 U	5 U	6 J	12 U		3 U		0.2 U		40
SF138	MW	6	10/24/1996		40 U	0.14	3 U			0.1 U		0.2 U		116
SF138	MW	6	04/24/1997		45 U	4.5 U	3 U			1.5 U		0.2 U		36.5
SF138	MW	6	02/11/1997		45 U	1.5 U	3 U			1.5 U		0.2		59.3
Surface Water - Total Metals (ug/l)														
PC100	RV	11	11/16/1998		0.74 U	0.29 J	1.1	0.41 U	6.9 U	0.82 J	1.5 U	0.2 U	4.5 U	228
PC305	RV	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		230
PC305	RV	6	10/12/1997		50 U	5 U	4 U	12 U		3 U		0.2 U		80
PC305	RV	6	04/24/1997		45 U	4.5 U	3 U	3 U		12.2		0.2 U		136
PC305	RV	6	02/04/1997		45 U	4.5 U	3 U	3.2		13.1		0.2 U		153
PC305	RV	7	10/29/1993				0.25 U			6				117
PC305	RV	7	12/01/1993				0.25 U			13				107
PC305	[illegible]	7	12/21/1993				0.25 U			2.5 U				124

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC305	RV	7	01/21/1994				0.25 U			2.5 U				105
PC305	RV	7	02/17/1994				0.25 U			2.5 U				91
PC305	RV	7	03/08/1994				0.25 U			2.5 U				133
PC305	RV	7	03/23/1994				0.25 U			2.5 U				117
PC305	RV	7	04/08/1994				0.25 U			2.5 U				96
PC305	RV	7	04/18/1994				0.25 U			2.5 U				60
PC305	RV	7	05/03/1994				1.3			2.5 U				74
PC305	RV	7	05/19/1994				0.25 U			6				76
PC305	RV	7	06/08/1994				0.25 U			5 J				83
PC305	RV	7	06/24/1994				0.3 J			2.5 U				68
PC305	RV	7	08/17/1994				0.5 J			2.5 U				89
PC305	RV	7	09/26/1994				0.25 U			8				99
PC305	RV	7	10/05/1994				0.25 U			2.5 U				100
PC305	RV	7	11/16/1994				0.25 U			2.5 U				110
PC305	RV	7	12/14/1994				0.25 U			2.5 U				129
PC305	RV	7	01/10/1995				1.4			24				374
PC305	RV	7	02/09/1995				1.1			10				225
PC305	RV	7	03/22/1995				2.2			9				218
PC305	RV	7	04/14/1995				2.5			5 J				178
PC305	RV	7	04/27/1995				1.2			2.5 U				110
PC305	RV	7	05/11/1995				1.4			2.5 U				96
PC305	RV	7	05/24/1995				0.8			2.5 U				84
PC305	RV	7	06/12/1995				0.5 J			5 J				87
PC305	RV	7	06/27/1995				0.25 U			2.5 U				87
PC305	RV	7	07/11/1995				0.25 U			2.5 U				86
PC305	RV	7	07/25/1995				0.25 U			2.5 U				89
PC305	RV	7	08/14/1995				0.25 U			2.5 U				102
PC305	RV	7	09/13/1995				0.25 U			8				104
PC305	RV	7	10/18/1995				0.25 U			2.5 U				107
PC305	RV	7	11/22/1995				0.6			2.5 U				112
PC305	RV	7	12/27/1995				1			2.5 U				157
PC305	RV	7	01/18/1996				0.7			8				138
PC305	RV	7	02/28/1996				0.6			5 J				406
PC305	RV	7	03/27/1996				0.6			5 J				199
PC305	RV	7	04/18/1996				0.25 U			13				134
PC305	RV	7	05/08/1996				0.5 J			6				131
PC305	RV	7	06/19/1996				0.6			10				108

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC305	RV	7	07/24/1996				0.8			7				102
PC305	RV	7	08/21/1996				0.25 U			5 J				104
PC305	RV	7	09/26/1996				0.25 U			7				111
PC305	RV	7	10/29/1996				0.25			0.25				104
PC305	RV	7	11/26/1996				0.5			5				147
PC313	RV	7	12/17/1996				0.6			6				156
PC313	RV	7	01/29/1997				0.5			2.5				139
PC313	RV	7	02/19/1997				8.6			19				169
PC313	RV	7	03/27/1997				0.7			14				159
PC313	RV	7	04/17/1997				1			8				146
PC313	RV	7	05/15/1997				0.8			37				122
PC313	RV	7	06/24/1997				0.25			2.5				76
PC313	RV	7	07/23/1997				0.5			7				117
PC313	RV	7	11/24/1997				0.6			2.5				115
PC313	RV	7	12/18/1997				1.8			6				161
PC313	RV	7	01/22/1998				8.5			200				1200
PC313	RV	7	02/25/1998				0.25			2.5				116
PC313	RV	7	03/20/1998				0.25			2.5				115
PC313	RV	7	04/24/1998				2.5			8				66
PC313	RV	7	05/25/1998				0.5			5 U				102
PC313	RV	7	06/25/1998				0.6			5 U				121
PC313	RV	3	05/14/1998		1.2	2 U	0.2	2 U	23	0.4	5 U	0.2 U	0.2 U	62
PC313	RV	11	11/16/1998		9.3	0.41 J	0.2 U	0.44 U	6.9 U	1.4 J	2.5 U	0.2 U	4.5 U	97.7
PC313	RV	23	12/03/1999		2 U	1 U	0.5 U	5 U	25 U	0.62 J	5 U	0.2 U	5 U	115
PC314	RV	2	11/11/1997		0.67 U	0.16 U	0.069 U	0.49 J	34.9 U	0.67	4.3 J	0.1 U	0.22 U	70.3
PC314	RV	3	05/14/1998		0.4	2 U	0.2 U	2 U	58	0.6	8	0.2 U	0.2 U	66
PC315	RV	2	11/04/1997		3.6 J	0.39 J	0.29 J	0.36 J	5 U	0.62	3.7 J	0.1 UJ	0.22 U	106
PC315	RV	2	11/11/1997		4.4 J	0.3 UJ	0.26 J	0.51 J	10.9 U	0.39 J	3 J	0.1 U	0.22 U	98.6
PC315	RV	18	05/25/1999						970	30	2.7			80
PC315	RV	3	05/14/1998		1.1	2 U	0.5	2 U	28	2.3	5 U	0.2 U	0.2 U	66
PC315	RV	3	05/18/1998		0.5 U	1 U	0.32	3 U	20 U	1.1	5 U	0.2 U	0.3 U	70.4
PC329	SP	2	11/13/1997		2.3 J	1	3.7	2.8 J	128	37.7	144	0.1 U	0.22 U	1470
PC329	SP	3	05/12/1998		1.1	1 U	1.2	3 U	23.5	11.8	18.1	0.2 U	0.3 U	306
PC330	AD	2	11/13/1997		1 U	2	0.72	0.94 J	891	3.4	183	0.1 U	0.22 U	438
PC330	AD	7	08/14/1997				0.5			2.5				142
PC330	AD	7	09/03/1997				0.5			2.5				125
PC330	AD	7	10/16/1997				0.6			2.5				148

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC330	AD	7	07/27/1998				0.5			5 U				110
PC330	AD	7	08/25/1998				0.5			5 U				118
PC330	AD	7	09/24/1998				0.5			5 U				128
PC330	AD	7	10/26/1998				0.5			5 U				136
PC330	AD	7	11/24/1998				1.2			5 U				172
PC330	AD	7	01/15/1999				0.8			13				115
PC330	AD	7	02/22/1999				0.6			5 U				147
PC330	AD	7	03/08/1999				0.6			5 U				145
PC330	AD	3	05/12/1998			1		3 U		0.5 U		0.2 U	0.3 U	
PC330	AD	3	05/12/1998		0.76		0.21		298		60.7			205
PC331	AD	2	11/14/1997		1.9 U	2.2	0.069 U	0.62 U	28.8 U	2.9	3.8 J	0.1 U	0.22 U	52.8 J
PC331	AD	3	05/12/1998		1.7	2.2	0.17	3 U	32	2.6	5 U	0.2 U	0.3 U	47.9
PC339	RV	18	10/21/1998				1 UJ			1				
PC339	RV	18	11/19/1998				1 UJ			1				140
PC339	RV	18	12/09/1998				1 UJ			1				140
PC339	RV	18	12/29/1998				1 UJ			2				
PC339	RV	18	02/24/1999				1 UJ			14				150
PC339	RV	18	04/20/1999				1 UJ			4				130
PC339	RV	18	05/06/1999						10 U	1	1			90
PC339	RV	18	05/19/1999						20	1	1			70
PC339	RV	18	05/25/1999						890	31	54			80
PC339	RV	18	05/27/1999						110	4	7			40
PC339	RV	18	06/01/1999						20	1	1			40
PC339	RV	18	06/16/1999							1				30
PC339	RV	18	07/20/1999											84
PC339	RV	18	08/11/1999											94.3
PC339	RV	18	08/31/1999							0.59				102
PC339	RV	3	05/16/1998		0.44 U	0.23 U	0.25 J	0.44 U	30.9 J	0.69 J	1.7 J	0.16 U	0.042 U	86.8
PC7500	AD	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	235	1 U	26.8	0.2 U	0.4 U	90.4
PC7501	RV	13	07/15/1994		1 U	2 U	3.7	0.3 U	153	21.8	0.1 U	0.2 U	0.4 U	443
PC7503	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	122	2.1	0.1 U	0.2 U	0.4 U	121
PC7504	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	92.1	1 U	0.1 U	0.2 U	0.4 U	135
PC7505	AD	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	72.6
PC7602	SP	13	07/18/1994		1 U	2 U	6.6	10.9	5 U	2.4	13.9	0.2 U	0.4 U	1430
PC7602	SP	13	11/18/1994		1 U	2 U	6.7	5.3	5 U	1 U	7.1	0.2 U	0.4 U	1420

Surface Water - Dissolved Metals (ug/l)

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC100	RV	11	11/16/1998		0.83 U	0.2 U	1.2	0.32 U	6.9 U	0.39 J	1.5 U	0.2 U	4.5 U	231
PC305	RV	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		230
PC305	RV	6	10/12/1997		50 U	5 U	5 J	12 U		3 U		0.2 U		80
PC305	RV	6	04/24/1997		45 U	4.5 U	3 U	3 U		1.5 U		0.2 U		111
PC305	RV	6	02/04/1997		45 U	1.5 U	3 U	3 U		1.5 U		0.2 U		128
PC305	RV	7	10/29/1993				0.25 U			6				131
PC305	RV	7	12/01/1993				0.25 U			1.5 U				108
PC305	RV	7	12/21/1993				0.25 U			1.5 U				115
PC305	RV	7	01/21/1994				0.25 U			1.5 U				103
PC305	RV	7	02/17/1994				0.25 U			1.5 U				95
PC305	RV	7	03/08/1994				0.6			1.5 U				135
PC305	RV	7	03/23/1994				0.25 U			1.5 U				121
PC305	RV	7	04/08/1994				0.25 U			1.5 U				104
PC305	RV	7	04/18/1994				0.25 U			1.5 U				57
PC305	RV	7	05/03/1994				0.7			1.5 U				71
PC305	RV	7	05/19/1994				0.25 U			1.5 U				73
PC305	RV	7	06/08/1994				0.25 U			1.5 U				86
PC305	RV	7	06/24/1994				0.4 J			1.5 U				78
PC305	RV	7	08/17/1994				0.25 U			2.5 J				89
PC305	RV	7	09/26/1994				0.25 U			1.5 U				100
PC305	RV	7	10/05/1994				0.25 U			1.5 U				98
PC305	RV	7	11/16/1994				0.25 U			1.5 U				129
PC305	RV	7	12/14/1994				0.25 U			1.5 U				124
PC305	RV	7	01/10/1995				1.5			5				402
PC305	RV	7	02/09/1995				0.9			1.5 U				224
PC305	RV	7	03/22/1995				1.2			4				202
PC305	RV	7	04/14/1995				1			1.5 U				152
PC305	RV	7	04/27/1995				3.2			1.5 U				104
PC305	RV	7	05/11/1995				2			3 J				77
PC305	RV	7	05/24/1995				0.5 J			1.5 U				82
PC305	RV	7	06/12/1995				0.25 U			1.5 U				85
PC305	RV	7	06/27/1995				0.25 U			1.5 U				88
PC305	RV	7	07/11/1995				0.3 J			1.5 U				85
PC305	RV	7	07/25/1995				0.25 U			4				89
PC305	RV	7	08/14/1995				0.25 U			1.5 U				101
PC305	RV	7	09/13/1995				0.25 U			4				97
PC305	RV	7	10/18/1995				0.25 U			2.5 J				105

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC305	RV	7	11/22/1995				0.6			1.5 U				123
PC305	RV	7	12/27/1995				0.8			1.5 U				149
PC305	RV	7	01/18/1996				1.1			4				127
PC305	RV	7	02/28/1996				0.604			1.5 U				198
PC305	RV	7	03/27/1996				0.7			3 J				280
PC305	RV	7	04/18/1996				0.25 U			11				129
PC305	RV	7	05/08/1996				0.5 J			4				152
PC305	RV	7	06/19/1996				0.6			5				186
PC305	RV	7	07/24/1996				0.8			5				106
PC305	RV	7	08/21/1996				0.25 U			1.5 U				97
PC305	RV	7	09/26/1996				0.9			1.5 U				114
PC305	RV	7	10/29/1996				0.25			0.15				99
PC305	RV	7	11/26/1996				0.25			3				157
PC313	RV	7	12/17/1996				0.8			1.5				167
PC313	RV	7	01/29/1997				0.25			1.5				124
PC313	RV	7	02/19/1997				2.4			4				157
PC313	RV	7	03/27/1997				0.6			3				146
PC313	RV	7	04/17/1997				1.7			3				144
PC313	RV	7	05/15/1997				1.2			1.5				72
PC313	RV	7	06/24/1997				0.25			2.5				74
PC313	RV	7	07/23/1997				0.5			1.5				124
PC313	RV	7	11/24/1997				0.5			1.5				113
PC313	RV	7	12/18/1997				0.8			3				130
PC313	RV	7	01/22/1998				8.6			36				1210
PC313	RV	7	02/25/1998				0.5			1.5				117
PC313	RV	7	03/20/1998				0.25			1.5				105
PC313	RV	7	04/24/1998				2.2			3				66
PC313	RV	7	05/25/1998				0.5			3 U				100
PC313	RV	7	06/25/1998				0.7			8				128
PC313	RV	3	05/14/1998		1.2	2 U	0.2	2 U	20 U	0.3	5 U	0.2 U	0.2 U	62
PC313	RV	11	11/16/1998		8.7	0.27 J	0.19 U	0.31 U	6.9 U	0.36 J	2 U	0.2 U	4.5 U	96.8
PC313	RV	23	12/03/1999		2 U	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	114
PC314	RV	2	11/11/1997		0.5	0.18	0.042	0.5 U	19	0.29	3.8	0.2 U	0.03 U	62.4
PC314	RV	3	05/14/1998		0.5	2 U	0.2	2 U	27	0.2	7	0.2 U	0.2 U	64
PC315	RV	2	11/04/1997		3.4	0.35	0.4	0.5 U	10 U	0.27	2.6	0.2 U	0.03 U	102
PC315	RV	2	11/11/1997		4	0.21	0.26	0.5 U	10 U	0.22	1.3	0.2 U	0.03 U	93.8
PC315	RV	18	05/25/1999				1 U		970	1 U	54			40

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC315	RV	3	05/14/1998		1.1	2 U	0.4	2 U	46	0.8	5 U	0.2 U	0.2 U	68
PC315	RV	3	05/18/1998		0.5 U	1 U	0.33	3 U	20 U	0.51	5 U	0.2 U	0.3 U	69.6
PC329	SP	2	11/13/1997		2.1	0.96	4.14	2.7	104	42.3	148	0.2 U	0.03 U	1410
PC329	SP	3	05/12/1998		1.1	1 U	1.3	3 U	20 U	7.6	17.8	0.2 U	0.3 U	301
PC330	AD	2	11/13/1997		0.52	0.76	0.53	0.5 U	13	0.12	139	0.2 U	0.03 U	349
PC330	AD	7	08/14/1997				0.5			3				133
PC330	AD	7	09/03/1997				0.5			1.5				142
PC330	AD	7	10/16/1997				0.6			1.5				164
PC330	AD	7	07/27/1998				0.5			3 U				108
PC330	AD	7	08/25/1998				0.5			3 U				115
PC330	AD	7	09/24/1998				0.5 U			3 U				136
PC330	AD	7	10/26/1998				0.5			3 U				139
PC330	AD	7	11/24/1998				1.1			3 U				177
PC330	AD	7	01/15/1999				0.7			3 U				110
PC330	AD	7	02/22/1999				0.8			3 U				151
PC330	AD	7	03/08/1999				0.6			3 U				145
PC330	AD	3	05/12/1998		0.73	1 U	0.2	3 U	20 U	0.5 U	50.5	0.2 U	0.3 U	
PC330	AD	3	05/12/1998											192
PC331	AD	2	11/14/1997		1.7	2.4	0.096	0.57	10 U	0.9	1.4	0.2 U	0.03 U	37.2
PC331	AD	3	05/12/1998		1.7	2	0.13	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	39.2
PC339	RV	18	10/21/1998				1 UJ			1 UJ				140
PC339	RV	18	11/19/1998				1 UJ			1 UJ				140
PC339	RV	18	12/09/1998				1 UJ			1 UJ				139
PC339	RV	18	12/29/1998				1 UJ			1				168
PC339	RV	18	02/24/1999				1 UJ			1				135
PC339	RV	18	04/20/1999				1 UJ			1				122
PC339	RV	18	05/06/1999				1 U		10 U	1 U	1 U			95
PC339	RV	18	05/19/1999				1 U		10 U	1 U	1 U			68
PC339	RV	18	05/25/1999				1 U		6	1 U	2			39
PC339	RV	18	05/27/1999				1 U		10 U	1 U	1 U			40
PC339	RV	18	06/01/1999				1 U		10 U	1 U	1 U			40
PC339	RV	18	06/16/1999				1			1				35
PC339	RV	18	07/20/1999				1 U			1 U				87
PC339	RV	18	08/11/1999				1 U			1 U				96
PC339	RV	18	08/31/1999				1 U			1 U				108
PC339	RV	3	05/16/1998		0.5 U	0.23 U	0.28 J	0.44 U	38.8 J	0.7 J	1.6 J	0.16 U	0.042 UJ	87.2 J
PC7656	RV	13	—			4 U	0.6 U	0.6 U	18	0.702	1.2			260

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC7656	RV	13	03/01/1993			4 U	0.6 U	0.6 U	24.8	1.23	1.1			152
PC7656	RV	13	08/01/1993			4 U	0.6 U	0.6 U	3.2	2 U	0.2 U			147
PC7657	RV	13	—			4 U	0.6 U	0.6 U	15	0.571	0.2 U			189
PC7657	RV	13	03/01/1993			4 U	0.6 U	0.6 U	17	0.598	0.2 U			150
PC7657	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			148
PC7658	RV	13	—			4 U	0.6 U	0.6 U	20	0.433	0.2 U			197
PC7658	RV	13	03/01/1993			4 U	0.6 U	3.1	15	0.677	0.2 U			153
PC7658	RV	13	08/01/1993				0.6 U	0.6 U	3.4	2 U	0.2 U			165
PC7698	RV	13	—			4 U	0.6 U	3.8	12	1.97	1.3			228
PC7698	RV	13	03/01/1993			4 U	0.6 U	0.6 U	17	0.744	0.2 U			150
PC7698	RV	13	08/01/1993				0.6 U	3.6	6.7	2 U	1.1			152

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	7	6	2.9	437	80.9	2.16	31.3	1	1	0
Arsenic	7	7	15.7	523	136	1.32	22	6	1	0
Cadmium	7	6	0.73	82.6	19.6	1.69	9.8	2	0	0
Copper	7	7	13.4	1,430	257	2.02	100	2	1	0
Iron	7	7	19,900	45,300	28,100	0.31	65,000	0	0	0
Lead	7	7	183	7,690	3,280	0.8	171	7	4	0
Manganese	7	7	37.4	1,940	987	0.56	3,597	0	0	0
Mercury	7	7	0.12	2.8	0.776	1.17	23.5	0	0	0
Silver	7	7	0.17	56.1	12	1.65	391	0	0	0
Zinc	7	7	254	8,990	2,390	1.36	280	6	2	0

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	5	5	3.1	23.9	11.4	0.68	31.3	0	0	0
Arsenic	5	5	18.3	181	84.4	1	22	3	0	0
Cadmium	5	4	8.5	34.7	15.8	0.8	9.8	2	0	0
Copper	5	4	22.6	197	77	1.05	100	1	0	0
Iron	5	5	20,000	128,000	53,200	0.85	65,000	1	0	0
Lead	5	5	847	6,960	3,050	0.83	171	5	3	0
Manganese	5	5	207	8,990	2,410	1.54	3,597	1	0	0
Mercury	5	5	1	4.4	2.98	0.47	23.5	0	0	0
Silver	5	5	0.76	10.4	5.53	0.71	391	0	0	0
Zinc	5	5	408	16,800	5,160	1.29	280	5	3	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	52	32	0.6	14.7	2.13	1.62	3.3	4	0	0
Arsenic	52	47	4.95	262	49.7	1.36	13.6	32	5	0
Cadmium	52	44	0.113	18.2	4.69	0.99	1.56	35	1	0
Copper	51	50	6.58	284	48.6	1.03	32.3	24	0	0
Iron	52	52	6,270	50,900	20,300	0.46	40,000	2	0	0
Lead	52	52	5.16	6,680	1,020	1.37	51.5	46	27	2
Manganese	52	52	16.1	1,400	645	0.53	1,210	5	0	0
Mercury	52	26	0.0521	1.6	0.349	1.21	0.179	12	0	0
Silver	52	42	0.175	26.6	2.72	1.61	4.5	4	0	0
Zinc	52	52	10	6,930	1,200	1.08	200	45	8	0

Statistical Summary of Total Metals Concentrations in Groundwater
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	7	7	2.1	7.7	4.97	0.48	6	4	0	0
Arsenic	7	1	4	4	4	< 0.001	50	0	0	0
Cadmium	7	5	1	97.8	25.2	1.62	2	4	1	0
Copper	7	7	1.7	45.2	9.21	1.73	1	7	1	0
Iron	7	3	41.9	358	149	1.21	300	1	0	0
Lead	7	3	1.2	11.3	5	1.1	15	0	0	0
Manganese	7	7	9.3	1,390	243	2.09	50	3	1	0
Zinc	7	7	103	10,200	3,070	1.19	30	7	5	3

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	66	5	0.5	241	49.3	2.17	6	1	1	0
Arsenic	69	27	0.17	36.9	3.45	2.09	50	0	0	0
Cadmium	127	107	0.27	190	11.3	2.32	2	89	7	0
Copper	70	41	0.21	568	28.1	3.36	1	33	9	3
Iron	71	41	5.6	23,100	1,310	2.91	300	17	5	0
Lead	131	110	0.13	2,160	44.1	4.9	15	26	5	1
Manganese	71	42	0.6	2,610	333	1.84	50	21	11	0
Silver	63	2	0.22	10.7	5.46	1.36	100	0	0	0
Zinc	130	123	6.7	65,400	3,580	2.31	30	118	104	45

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	36	12	0.5	267	23	3.34	2.92	1	1	0
Arsenic	113	28	0.1	33.1	2.26	2.73	150	0	0	0
Cadmium	175	116	0.38	226	13	2.4	0.38	115	55	6
Copper	115	46	0.26	1,070	44.7	3.94	3.2	22	4	2
Iron	112	67	2.5	11,700	516	3.26	1,000	8	1	0
Lead	175	131	0.08	2,560	52.1	5.82	1.09	106	17	4
Manganese	117	69	0.7	3,070	302	2.08	20.4	30	18	3
Silver	34	1	0.056	0.056	0.056	< 0.001	0.43	0	0	0
Zinc	177	171	3.8	73,600	3,440	2.66	42	145	121	34

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Copper	2	1	0.52	0.52	0.52	< 0.001	1	0	0	0
Iron	3	1	20	20	20	< 0.001	300	0	0	0
Lead	2	1	0.15	0.15	0.15	< 0.001	15	0	0	0
Manganese	2	1	2.3	2.3	2.3	< 0.001	50	0	0	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	5	1	0.11	0.11	0.11	< 0.001	150	0	0	0
Copper	5	1	5.2	5.2	5.2	< 0.001	3.2	1	0	0
Iron	6	3	10	18	15	0.29	1,000	0	0	0
Lead	6	2	0.18	0.367	0.274	0.48	1.09	0	0	0
Zinc	6	4	2.5	12	8.3	0.52	42	0	0	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	9	6	5.4	59.7	23.8	1.1	31.3	2	0	0
Arsenic	9	9	9.2	347	96.1	1.19	22	6	1	0
Cadmium	9	4	1.9	4	2.95	0.29	9.8	0	0	0
Copper	9	9	5.8	162	56.7	0.85	100	1	0	0
Iron	9	9	16,600	71,300	32,800	0.53	65,000	1	0	0
Lead	9	9	140	8,260	2,940	1.08	171	8	4	0
Manganese	9	9	93	1,070	571	0.57	3,597	0	0	0
Mercury	9	8	0.11	2.2	0.938	0.82	23.5	0	0	0
Silver	9	8	0.45	11.8	5.38	0.92	391	0	0	0
Zinc	9	9	64.8	1,030	579	0.48	280	8	0	0

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	6	4	4.2	20.6	12.8	0.58	31.3	0	0	0
Arsenic	6	6	17.6	227	95.4	0.88	22	5	1	0
Cadmium	6	5	7	122	46.1	1.01	9.8	3	1	0
Copper	6	6	24.9	779	327	0.91	100	5	0	0
Iron	6	6	12,100	103,000	42,500	0.87	65,000	2	0	0
Lead	6	6	331	4,290	1,750	0.86	171	6	3	0
Manganese	6	6	18.6	988	481	0.98	3,597	0	0	0
Mercury	6	6	0.14	4.6	1.22	1.44	23.5	0	0	0
Silver	6	6	0.27	7.7	2.57	1.11	391	0	0	0
Zinc	6	6	113	16,900	5,600	1.15	280	5	3	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	22	12	0.92	31.8	7.42	1.62	3.3	3	0	0
Arsenic	22	22	2.79	60.6	17.7	0.87	13.6	10	0	0
Cadmium	22	22	0.38	1.7	0.921	0.38	1.56	2	0	0
Copper	22	22	10.1	41.6	19.2	0.42	32.3	1	0	0
Iron	22	22	9,170	24,200	15,900	0.26	40,000	0	0	0
Lead	22	22	24.8	738	198	0.72	51.5	21	1	0
Manganese	22	22	127	739	405	0.39	1,210	0	0	0
Mercury	22	5	0.0478	0.13	0.0694	0.49	0.179	0	0	0
Silver	22	18	0.344	0.993	0.633	0.29	4.5	0	0	0
Zinc	22	22	128	516	298	0.32	200	19	0	0

Statistical Summary of Total Metals Concentrations in Groundwater
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	8	4	1.6	7.7	4.8	0.67	6	2	0	0
Arsenic	8	1	1	1	1	< 0.001	50	0	0	0
Cadmium	8	3	0.52	1.4	0.817	0.62	2	0	0	0
Copper	8	6	1.2	166	52.6	1.45	1	6	2	2
Iron	8	4	56.5	2,080	1,100	0.9	300	3	0	0
Lead	8	4	0.73	16.6	8.68	0.91	15	1	0	0
Manganese	8	6	2	262	89.3	1.42	50	2	0	0
Zinc	8	8	26.2	2,420	679	1.56	30	7	2	0

Statistical Summary of Dissolved Metals Concentrations in Groundwater
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	8	2	7.6	7.8	7.7	0.02	2.92	2	0	0
Arsenic	8	1	0.14	0.14	0.14	< 0.001	150	0	0	0
Cadmium	8	2	0.53	6	3.27	1.18	0.38	2	1	0
Manganese	3	1	5.7	5.7	5.7	< 0.001	20.4	0	0	0
Mercury	8	1	0.2	0.2	0.2	< 0.001	0.77	0	0	0
Zinc	8	8	26.5	160	74.8	0.64	42	5	0	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	29	10	0.4	9.3	2.59	1.03	6	1	0	0
Arsenic	29	8	0.29	2.2	1.19	0.7	50	0	0	0
Cadmium	107	63	0.17	8.6	1.27	1.44	2	9	0	0
Copper	29	8	0.36	10.9	3.06	1.18	1	4	1	0
Iron	31	19	20	970	222	1.44	300	3	0	0
Lead	115	75	0.25	200	9.61	2.48	15	8	1	0
Manganese	31	19	1	183	28.7	1.77	50	4	0	0
Zinc	115	115	30	1,470	170	1.42	30	114	9	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	21	13	0.5	8.7	2.1	1.08	2.92	3	0	0
Arsenic	31	8	0.18	2.4	0.891	0.97	150	0	0	0
Cadmium	121	65	0.042	8.6	0.972	1.34	0.38	50	3	0
Copper	33	5	0.57	3.8	2.75	0.47	3.2	2	0	0
Iron	35	19	3.2	970	72.4	3.02	1,000	0	0	0
Lead	121	60	0.12	42.3	3.52	2	1.09	37	3	0
Manganese	35	16	1.1	148	27.1	1.79	20.4	4	0	0
Zinc	121	121	35	1,410	146	1.12	42	114	2	0

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram

Prichard Creek

CSM Unit 1, Upper Watersheds

Prichard Creek

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ABBREVIATIONS AND ACRONYMS

AWQC	Ambient Water Quality Criteria
BLM	Bureau of Land Management
cfs	cubic foot per second
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
CV	coefficient of variation
EE/CA	Engineering Evaluation and Cost Analysis
EPA	U.S. Environmental Protection Agency
EV	expected value
FS	feasibility study
µg/L	microgram per liter
NFCDR	North Fork Coeur d'Alene River
North Fork	North Fork Coeur d'Alene River
PDF	probability density function
PrichCrkSeg	Prichard Creek segment
PRG	preliminary remediation goal
RI	remedial investigation
SL	screening level
TMDL	total maximum daily load
URSG	URS Greiner, Inc.
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Prichard Creek Watershed is located within the Coeur d'Alene River basin and is a western-flowing tributary of the North Fork Coeur d'Alene River (North Fork). The Bureau of Land Management (BLM) has identified 58 source areas (e.g., mining waste rock dumps, adits, and jig tailings piles) within the watershed (BLM 1999). The watershed has been affected by mining activities and past and continuing releases of mining wastes.

Previous clean-up action in the Prichard Creek watershed consists of some isolated portal closures conducted by the USDA Forest Service in the 1998, 1999, and 2000 field seasons. A non-time critical CERCLA removal action is planned by the USDA Forest Service for implementation at the Paragon Mine in the Prichard watershed for the 2001/2002 construction season. A non-time critical CERCLA removal action is also planned for the Jack Waite mine and mill site on the East Fork of Eagle Creek, a tributary of Prichard Creek. Sampling in support of development of an Engineering Evaluation and Costs Analysis (EE/CA) is currently being performed to support decision-making for the cleanup of this site. The Forest Service is working under an agreement with an identified potential responsible party to facilitate this clean-up action (Johnson 2000).

The Prichard watershed is included in an integrated watershed analysis of the Prichard, Beaver and Eagle Creek drainages that is being currently performed for the Forest Service and Bureau of Land Management by the United States Geological Survey. The watershed analysis is being used to help assess the environmental and human health risks, and to establish priorities for reclamation work at numerous abandoned mine sites located in the National Forest lands in these watersheds (Johnson 2000).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself has been divided into three segments to focus this investigation (Figure 1.1-1). Brief descriptions of each segment are presented in this section.

1.1 SEGMENT DESCRIPTIONS

Segment PrichCrkSeg01 contains the headwaters of Prichard Creek down to just above the Paragon mill site (Figure 4.1-1). The BLM identified five mining-related sites (source areas of potential metals contamination) in this segment; however, Prichard Creek does not receive much

metals input from this segment. The area is relatively undisturbed with an intact and well-vegetated riparian zone and stable stream banks.

Segment PrichCrkSeg02 contains Bear Gulch, a tributary to Prichard Creek (Figure 4.1-3). The BLM identified nine source areas in this segment. Slightly elevated concentrations of dissolved lead have been observed in the lower part of Bear Gulch. The area is relatively undisturbed, with an intact and well-vegetated riparian zone and stable stream banks.

Segment PrichCrkSeg03 contains Prichard Creek, below the Paragon mill site, to its confluence with the North Fork (Figure 4.1-5). The BLM identified 44 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than ambient water quality criteria (AWQC).

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Prichard Creek Watershed is one of eight reports contained within Part 2 presenting the remedial investigation (RI) results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on U.S. Environmental Protection Agency (EPA) Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final (USEPA 1988). This report contains the following sections:

- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology.
- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination; includes a summary of chemical results and estimates of mass loading from source areas
- Section 5–Fate and Transport; includes chemical and physical transport processes for metals
- Section 6–References

Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment, the ecological risk assessment, and the feasibility study (all under separate cover).

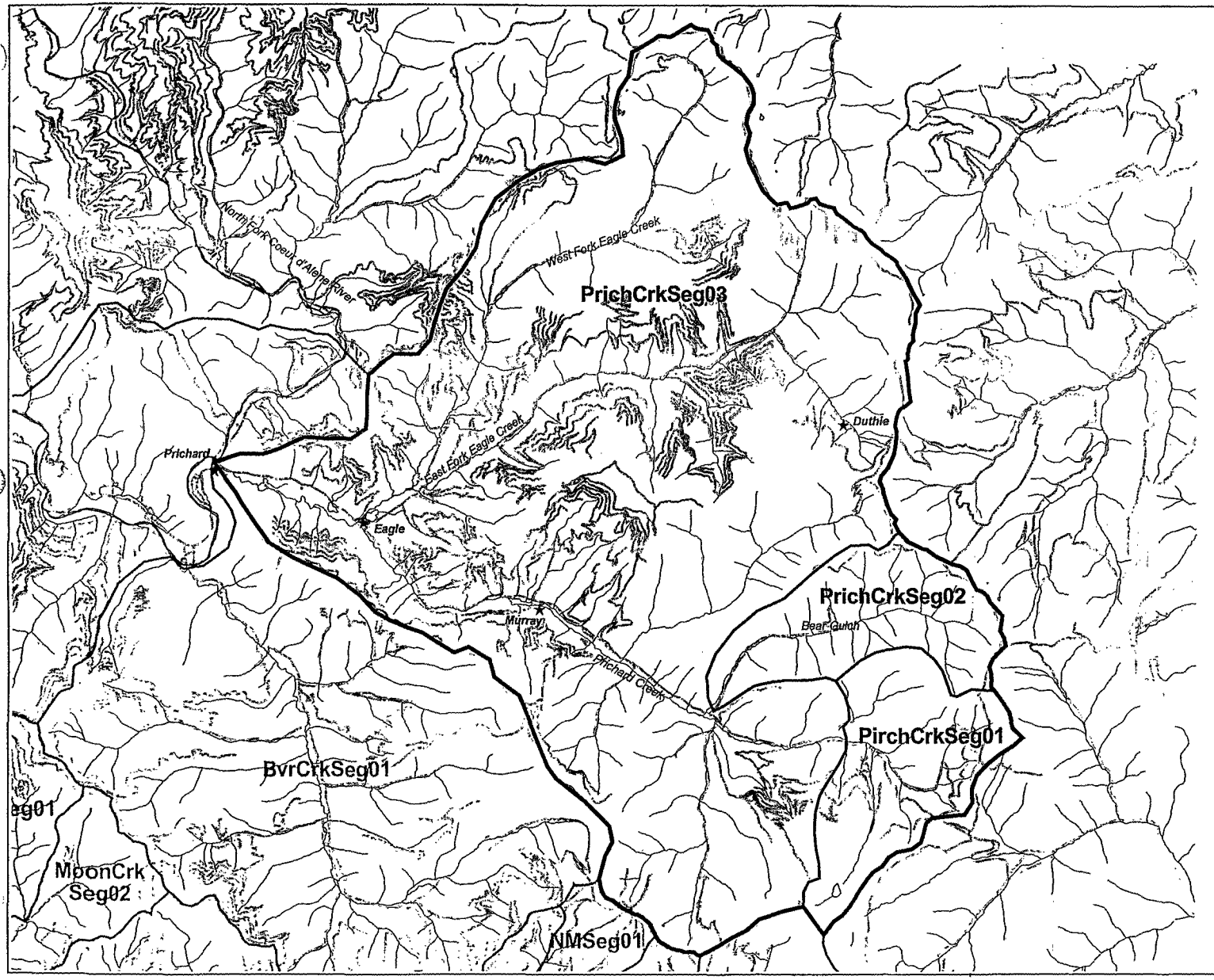

Figure 1.1-1
Prichard Creek Watershed

LEGEND

- Stream
- Road
- City
- Prichard Creek Watershed
- Prichard Creek Segment
- River Segment
- Lake/River

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:98,000

0.5 0 0.5 1 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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Generation 1
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V:Prichard Creek
E:Prichard Creek
L: Final RI Prichard Creek
7/11/2001
pdfn:\PDF files\RI\section1\Prichard Creek

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Prichard Creek Watershed are presented in this section.

2.1.1 Geomorphic Setting

The Prichard Creek Watershed is located in the northeast portion of the district, situated between the North Fork Coeur d'Alene River (North Fork) and the Idaho-Montana border (Part 1, Figure 1.2-2). Prichard Creek, the principal drainage of the watershed, flows in a westerly direction from its headwaters in the Bitterroot Mountains and empties into the North Fork (Part 1, Figure 1.2-2). The headwaters of the watershed consist of the upper reaches of Prichard Creek and Sullivan, Cascade, and Paragon Gulches at elevations ranging from 5,500 to 5,900 feet. The elevation at the mouth of Prichard Creek where it empties into the North Fork is 2,500 feet.

Like most drainages in the district, Prichard Creek and its tributaries flow through narrow, steep-walled, V-shaped canyons throughout their course, with the exception of the lower five mile reach of Prichard Creek between Murray and the North Fork (Umpleby and Jones 1923). The Prichard Creek channel widens along this five mile reach, generally exhibiting a relatively flat floodplain up to 0.5 mile wide that is enclosed by steep canyon walls.

2.1.2 Bedrock Geology

Weakly metamorphosed sedimentary rocks assigned to the Precambrian Belt Supergroup are the most prevalent rocks within the Prichard Creek Watershed (Umpleby and Jones 1923). The Prichard Formation argillite is by far the dominant rock type in the watershed. Lesser amounts of Burke Formation quartzite occur at the headwaters of Prichard Creek and in the following drainages that flow into Prichard Creek: Sullivan and Cascade Gulches, and at the upper part of Paragon Gulch (Umpleby and Jones 1923). The Burke Formation also occurs at the confluence with the North Fork, as do smaller masses of Wallace Formation (which consists of alternating beds of carbonate-bearing quartzite and argillite) and St. Regis Formation (consisting of thin-bedded quartzite and argillite).

Aside from Belt Supergroup rocks, the Gem Stock igneous monzonite outcrops along Granite Gulch and on the north side of Prichard Creek in the vicinity of the town of Raven and Cement

Gulch, about 9 miles above the confluence of Prichard Creek and the North Fork (Umpleby and Jones 1923).

The geologic contact between the Burke and Prichard Formations at the headwaters of the watershed is fault-controlled (Umpleby and Jones 1923). Similarly, in the vicinity of Eagle (about 2.5 miles above the confluence of Prichard Creek and the North Fork) the contacts between the Burke and Wallace Formations, and the Wallace and Prichard Formations are also fault-controlled (Umpleby and Jones 1923).

2.1.3 Structural Geology

The structural fabric of the Prichard Creek Watershed is dominated by two distinct structural trends: roughly east-west and north-northwest (Hobbs et al. 1965). There are two major, roughly parallel, north-northwest-trending faults of the watershed: (1) the northern extension of the Dobson Pass Fault, a normal fault (Part 1, Figure 3.2-2); and (2) the Murray Peak Fault (Hobbs et al. 1965), located 2 to 3 miles east of the Dobson Pass Fault, and extending northward beyond the trace of the Dobson Pass Fault. The sedimentary rocks in the area between these two faults have been folded into a north-trending anticlinal structure (Hobbs et al. 1965); north-trending fold axes are typical of the district to the north of the Osburn Fault (Hobbs et al. 1965).

The roughly east-west-trending Thompson Pass Fault (Hobbs et al. 1965) is the most prominent east-west structure in the watershed. The trace of this fault runs from the headwaters of Prichard Creek to a point about one mile south of Murray (Hobbs et al. 1965).

Mines in this watershed are typically fissure vein deposits with vein material (primarily quartz) filling faults and fractures.

2.1.4 Soils

Like most of the soils throughout the district, the soils of the Prichard Creek Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay, generally less than 2 feet thick (MFG 1992; Camp Dresser & McKee 1986). Valley soils are found within and along the flanks of Prichard Creek, most notably along the 5-mile reach above the confluence with the North Fork, and within and along the lower reaches of the various drainages that flow into Prichard Creek (Umpleby and Jones 1923).

The valley soils typically consist of gravel, sand and silt deposited on valley bottoms; in some areas this material is mixed or covered with tailings from milling operations (Umpleby and Jones 1923). Tailings are discussed further in Section 4, Nature and Extent of Contamination.

Three to 5 miles upstream of the confluence of Prichard Creek and the North Fork are terrace gravels (Umpleby and Jones 1923), which are a series of irregular masses up to 1 mile across in their longest dimension. These deposits are mixtures of sand and gravel that exist as benches up to 1,200 feet above nearby streams (Umpleby and Jones 1923).

Elevated metal concentrations may be present in some soils overlying ore deposits. These elevated concentrations or dispersion patterns were studied by the USGS (Gott and Cathrall 1980). The background evaluation presented in Part 1 of the RI takes into account this process.

2.1.5 Ore Deposits

Most of the mines in the Prichard Creek Watershed produced silver, lead, and zinc as their principal commodities. However, this watershed includes a series of mines (currently apparently not operating) whose principal commodity was gold, which is unlike all other areas within the district. Most of the gold mines are located within a 2-mile radius of the town of Murray (Part 1, Figure 1.2-2) (Ransome and Calkins 1908).

The Jack Waite is typical of most ore deposits in the watershed in that it consists of a steeply-dipping lead-zinc-silver fissure vein deposit which cuts across the bedding of the enclosing Prichard Formation argillite and quartzite (Umpleby and Jones 1923). Vein width varies from a fraction of an inch to 10 feet, averaging approximately 4 feet (Umpleby and Jones 1923). The ore minerals are galena and lesser sphalerite; the non-ore (gangue) minerals are quartz, and lesser siderite and pyrite (Umpleby and Jones 1923).

Gold mines in the watershed were typically nearly flat-lying gold-quartz veins that occurred parallel to the argillite beds of the Prichard Formation which enclosed the deposits (Ransome and Calkins 1908). The producing veins were typically 1-foot wide, although a maximum width of 10 feet is recorded (Gold Chest Mine). The non-ore minerals pyrite, siderite, and calcite were typically absent (or nearly so) from the gold-quartz veins (Ransome and Calkins 1908).

Waste rock piles are present at all mine workings and consist of broken, angular rock that is generally not milled and typically dumped near the mouth of workings. The largest waste rock pile in the watershed is located at the Jack Waite Mine, located 6 miles north of the town of

Murray (Part 1, Figure 1.2-2). The chemical and mineralogical content of waste rock in the Prichard Creek Watershed is discussed further in Section 4, Nature and Extent of Contamination.

In addition to the hard-rock mining of gold-quartz veins, alluvial or placer gold was recovered from bench gravels lying from 250 to 300 feet above the present streams and recent stream gravels (Ransome and Calkins 1908). Production figures for placer gold are apparently not available; however, it is assumed that placer gold production was considerably less than hard-rock gold mining.

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

The beginning of mining activity within the Prichard Creek Watershed can likely be attributed to Andrew Prichard. Prichard, who is also credited with the first discovery of gold in the Coeur d'Alene Mining District, began exploring drainages of the North Fork soon after his discovery of gold near the South Fork drainage of Big Creek. In 1882, Prichard found evidence of placer gold along Prichard Creek, and in March of 1883 he staked a claim east of the confluence of Eagle and Prichard Creeks. A small boom ensued as other miners staked claims in the area (Quivik 1999).

In contrast to the lead-zinc operations that were common in drainages of the South Fork, most of the early mining activity within the Prichard Creek Basin continued to be centered around gold mining. Gold mining was typically performed through a process known as placer mining. Placer mining consists of using high-pressure water to erode large volumes of alluvial material that is then washed through sluice boxes to recover gold. Although this type of mining practice does release large amounts of sediments, it does not alter the size or chemical composition of the mined material. Milling of gold ore was typically accomplished through a stamp milling process. Although mercury was sometimes used for this process, historical evidence for most mills in this area suggest that vanners were used to produce a product of nearly pure gold dust. Because this process recovered only several ounces of gold per ton of ore process, it has been assumed that essentially all of the material processed by these mills was disposed of within Prichard Creek and its tributaries (Quivik 1999).

Beginning in the early twentieth century, mines within the basin began to extract metals other than gold. None of these mines operated for as long or as continuously as the more profitable mines located within drainages of the South Fork (Quivik 1999). Many of the mines in the watershed were limited by access. In 1909, the completion of the Idaho Northern Railroad to a terminal 6 miles east of Murray helped spur some additional development of mining in this area (IGS 1999).

Production records for mines in the Prichard Creek Watershed indicate that approximately 636,000 tons of ore were mined, resulting in an estimated 497,000 tons of tailings (SAIC 1993). From this ore, an estimated 64,724 tons of lead, 15,567 tons of zinc, 56 tons of copper, 19 tons of silver and 0.38 tons of gold were produced (Mitchell and Bennett 1983).

2.1.6.1 Mines

The mines that operated in the Prichard Creek Watershed for which for production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity, and the segment in which the mine is (or was) located. Only mines with documented ore production are listed. Additionally, some mining company operations were carried out at more than one location, occasionally in more than one segment or even in more than one watershed. The ore production listed in Table 2.1-1 is the total for all mining operations.

2.1.6.2 Mills

Table 2.1-2 lists the mills with operations in the Prichard Creek Watershed for which there are records. This table includes the operating years of the mill and a summary of ownership, and the segment in which the mill is located. Not all mills are listed because records were not available for all mills.

2.1.7 Mine Workings

Underground workings in many mines are very extensive and act as collection and distribution systems for groundwater. Individual mine workings in this watershed are typically located within a single, relatively steep ridge. Recharging water infiltrates at the highest levels of a mountain ridge and discharges on the same ridge. This is referred to as a local flow system, characterized by short groundwater flow paths (a flow path is the route by which the water enters and exits the groundwater system) (Toth 1963).

Many adits and tunnels in this watershed act as discharge points for groundwater. Typically, adit drainage discharges directly to surface water or first infiltrates waste rock piles before discharging to surface water from seeps. Estimates on the number of adits and tunnels that are known to discharge mine drainage in this watershed are not available.

2.2 HYDROGEOLOGY

2.2.1 Conceptual Hydrogeologic Model

The hydrogeology of the Prichard Creek Watershed can be divided into two main groundwater systems: the bedrock aquifer and the shallow alluvial aquifer. The conceptual hydrogeologic model for the watershed assumes that a single unconfined aquifer is present in the shallow alluvial sediments, and these sediments are the principal hydrostratigraphic unit in the watershed. The shallow alluvial sediments consist of natural materials as well as mine tailings and waste rock. In general, the alluvium increases in thickness from the headwaters of Prichard Creek toward its confluence with the North Fork (Umpleby and Jones 1923). Very little specific hydrogeologic data are available for the Prichard Creek Watershed.

The bedrock aquifer within the Prichard Creek Watershed consists of argillites and quartzites of the Precambrian formations of the Belt Supergroup, including (principally) the Prichard Formation, and lesser amounts of the Wallace, Burke, and St. Regis Formations (Figure 4.3-2) (Hobbs et al. 1965). Relatively small masses of Cretaceous-aged igneous quartz monzonite are present about 3 miles north of the town of Murray (Part 1, Figures 1.2-2 and 3.2-2). In general, the bedrock has very low permeability. Secondary features such as fractures, faults, or mine workings may increase the permeability substantially. The hydrogeology of the bedrock aquifer is discussed in Section 2.1.7, Mine Workings.

The groundwater system of unconsolidated sediments overlying less permeable rocks occurs primarily in an elongate trough along the Prichard Creek, and varies in shape between V-shaped (e.g., as occurs between the headwaters in the Bitterroots to Murray) to U-shaped (e.g., as occurs between Murray and the confluence with the North Fork) (Part 1, Figure 1.2-2) (Umpleby and Jones 1923). The width of the V-shaped trough is as narrow as about 200 feet above Murray, and is as wide as approximately 1,500 feet between Eagle and the confluence with the North Fork (Part 1, Figure 1.2-2) (Umpleby and Jones 1923).

As observed in wells in the Canyon Creek and Ninemile Creek Watersheds, it is assumed that groundwater levels fluctuate seasonally. Groundwater levels are generally highest in the late

spring and lowest during winter and early spring when precipitation rates are lowest and snowmelt is not occurring.

2.2.2 Aquifer Parameters

Aquifer parameters are not available from the Prichard Creek Watershed for the presumed single unconfined aquifer in unconsolidated sediments overlying bedrock. However, based on reported lithologic similarities between the presumed single unconfined aquifer and the upper aquifer of the Smelterville Flats-Bunker Hill aquifer system, it is reasonable to expect that aquifer parameters presented in Table 2.2-1 are similar to the presumed single unconfined aquifer of the Prichard Creek Watershed. The range of horizontal hydraulic conductivities presented in Table 2.2-1 are typical of clean sand and gravels (Freeze and Cherry 1979).

2.2.3 Flow Rates and Directions

Based on similar watersheds (e.g., Canyon Creek and Ninemile Creek), it can be assumed that the general groundwater flow direction in the Prichard Creek Watershed parallels the flow of Prichard Creek surface water. Based on water level data recorded in Canyon Creek, it can be assumed that there are localized areas in Prichard Creek where the flow direction is downstream and toward the creek and some areas where the flow direction is downstream and away from the creek.

Based on an analysis of groundwater elevations in the water table aquifer in the Woodland Park area of Canyon Creek, which appears comparable to the Murray area along Prichard Creek, it can be assumed that groundwater in Prichard Creek has a fairly steep gradient, generally following the ground surface topography (Part 1, Figure 1.2-2). The gradient of 0.035 calculated for the Woodland Park area is inferred to be comparable to the Murray area (Part 1, Figure 1.2-2).

2.2.4 Surface Water/Groundwater Interaction

Based on groundwater information collected from the Canyon Creek Watershed, it can be assumed that shallow alluvial deposits along Prichard Creek serve as aquifers, and if they are hydraulically connected, they are capable of taking from or adding to flow in the creek. It is further assumed that the interaction of the surface water in Prichard Creek and groundwater in the shallow alluvial aquifers creates gaining or losing reaches. During the spring snowmelt and resulting high creek levels, the gaining reaches of the stream may temporarily experience reversals in the surface water/groundwater hydraulic gradient (i.e., become losing reaches).

2.2.5 Groundwater Use

Use of groundwater supplies for domestic, municipal, and industrial applications (as it relates to human consumption) is discussed in the Baseline Human Health Risk Assessment.

2.3 SURFACE WATER HYDROLOGY

The following sections describe the surface water hydrology of Prichard Creek, a tributary to the North Fork. The watershed has a drainage area of approximately 97.8 square miles with approximately 45 miles of mapped channel length.

2.3.1 Available Information

The available hydrologic information for Prichard Creek includes United State Geological Survey (USGS) stream flow data for water year 1999, climatological data for Wallace, ID, and instantaneous discharge data from a variety of consultants obtained between 1998 and 1999.

The USGS began reporting stream flow discharge data from Station Number 12411935, at the mouth of Prichard Creek at Prichard, ID, on October 1, 1998 (USGS 2000). This station is located at the downstream end of segment PrichCrkSeg03. This station records water stage at 15-minute intervals. Discharge is calculated from the stage data based on a rating curve developed for the specific gage. The rating curve is developed through time by measuring discharge at known stages to relate stage to discharge. Once a rating curve is developed, a discharge can be calculated by comparing a known stage to the rating curve. One complete year of discharge data, water year 1999, is available for Prichard Creek. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Wallace, Woodland Park were collected for the same period. This precipitation gage is the nearest gage to Prichard Creek (WRCC 2000). The mean daily discharge hydrograph and precipitation data are presented in Figure 2.3.1-1.

Stream discharge measurements were taken in association with water quality sampling events completed by URS and USGS. These measurements occurred from May 6, 1998, to September 8, 1999. These data are summarized in Table 2.3.1-1.

In addition to the USGS and consultants' hydrologic information, the U.S. Department of Housing and Urban Development, Federal Insurance Administration completed a flood insurance study for the Shoshone County, Idaho in 1979 (FIA 1979). This document reported computed

peak discharges for 10-year (3,850 cubic feet per second [cfs]), 50-year (6,480 [cfs]), 100-year (8,020 cfs) and 500-year (12,190) events near the mouth of Prichard Creek. Although these values reported might be dated and coefficients used to calculate these discharges may contain some error, they do provide some basis for selecting a design discharge for remedial actions.

2.3.2 Hydrologic Description

This section describes the hydrology of Prichard Creek based on water year 1999 stream discharge and precipitation data and discharge measurements obtained during water quality sampling. Base flow discharge is estimated at 15 to 20 cfs, and average annual discharge is approximately 225 cfs. The maximum instantaneous discharge recorded during water year 1999 was 1,900 cfs, on May 25, 1999, with a mean daily discharge on that day of 1,750 cfs. The minimum mean daily discharge for this period of record was 16 cfs. The discharge measurements presented in Table 2.3.1-1 are consistent with the discharge measurements taken during 1999.

2.3.2.1 Flood Frequency

Because historical discharge data are not available for Prichard Creek, discharge estimates from the FIS are reported. These estimates are presented in Table 2.3.2-1. The values indicated in Table 2.3.2-1 are larger than the extrapolated maximum mean daily discharge for water year 1999 and may provide guidance for design of remedial actions. The bankful discharge, the approximately 1.5 year event, is estimated to be approximately 1,000 cfs.

2.3.2.2 Water Year 1999

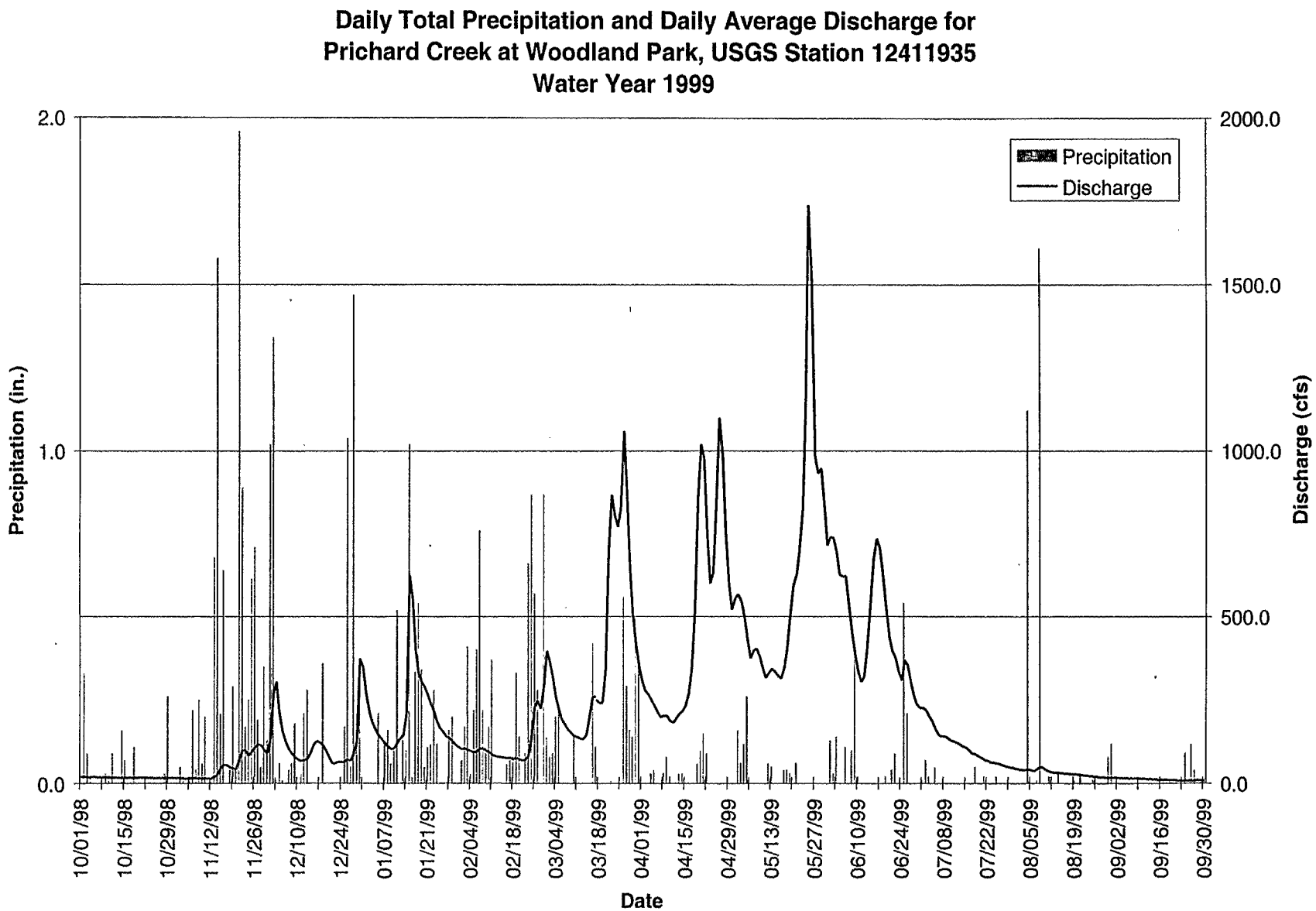
Total annual average precipitation at the WRCC Wallace at Woodland Park Station for the 51-year period of record is 37.7 inches while for water year 1999 the total precipitation was 39.8 inches. Total annual average snowfall for the WRCC station is 83.7 inches while for water year 1999 the total snowfall was 82.2. While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was typical.

Table 2.3.2-2 summarizes the mean monthly flows for Prichard Creek, and the mean monthly precipitation (rain and snow water content), and total snowfall at the WRCC station at Wallace, Woodland Park. Table 2.3.2-1 and Figure 2.3.1-1 indicate the majority of precipitation, 83 percent, occurred from October to March. Much of this precipitation was in the form of snow that did not immediately run off into the channel. However, increased discharge, above the average annual discharge of 250 cfs, occurred four times during the winter and spring months,

from December 2 to 3, from December 30 to January 1, from January 15 to January 22, and from February 25 to March 4, for a total of 21 days. In contrast, during the spring and summer months, discharge in Prichard Creek remained above the average annual discharge from March 16 to July 2, with the exception of April 6 to 13, for a total of 101 days.

The increase in discharge during the spring and summer is attributed to increased runoff caused by snowmelt in the upstream watersheds. Maximum daily temperature and mean daily discharge for water year 1999 for Prichard Creek are presented in Figure 2.3.2-1. Increased temperatures over these periods melted much of the snow in the upper basin. Rain on snow also may have contributed to these increased discharges as indicated in Figure 2.3.2-1 where precipitation events also occurred during periods of increased temperature.

Based on the existing data, it is expected that water year 1999 was typical from a total snowfall and total water budget perspective in the Prichard Creek Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the magnitude and timing of peak discharges.



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Coeur d'Alene Basin RI/FS
RI REPORT

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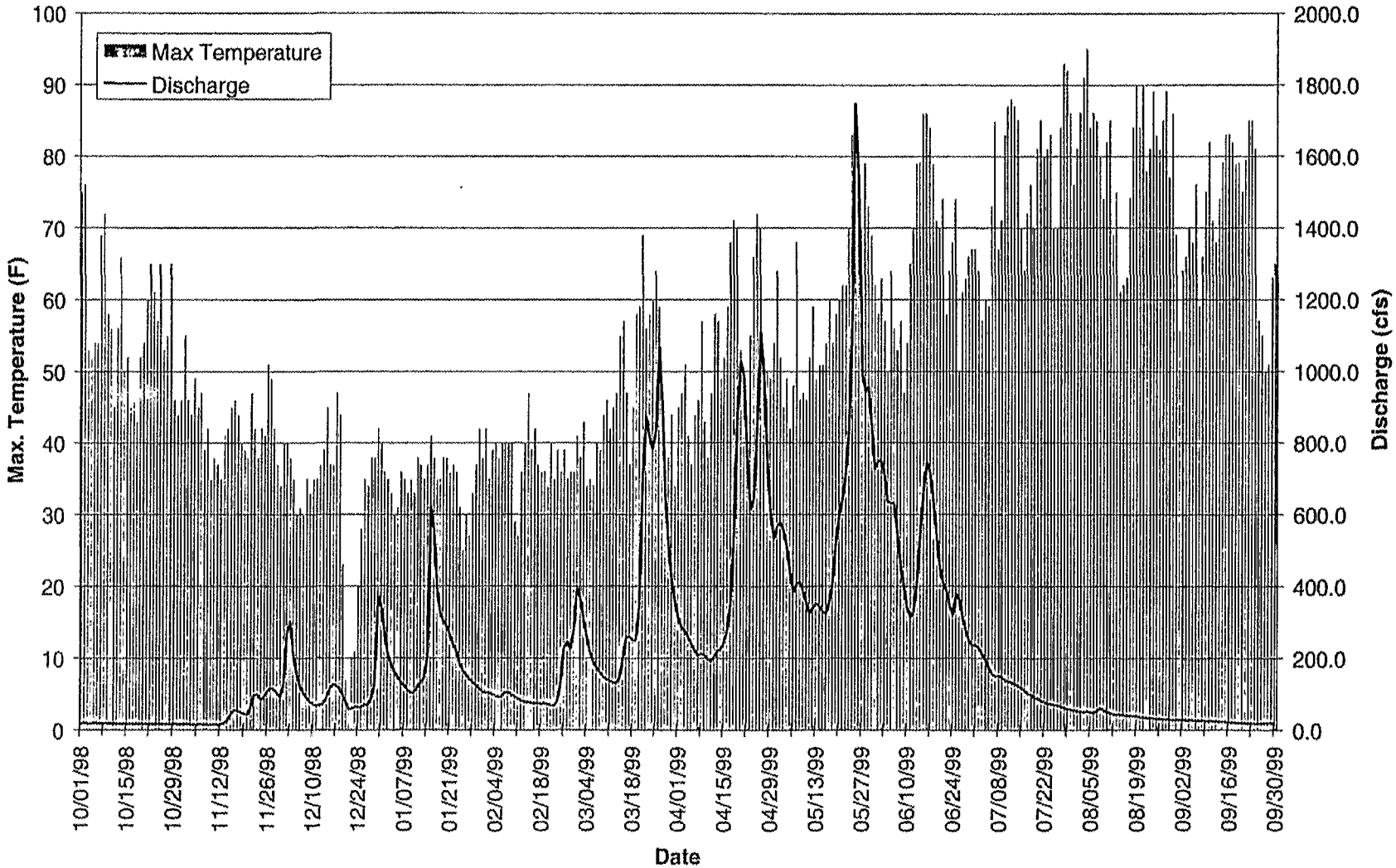
Prichard Creek Series
07/11/01

Figure 2.3.1-1

Daily Maximum Temperature and Daily Average Discharge for Prichard Creek, USGS Station 12411935 Water Year 1999



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RI REPORT

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Prichard Creek Series
07/11/01

Figure 2.3.2-1

Table 2.1-1
Mines in Prichard Creek Watershed With Recorded Production

Segment	Production Years [a]	Ore (tons)[a]	Mill	Tailings (tons)[b]	Comments
Bear Top (Orofino) Mine					
PrichCrkSeg02	1904-1973	29,396	Bear Top Mill, Nabob concentrator near Pinehurst	36,053	The Bear Top Mining Company was developing the Beartop Mine by 1905. The Beartop Mine and Orofino Mine were consolidated by 1911. Historic information for the site tends to indicate that the mine operated fairly continuously mining lead ore through 1935. Ore from the mine accounted for the largest share of output from the Summit mining district in 1931. There is some mention of the mine operating again after World War II, but the duration of these operations is unclear. The mine was operated by lessees during several periods during the 1960s. Development work was restarted again in 1977 and the mine operated through 1980 (IGS 1999).
Black Horse Mine					
PrichCrkSeg01	1905, 1917-1948	8,621	Black Horse Mill	7,614	The Blackhorse Mine is located on Paragon Gulch, upstream of the Lower Paragon mine. The Idaho-Montana Summit Mining Company began operating the Blackhorse claim in 1905. The completion of the Idaho Northern Railroad to Murray in 1909, spurred considerable development at the mine due to ease of ore shipping. In 1910, a concentration mill was built on Paragon Gulch for processing of ore from the mine. The last recorded mining activity at the site occurred in 1948, when 110 tons of zinc-lead ore were shipped from the mine (IGS 1999).
Crystal Lead Mine					

Table 2.1-1 (Continued)
Mines in Prichard Creek Watershed With Recorded Production

Segment	Production Years [a]	Ore (tons)[a]	Mill	Tailings (tons)[b]	Comments
PrichCrkSeg03	1941-1952	11,237	Silver Crescent Mill, Hercules Mill, Galena Mill	9,668	The Crystal Lead Mine is located about ¾ mile above the confluence of Cottonwood Creek and the West Fork Eagle Creek. The property was owned by the Lead Crystals Mining Company from about 1911 to 1931. In 1914 the mine consisted of about 250 feet of workings. By the end of the 1920s, total development was approximately 2,400 feet. Several shipments of lead ore were shipped from the mine in 1924, 1925 and 1926 but apparently these shipments were not well documented. The mine was sold to the Crystal Lead Mining Company in 1931. After the purchase, the mine saw little activity for the next decade. In 1941 the mine was operated by a lessee. During that year, 300 tons of lead ore were shipped to the Silver Crescent mill near Osburn and 20 tons of ore were shipped to a smelter. In 1943, mine production consisted of 456 tons of zinc-lead ore that was shipped to the Hercules Mill and 5 tons of high grade ore that was shipped to the Bunker Hill Smelter. Crystal Lead Mines Company shipped 994 tons of lead ore to the Hercules mill in 1944. Ore production for the years 1945 and 1947 were shipped to the Galena Mill near Wallace. Production for these years was 4,288 and 1,517 tons respectively. The mine also shipped 36 tons of high-grade lead ore directly to a smelter (IGS 1999).
Golden Chest Mine					
PrichCrkSeg03	1902-1949	61,704	100 ton flotation plant owned by Idaho Mother Lode Gold Mines, Inc., Cedar Creek Mill	61,606	The Golden Chest Mine is located on Reeder Gulch near the town of Murray. The mine has been described as the principal gold mine in the Murray district. Maps of the mine show over 13,000 feet of workings. The Golden Chest Group also contained the first quartz claim recorded in the Murray district. The Golden Chest Mining Company was the first to incorporate in the Coeur d'Alene district in 1884. In 1937 and 1940, the Golden Chest accounted for the greatest percentage of metal output in the Summit district. Development of the mine continued during the 1980s and 1990s (IGS 1999).

Table 2.1-1 (Continued)
Mines in Prichard Creek Watershed With Recorded Production

Segment	Production Years [a]	Ore (tons)[a]	Mill	Tailings (tons)[b]	Comments
Jack Waite Mine					
PrichCrkSeg03	1928-1969	513,652	Jack Waite Mill	374,323	***Jack Waite Mine* (not listed as a source by BLM)** The Jack Waite Mine was discovered around 1900. Shipments from the mine began the following year. The mine was operated until being closed around 1918 due to flooding that made roads to the mine impassable. The mine was later reopened in 1923. The Jack Waite Mining Company took over the mine in 1927 and soon merged with the Silver King Mining Company. The mine was closed for a short time in 1932 but was reopened in 1933. The American Smelting & Refining Company (Asarco) acquired a 40-year lease on the property in 1934 and operated the mine until relinquishing the lease in 1961. Other lessees operated the mine from 1962 to 1965. The mine has been inactive since that time except for periodic exploration programs (IGS 1999).
Liberty Mine					
PrichCrkSeg03	1954	5			The Liberty Mine is located north of the town of Murray, near the headwaters of Cougar Gulch. Little of the mine's history is known, except that a small quantity of lead ore was shipped from the mine in 1954. A site inspection conducted in 1996 reported that a single open adit and waste dump are located on the property. A seep from the adit was observed (IGS 1999).
Mother Lode Mine					

Table 2.1-1 (Continued)
Mines in Prichard Creek Watershed With Recorded Production

Segment	Production Years [a]	Ore (tons)[a]	Mill	Tailings (tons)[b]	Comments
PrichCrkSeg03	1911,1939	350	Mother Lode Mill, Golden Chest Mill, Mountain Lion Mill	345	The Mother Lode group includes the Yosemite, Daddy, Treasure Box, Mother Lode, and Occident mines. Mining in the Mother Lode group began about 1883. Various historical references provide mention of gold ore extraction from the Mother Lode in 1911, 1934, and 1938, but little information is available about how continuous operations were. Little mention can be found of operations at the mine after 1938, except for an exploration project by Newmont Mining in the late 1980s (IGS 1999).
Silver Strike Mine					
PrichCrkSeg03	1909-1948	4,186	Cedar Creek Mill	3,673	The Cedar Creek Mining Company began operations on the Cedar Creek Mine (renamed Silver Strike mine in 1936) in 1909. In 1928 and 1929 Cedar Creek lead ore accounted for the greatest percentage of ore produced in the district. Production from 1909 to 1930 was 5,421 tons of ore, 33.88 ounces of gold, 23,481 ounces of silver, 5,039 pounds of copper, and 910, 713 pounds of lead. After being renamed in 1936, the mine operated for approximately a year before a fire destroyed buildings and equipment on-site. The property did not operate after this time (IGS 1999).
Terrible Edith (Pontiac) Mine					

Table 2.1-1 (Continued)
Mines in Prichard Creek Watershed With Recorded Production

Segment	Production Years[a]	Ore (tons)[a]	Mill	Tailings (tons)[b]	Comments
PrichCrkSeg03	1904-1955	6,456	Hercules Mill, custom milling plant in Utah	3,606	The Terrible Edith Mine is located north of Murray, near the headwaters of Wesp Gulch. The Terrible Edith was formed by the consolidation of the Terrible Group and the Edith, which were located about 1886 by James Woods and Wash Snyder respectively. Some shipments of ore were made from 1912 through 1917. By this time, the high grade lead and zinc ore from the mine accounted for some of the best product in the district. Carload lots of ore assayed as high as 63% lead. A small shipment of ore was reported in 1921. In 1925 the property was acquired by the Chester Company, which was later reorganized as the Pontiac Mining Company. Several shipments of ore were reported in 1926 and the company shipped one car of lead-zinc ore for testing in 1928. In 1928 the company also announced that it had enough ore exposed to justify construction of a 50-ton flotation mill, but apparently the mill was never built. One car of ore was shipped in 1929, and a lessee shipped 115 tons of lead-zinc ore to the Hercules Mill near Wallace during the following year. A small shipment was also reported shipped to a mill in Utah during 1934. In 1947, 495 tons of zinc-lead ore were shipped from the mine and in 1950, mine production yielded 68 tons of concentrates. Ore was also produced from the mine in 1954 (IGS 1999).

Note:
Blank cells indicate there was most likely no mill located on site, and ores were probably shipped elsewhere for milling. No records were found identifying the mill to which the ore was shipped. Estimated tailings produced by each mine were not necessarily disposed of within the reach where the ores were mined.

[a]Source: Mitchell and Bennett 1983
[b]Source: SAIC 1993

Table 2.1-2
Mills With Documented Operations in Prichard Creek Watershed

Segment	Operating Years	Ownership	Comments
Bear Top Mill			
PrichCrkSeg02	1906- ???	Bear Top Mining Company	The Bear Top Mining Company operated one of the first concentrators in the Murray area. The equipment for the mill was purchased from the Black Bear Mill in 1904. The mill went into operation in 1906, producing lead-silver concentrates. In 1909, the mill was modified to also produce zinc concentrates (Quivik 1999). The Bear Top and Orofino mines were consolidated in 1911. By this time, ore was being processed at a 150-ton mill. In 1929, the mill was rebuilt and capacity was increased to 200 tons per day (IGS 1999).
Black Horse Mill			
PrichCrkSeg01	1910-1917	Idaho-Montana Summit Mining Company	In 1910, a 150-ton concentration mill was built to process ores from the Black Horse Mine. The mill was located near the mouth of Paragon Gulch. The mill also processed ores from the Chicago Mine. Ore processing at the mill ceased about 1917 (IGS 1999).
Four Square Mill			
PrichCrkSeg03	Unknown	Four Square Gold Company	Little historical information is available for the Four Square Mill. There is some historical reference to a 10-stamp mill being operated at the site (IGS 1999).
Giant Ledge Millsite			
PrichCrkSeg03	Unknown		Mining records indicate that ore concentrates were shipped from the Giant Ledge Millsite in 1926 and 1930 (IGS 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Prichard Creek Watershed

Segment	Operating Years	Ownership	Comments
Golden Chest Mill			
PrichCrkSeg03	1894-1916	Gold Chest Mining Co. (Quivik 1999)	The Golden Chest Mill was the first mill in the Coeur d'Alene district to produce tungsten. The mill began operating in 1894 as a 10-stamp gold mill equipped with vanners. The mill was later enlarged to 20 stamps. The mill was operated through about 1916 (Quivik 1999).
Jack Waite Mill			
PrichCrkSeg03	1926- ???	Jack Waite Mining Company, possibly operated by ASARCO under a lease agreement.	A 125-ton flotation plant was built at the Jack Waite Mine in 1926. This mill was enlarged in 1928. In 1930, the construction of a new 500-ton mill was started. The mill was destroyed by a fire in 1985 (IGS 1999).
Monarch Mill			
PrichCrkSeg03	1905- ???	Monarch Mining Company	A 75-ton mill was operating at the Monarch Mine by 1905. By 1910, the Monarch Mining Company had completed construction of a 200-ton concentration plant. This plant used rolls, jigs, a Huntington mill, Wilfrey tables, and Frue vanners (IGS 1999).
Mother Lode Mill			
PrichCrkSeg03	Unknown	Idaho Mother Lode Gold Mines, Inc.	There is some record of gold ore processing at the Mother Lode mine using a 5-stamp mill. Ores of the Mother Lode and Golden Chest mines were also treated in a 100-ton flotation plant during the 1930s (IGS 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Prichard Creek Watershed

Segment	Operating Years	Ownership	Comments
Mountain Lion Mine Stamp Millsite			
PrichCrkSeg03	1925- ???	Mr. William Wylie, operated by the Kings Pass Gold Co. Inc. under a lease agreement.	Milling operations at the Mountain Lion Mine consisted of small capacity gold stamp mills. A 3-stamp mill was operated on the property in 1925. A 3-ton mill, which used stamps and amalgamation, was used during the 1930s. Later in the 1960s, a 5-stamp mill equipped with amalgamation plates was used (IGS 1999).
Cedar Creek Mill (Silver Strike)			
PrichCrkSeg03	1928-1933	Cedar Creek Mining Co., Silver Strike Mining Co.	A new 100-ton flotation plant was built to process the ores of the Cedar Creek Mine (later named the Silver Strike) about 1928. The mill was operated intermittently for the next several years and was then rented to the Golden Chest Mine for 2 months in 1933. The mill equipment was sold in 1952 (IGS 1999).

Table 2.2-1
Summary of Aquifer Parameters of the Smelterville Flats-Bunker Hill Upper Aquifer

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Vertical Hydraulic Conductivity (ft/day)	Transmissivity 2 (ft/day)	Storativity (unitless)	Effective Porosity
Upper Aquifer	500 - 10,790	0.0025[a]	10,002 - 216,852	0.0015 - 0.09	23.6 - 29.0

[a]Based on one test conducted on a sample of upper aquifer alluvium from borehole GR-26U at 13.5 feet below ground surface. No units given in original source document.

Source: MFG (1992)

Table 2.3.1-1
Summary of Discharge Data From Project Database
Segment PrichCrkSeg03

Segment Name	Location	Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
PrichCrkSeg03	PR 14	URS, USGS	14	05/06/98	09/08/99	5	1170	cfs
PrichCrkSeg03	PR 16	URS	1	05/05/98	05/05/98	404	404	cfs
PrichCrkSeg03	PR 17	URS	1	05/06/98	05/06/98	178	178	cfs
PrichCrkSeg03	PR 18	URS	1	05/05/98	05/05/98	217	217	cfs
PrichCrkSeg03	PR 19	URS	1	05/06/98	05/06/98	29.7	29.7	cfs
PrichCrkSeg03	PR 20	URS	1	05/06/98	05/06/98	26.9	26.9	cfs
PrichCrkSeg03	PR 21	URS	1	05/08/98	05/08/98	21.4	21.4	cfs
PrichCrkSeg03	PR 22	URS	1	05/08/98	05/08/98	13.7	13.7	cfs
PrichCrkSeg03	PR 23	URS	1	05/09/98	05/09/98	254	254	cfs
PrichCrkSeg03	PR 24	URS	1	05/07/98	05/07/98	88.3	88.3	cfs
PrichCrkSeg03	PR 25	URS	1	05/07/98	05/07/98	270	270	cfs
PrichCrkSeg03	PR 26	URS	1	05/08/98	05/08/98	0.0422	0.0422	cfs
PrichCrkSeg03	PR 27	URS	1	05/09/98	05/09/98	231	231	cfs
PrichCrkSeg03	PR 28	URS	1	05/08/98	05/08/98	0.0005	0.0005	cfs
PrichCrkSeg03	PR 29	URS	1	05/09/98	05/09/98	216	216	cfs
PrichCrkSeg03	PR 30	URS	1	05/08/98	05/08/98	24.8	24.8	cfs
PrichCrkSeg03	PR 31	URS	1	05/10/98	05/10/98	189	189	cfs
PrichCrkSeg03	PR 32	URS	1	05/08/98	05/08/98	57.8	57.8	cfs
PrichCrkSeg03	PR 33	URS	1	05/10/98	05/10/98	127	127	cfs
PrichCrkSeg03	PR 34	URS	1	05/10/98	05/10/98	3.96	3.96	cfs
PrichCrkSeg03	PR 35	URS	1	05/10/98	05/10/98	70.1	70.1	cfs
PrichCrkSeg03	PR 36	URS	1	05/08/98	05/08/98	94.4	94.4	cfs
PrichCrkSeg03	PR 37	URS	1	05/10/98	05/10/98	3.13	3.13	cfs
PrichCrkSeg03	PR 38	URS	1	05/10/98	05/10/98	65.5	65.5	cfs
PrichCrkSeg03	PR 41	URS	1	05/09/98	05/09/98	21.8	21.8	cfs
PrichCrkSeg03	PR 42	URS	1	05/11/98	05/11/98	2.87	2.87	cfs
PrichCrkSeg03	PR 43	URS	1	05/11/98	05/11/98	16.7	16.7	cfs
PrichCrkSeg03	PR 44	URS	1	05/11/98	05/11/98	3.91	3.91	cfs

Table 2.3.1-1 (Continued)
Summary of Discharge Data From Project Database
Segment PrichCrkSeg03

Segment Name	Location	Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
PrichCrkSeg03	PR 45	URS	1	05/12/98	05/12/98	2.13	2.13	cfs
PrichCrkSeg03	PR 46	URS	1	05/12/98	05/12/98	2.88	2.88	cfs
PrichCrkSeg03	PR 47	URS	1	05/12/98	05/12/98	1.68	1.68	cfs
PrichCrkSeg03	PR 48	URS	1	05/19/98	05/19/98	19	19	cfs
PrichCrkSeg03	PR 49	URS	1	05/19/98	05/19/98	16.2	16.2	cfs

Note:
cfs - cubic feet per second

Table 2.3.2-1
Estimated Recurrence Intervals, Prichard Creek

Recurrence Interval (Years)	Flood Insurance Study Prichard Creek below Eagle Creek Estimated Peak Flow (cfs)
2	not available
5	not available
10	3,850
25	not available
50	6,480
100	8,020

Note:
cfs - cubic feet per second

Table 2.3.2-2
Precipitation Summary and Discharge Comparison for Water Year 1999,
Wallace, Woodland Park, Idaho
NOAA Cooperative Station 109498

Climate Indicators	Monthly Totals												Annual Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Total Precipitation (in.)	1.2	9.7	6.9	4.7	6.9	3.5	0.7	0.9	1.8	0.2	3.0	0.3	39.8
Total Snowfall (in.)	0.0	6.3	8.7	18.9	26.4	21.3	0.6	0.0	0.0	0.0	0.0	0.0	82.2
Mean Monthly Discharge (cfs) (Prichard Creek)	18.0	50.5	126	211	111	402	482	634	483	118	41.1	22.4	225
Average Precipitation for Period of Record (in.)	2.9	4.9	5.2	5.0	3.9	3.4	2.8	2.7	2.6	1.3	1.4	1.9	37.7
Average Snowfall for Period of Record (in.)	0.5	8.3	22.6	24.0	15.0	10.5	2.5	0.3	0.0	0.0	0.0	0.0	83.7

Note:
cfs - cubic feet per second

3.0 SEDIMENT TRANSPORT PROCESSES

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movements incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing provides exposed soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. For purposes of this report, sediment yield will be defined in units of tons per square mile per year. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bed load. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bed load consists of larger and heavier particles that move downstream by rolling sliding or hopping on the channel bed (Dunne and Leopold 1978).

All sediment motion downstream is dictated by the shear and gravitational forces acting at a given time and place within the channel. For sediment transport purposes, gravitational forces are essentially constant. Shear forces, however are dynamic through space and time and are dependent upon the location, depth of water, and slope of the water surface. Sediment transport occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et al. 1992).

Sediment derived in Prichard Creek is transported to the North Fork. Based on review of aerial photographs, likely sediment sources within the Prichard Creek Watershed are mining waste, mobilization of channel bed sediment, bank erosion, and some rock debris situated adjacent to channels. Logging and drill exploration roads may also provide a sediment source. In this discussion, the available information, analyses, and likely sediment sources are described.

3.1 AVAILABLE INFORMATION

For the Prichard Creek watershed, 1998 photographs by URS Greiner, Inc. (URSG) and CH2M HILL (URSG and CH2M HILL 1999) were reviewed. USGS sediment gaging data are not available for Prichard Creek; therefore, estimates of sediment yield are not included in this discussion.

3.2 ANALYSES

3.2.1 Channel Descriptions

The 1998 set of aerial photographs by URSG and CH2M HILL were reviewed to describe Prichard Creek. Photographic coverage of Prichard Creek exists from Eagle Creek to the upstream end of segment PrichCrkSeg03 and the upstream end of Eagle Creek, also in segment PrichCrkSeg03. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system.

Prichard Creek, upstream of the Eagle Creek confluence displays a multi-threaded, braided pattern indicating a high sediment load. The valley floor adjacent to the channel is 500 to 1,000 feet wide and is well vegetated with trees and other vegetation.

Approximately 1.9 miles upstream of the Eagle Creek confluence, deposits from the Prichard Creek Dredge Tailings have been placed on the north bank of the channel. From the photographs reviewed, Prichard Creek appears to flow adjacent to and between piles of spoil. The spoils fill much of the valley bottom not occupied by roads or the channel. Prichard Creek has a braided pattern in this reach. The dredge spoils continue upstream to the town of Murray. These spoils may be a sediment source to Prichard Creek where in contact with the creek.

Upstream of Murray to the confluence with Butte Gulch, the channel is constrained by hillslopes on the south and road embankments on the north. Logging and exploration drill roads criss cross the hillslopes above Prichard Creek. Additional dredge spoils appear to have been placed in discrete areas along the channel through this section.

Upstream of Butte Gulch, the channel is constrained by hillslopes and road embankments. Additional dredge spoils have been placed adjacent to the channel at the mouth of Bear Gulch.

Upstream of Bear Gulch to the upstream end of segment PrichCrkSeg03, Prichard Creek has a multi-threaded braided pattern with relict channels visible in the photographs reviewed.

In the upstream portion of Eagle Creek likely sediment sources include logging and drill exploration roads. Additionally, a deposit of rock debris is situated adjacent to the channel at Duthie in Tributary Creek.

3.3 SUMMARY

The Prichard Creek Watershed appears to have few sediment sources. Likely sediment sources include channel bed remobilization and minor bank erosion. In addition, sediment from the Prichard Creek dredge tailings in contact with surface water and Prichard Creek are sources of sediment to Prichard Creek. These appear less significant than other areas in the Coeur d'Alene River Basin.

These observations were based on a limited review of the available data, photographs, and topographic maps at the time of review. Not all potential sediment sources were identified, as potential sediment sources literally cover the entire watershed. Primary sources were identified based on review of the available information.

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the three segments of the Prichard Creek watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels; and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x) and 100 times (100x) the screening level were identified and presented in the following data summary tables. The magnitudes of exceedance (10x and 100x) were arbitrarily selected to delineate areas of contamination. Metals identified in this evaluation are further evaluated in either the human health or ecological risk assessments (under separate cover).

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4. Data source references are included as Attachment 1. Chemical data collected in Prichard Creek and used in this evaluation are presented in Attachment 2. Data summary tables include sampling location, data source reference, collection date, depth, and reported concentration. Screening level exceedances are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-8.

The nature and extent of contamination were evaluated by screening chemical results against applicable risk-based screening criteria and available background concentrations. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the feasibility study (FS).

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening

level (SL) to which the detected concentration is compared. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional baseline or background studies for soil, sediment and surface water and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1.

Source areas within Prichard Creek are presented in Tables 4.1-1 through 4.1-3. These sites are based on source areas initially identified by the BLM (1999) and further refined during the RI/FS process. The tables include source area names, source ID, source area acres, description, number of samples by matrix type, and metals exceeding 1x, 10x and 100x the screening levels in surface soil, subsurface soil, sediment, groundwater and surface water.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-8) are included in Tables 4.1-1 through 4.1-3; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Tables 4.1-1 through 4.1-3.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment PrichCrkSeg01

4.1.1.1 Surface Soil

One surface soil sample from segment PrichCrkSeg01 was collected and analyzed for total metals. Zinc was detected at a concentration greater than 10x the screening level.

4.1.1.2 Surface Water

Two surface water samples for total metals and one for dissolved metals were collected and analyzed in segment PrichCrkSeg01. Copper and zinc were detected at concentrations greater than 10x the screening levels for total metals. Cadmium and zinc were detected at concentrations greater than 10x the screening levels for dissolved metals.

4.1.1.3 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PrichCrkSeg01 that may be significant contributors of metals to Prichard Creek. Summary source area data are presented in Table 4.1-1.

One of the five source areas in this segment was sampled for surface soil and surface water. Chemical concentrations for cadmium, copper, and zinc were greater than 10x the screening level in surface soil and surface water.

4.1.2 Segment PrichCrkSeg02

4.1.2.1 Surface Soil

Two surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Cadmium, lead and zinc were found at concentrations exceeding 10x the screening levels. Concentrations of lead and zinc were also found at greater than 100x the screening levels.

4.1.2.2 Surface Water

Four surface water samples for total metals and two for dissolved metals were collected and analyzed in segment PrickCrkSeg02. The concentration of total zinc exceeded 10x the screening level at one location. Concentrations of dissolved lead and zinc detected in the surface water exceeded 10x the screening levels.

4.1.2.3 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PrichCrkSeg02 that may be significant contributors of metals to Prichard Creek. Summary source area data are presented in Table 4.1-2.

Two of the nine source areas in this segment were sampled for surface soil and surface water. Bear Gulch Unnamed Millsite displayed concentrations of lead and zinc that exceeded 100x the screening levels. Concentrations of total and dissolved zinc at the Silver Crystal source area exceeded 10x the screening levels.

4.1.3 Segment PrichCrkSeg03

4.1.3.1 Surface Soil

Nine surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Arsenic, cadmium, lead and zinc were detected at concentrations greater than 10x the screening levels. Arsenic and zinc were also detected in the surface soil of segment PrichCrkSeg03 at concentrations that exceeded 100x the screening levels.

4.1.3.2 Surface Water

Eighty-nine surface water samples for total metals and 77 surface water samples for dissolved metals in PrichCrkSeg03 were collected and analyzed. Sampling results for total metals indicate concentrations of copper, iron, lead, manganese and zinc exceeded 10x the screening level. Copper was also detected in one sample at a concentration greater than 100x the screening level.

Sampling results for dissolved metals show concentrations of cadmium, copper, lead, manganese and zinc at concentrations in excess of 10x the screening levels.

4.1.3.3 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PrichCrkSeg03 that may be significant contributors of metals to Prichard Creek. Summary source area data are presented in Table 4.1-3.

Thirteen of the 44 source areas in segment PrichCrkSeg03 were sampled for surface soil and/or surface water. Arsenic, cadmium, copper, lead and zinc were detected in surface soil of multiple sites at concentrations greater than 10x the screening level. In addition, samples collected at Paragon Lower Millsite show two concentrations of zinc that exceeded 100x the screening level; samples collected at Silver Strike Mine show one concentration of arsenic that exceeded 100x the screening level; and samples collected at Prichard Creek Impacted Floodplain showed a concentration of zinc that exceeded 100x the screening level.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and Extent further discussed the use of plotting discrete sampling event versus the probabilistic analysis of the mass loading data in fate and transport.

The Prichard Creek Watershed has limited data by which to assess mass loading in surface water or groundwater. Stream sampling conducted in May 1998 was the most comprehensive and is summarized in Table 4.2-1. Additional sampling was conducted on Prichard Creek near the confluence with the North Fork (PR14) and is also summarized in the table.

The order of sampling locations on Prichard Creek listed in Table 4.2-1 is from upstream to downstream. Mass loading from side streams is listed from upstream to downstream in the order the mass load would be introduced into Prichard Creek. The additional PC14 data near the mouth of Prichard Creek is listed in order of increasing flow. Figures 4.1-7 and 4.1-8 show the surface water sampling locations that are listed in Table 4.2-1.

As shown in Table 4.2-1, the May 1998 sampling event took place over a period of several days. This makes it difficult to assess changes in mass loading from potential mine sources located in the watershed. However, regarding mass loading, the following general observations can be made.

1. Based on a base flow of 15 to 20 cubic feet per second (Section 2.2), the May 1998 event probably represents a moderately high-flow event. Sampling location PR14 probably represents the mass load in surface water discharging to the North Fork. The total lead loading at this location ranged from less than 1 pound per day to 158 pounds per day. The dissolved zinc loading ranged from 6 pounds per day to 180 pounds per day.

2. During the May 1998 event, overall lead loading in Prichard Creek was low and did not exceed 3 pounds per day. The zinc loading increased steadily from 13 pounds per day (PR36, upstream) to 67 pounds per day (PR16, downstream). Two measurements appear skewed, PR24 and PR14. The flow and corresponding zinc load at these sampling locations decrease relative to the next upstream sampling location. The flows appear inconsistent and may reflect difficulties in obtaining measurements.

3. Tributary Creek, a tributary to East Fork Eagle Creek, has 7 pounds per day of lead loading (PR22) and 45 pounds per day of zinc loading (PR21) near the headwaters during the May sampling. Downstream at sampling location PR48, the lead load decreases to 2 pounds per day and less than measurable for zinc.

4. Sampling location PR18 is the furthest downstream sampling location on West Fork Eagle Creek prior to the confluence with Prichard Creek. Lead loading at this location was 3 pounds per day and zinc loading was 62 pounds per day. This loading would include load contributed by the East Fork Eagle Creek (including Tributary Creek).

5. Loading measured in other tributaries did not appear to add substantial load to Prichard Creek.

6. Potential sources for observed loading in the Prichard Creek Watershed include unknown sources on Tributary Creek and floodplain sediments mapped by the BLM along Prichard Creek.

Regarding groundwater, information was not available to evaluate potential mass loading. However, the section of Prichard Creek between sampling locations PR 33 and PR24 has a developed floodplain. The floodplain is identified as a source of mine tailings. The USGS seepage study in Canyon Creek demonstrated that where stream systems widen and a floodplain develops, an exchange of mass load between surface water and groundwater could occur (URSG 2000). There is a potential for such an exchange in Prichard Creek.

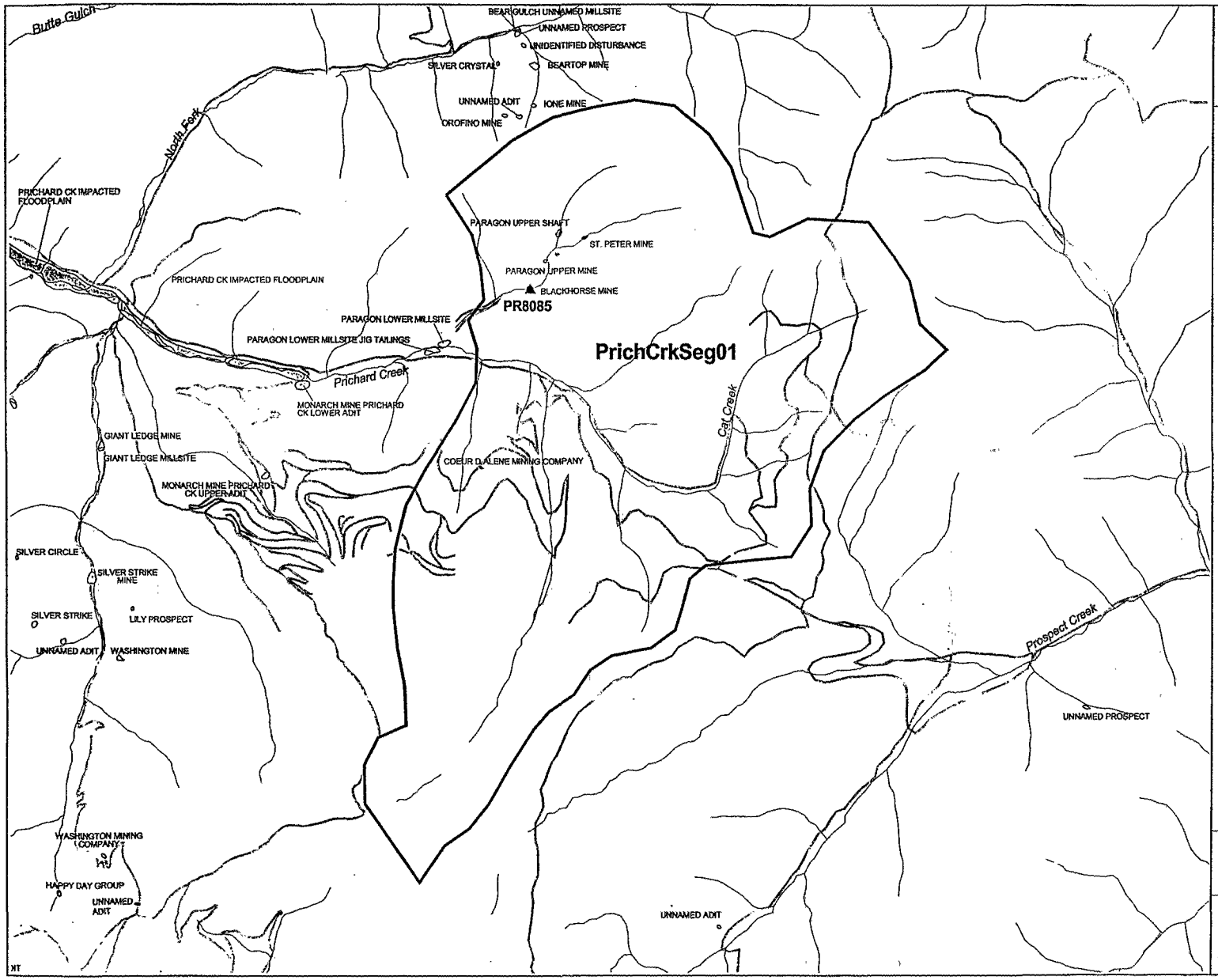
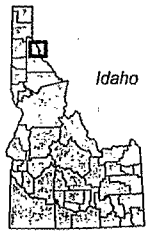


Figure 4.1-1
Prichard Creek Segment PrichCrkSeg01
Source Areas and Soil/Sediment Sampling Locations

LEGEND

- ▲ Tailings Sampling Location
- Stream
- Road
- ★ City
- Prichard Creek Segment 1
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:36,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4182900.8615.05e
Generation 1
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V: PrichSeg1 Soil
E:soil
L: Final RI PrichSeg01 Soil
7/11/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 11, 2001

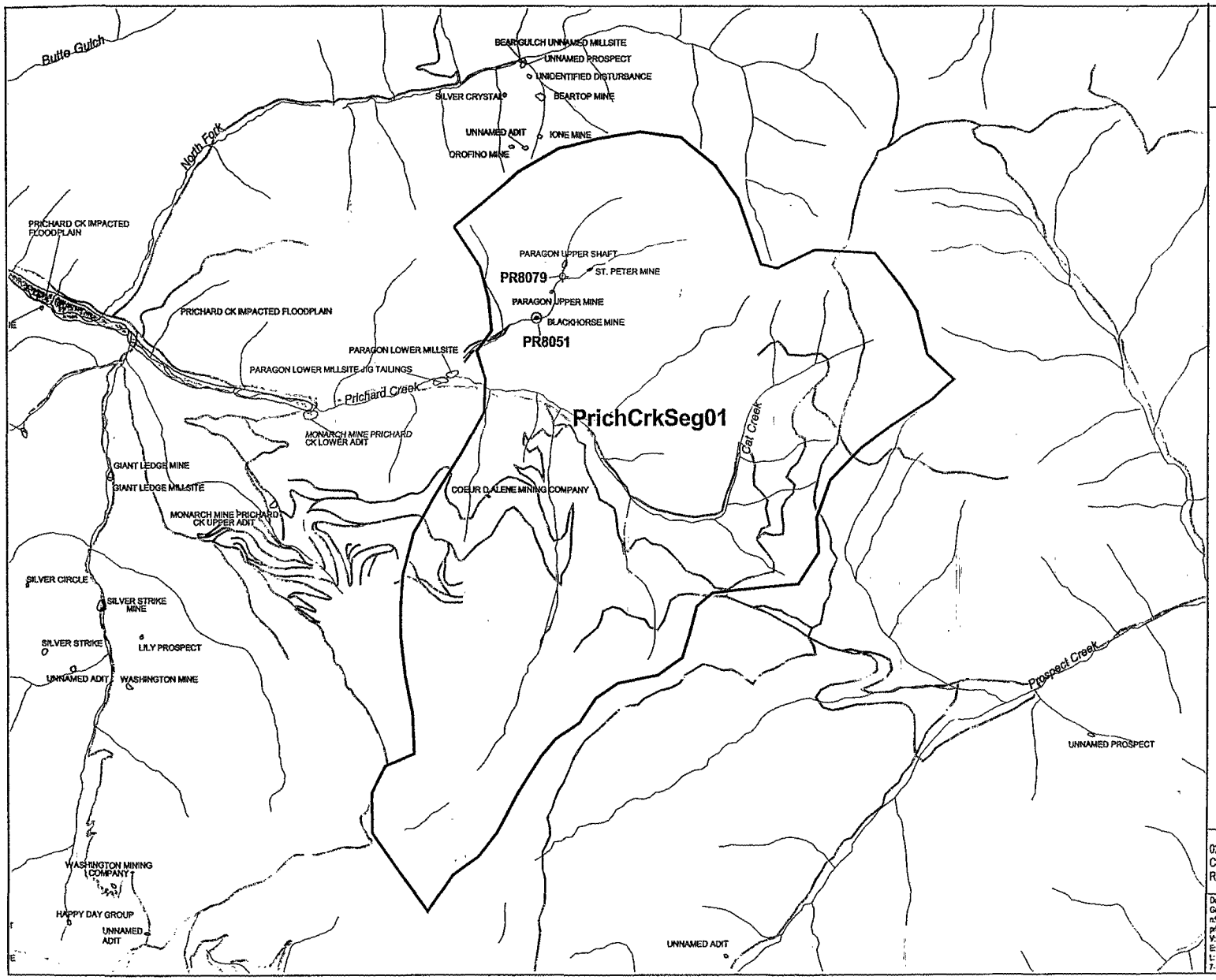
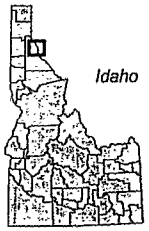


Figure 4.1-2
Prichard Creek Segment PrichCrkSeg01
Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Prichard Creek Segment 1
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:36,000

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027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

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Generation 1
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prichard_3-29.apr
V: PrichCrkSeg01 surface water
E: surface water
L: Final RI PrichCrkSeg01 SW
7-11-01

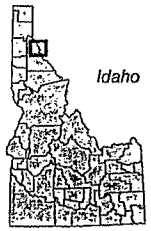
This Map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 11, 2001

Figure 4.1-3
Prichard Creek Segment PrichCrkSeg02
Source Areas and Soil/Sediment Sampling Locations

LEGEND

- ▲ Tailings Sampling Location
- Stream
- Road
- ★ City
- Prichard Creek Segment 2
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:36,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.8515.05a
Generation 1
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V: PrichSeg02 soil
E:SOIL
L: Final RI PrichSeg02 soil
7/11/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

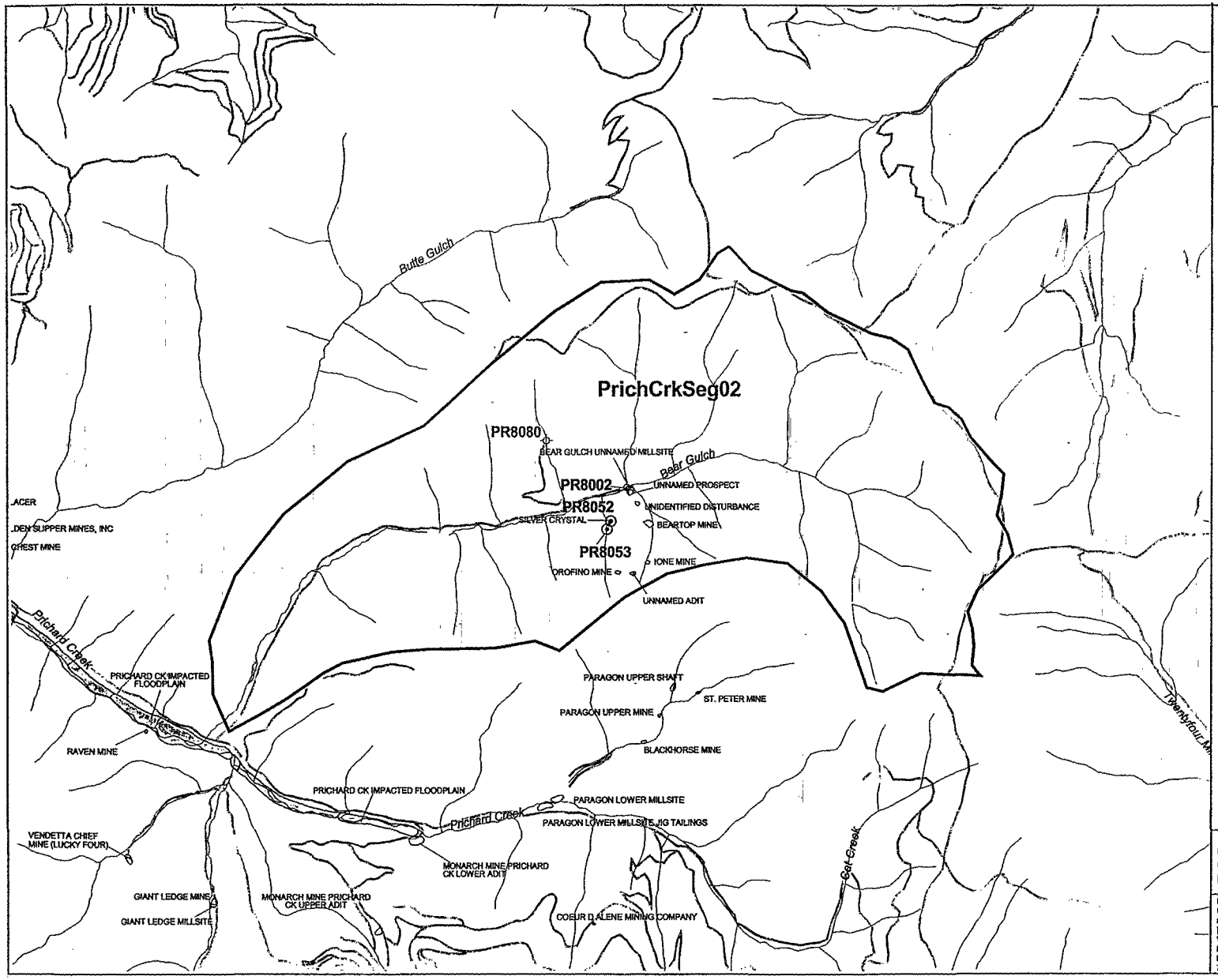

Figure 4.1-4
Prichard Creek Segment PrichCrkSeg02 Source Areas and Surface Water Sampling Locations

LEGEND

- River Sampling Location
- Adit Sampling Location
- Stream
- Road
- City
- Prichard Creek Segment 2
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:36,000

0 0.5 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 416200.0615.05a
Generation 1
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V: PrichSeg02 SW
E: SW
L: Final RI PrichSeg02 SW
7/11/01

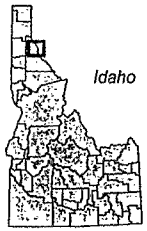
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

Figure 4.1-5
Prichard Creek Segment PrichCrkSeg03 Northern Half Source Areas and Soil/ Sediment Sampling Locations

LEGEND

- ▲ Tailings Sampling Location
- Stream
- Road
- ★ City
- Prichard Creek Segment 3
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:60,000

0 0.5 1 Miles

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027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.8615.05a
Generation 1
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\prichard_3-29.apr
V: Prichard Creek Segment 03 Soil
Enorthern half
L: Final RI PrichSeg03 Northern Soil
7/11/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

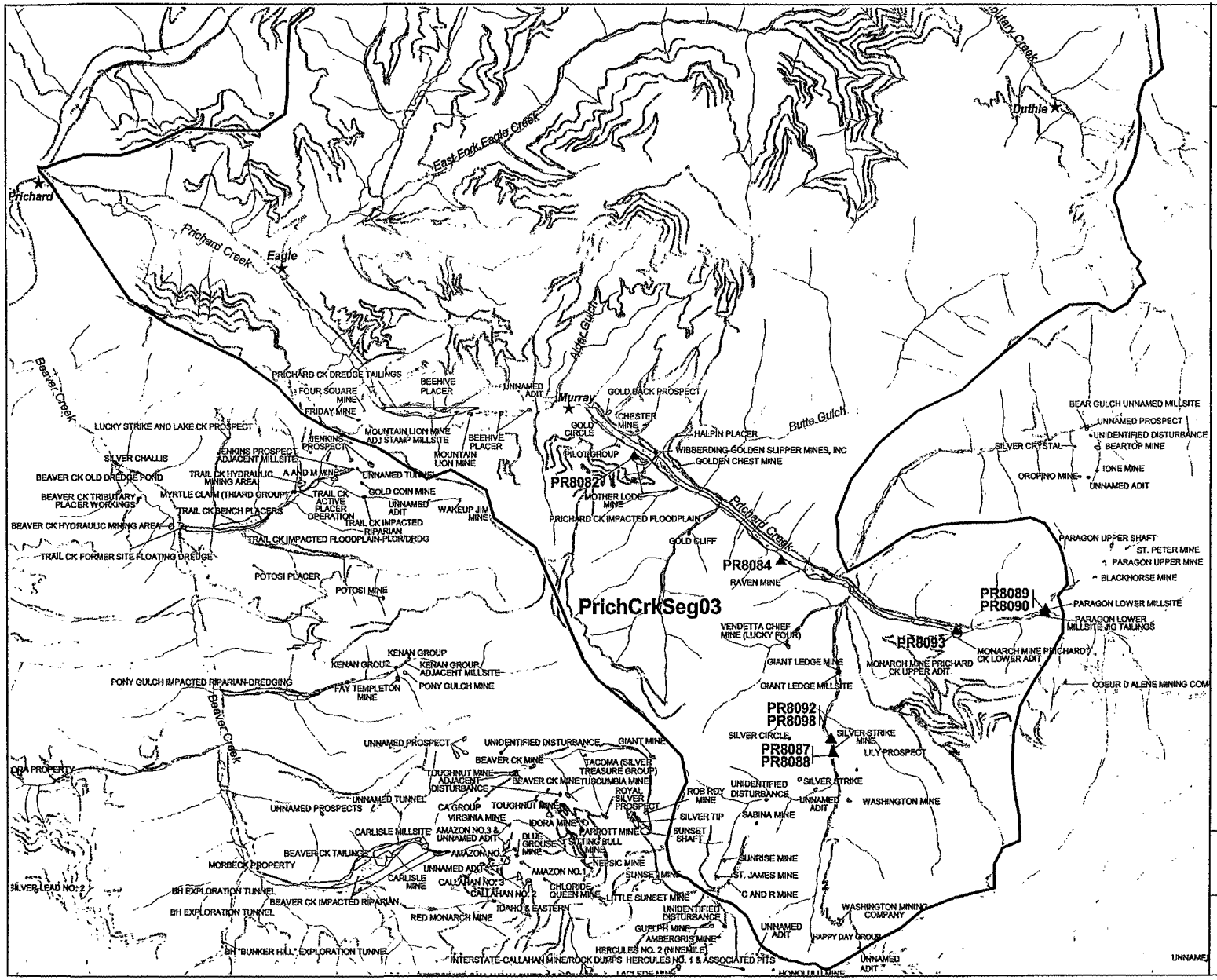

Figure 4.1-6
Prichard Creek Segment PrichCrkSeg03 Southern Half Source Areas and Soil/Sediment Sampling Locations

LEGEND

- ▲ Tailings Sampling Location
- Stream
- Road
- ★ City
- Prichard Creek Segment 3
- Source Area and Name

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:60,000
0 0.5 1 Miles

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027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.8615.05e
Generation 1
n:\Projects\RI_FS\Prichard_Creek
\prichard_3-29.apr
V: Prichard Creek Segment 03 Soil
E: southern half
L: Final RI PrichSeg03 south Soil
7/11/01

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

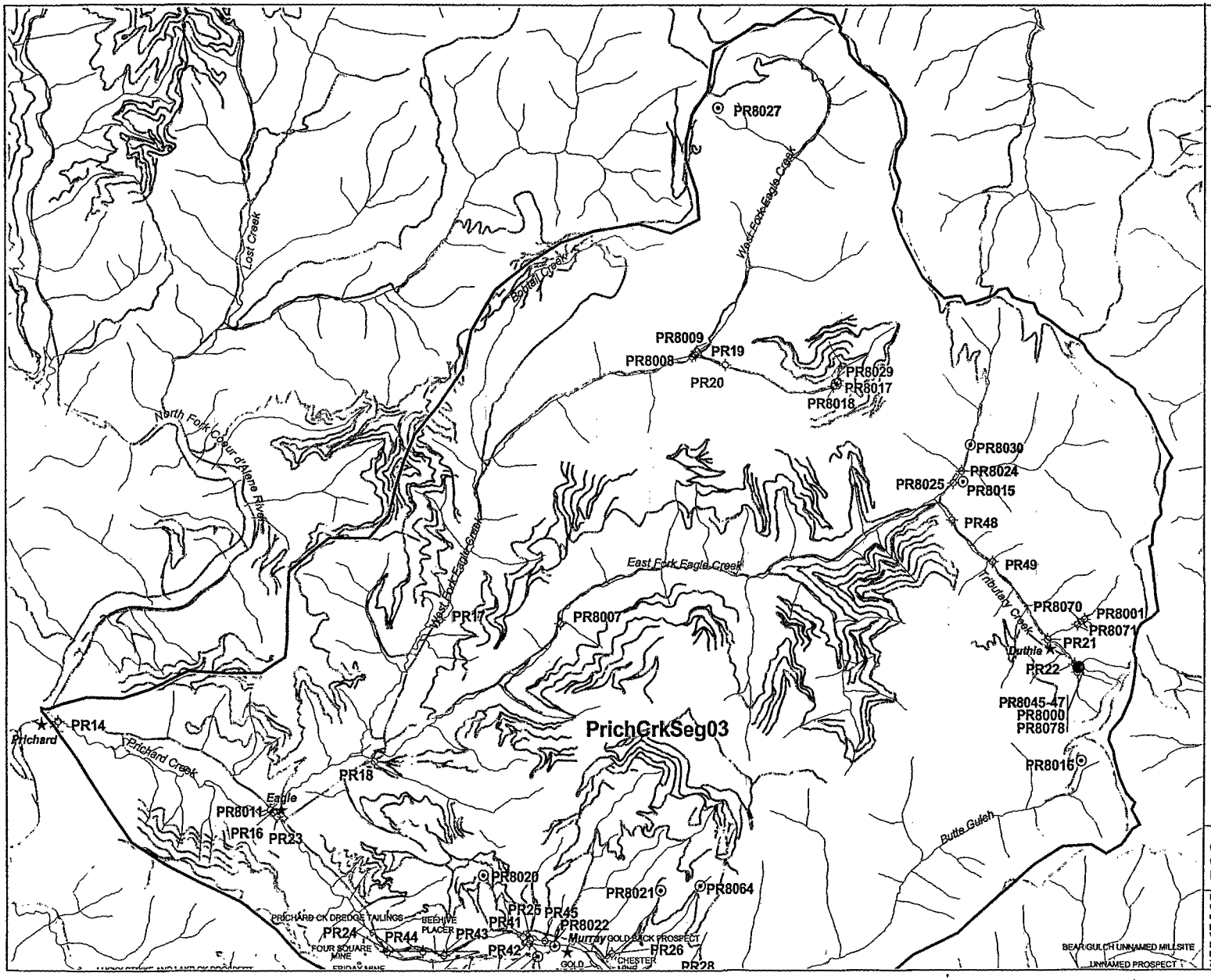


Figure 4.1-7
Prichard Creek Segment PrichCrkSeg03
Northern Half Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Prichard Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Basemap coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:60,000

0 0.5 1 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4152500 6615.05a
Generation 1
n:\Projects\RI_FS\Prichard_Creek\
prichard_3-29.apr
V: Prichard Northern Half
E:Northern Half
L: Final RI PrichSeg03 northern SW
7/11/01

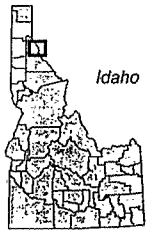
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 11, 2001

Figure 4.1-8
Prichard Creek Segment PrichCrkSeg03 Southern Half Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Prichard Creek Segment 3
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:60,000

0 0.5 1 Miles

N

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.8615.05e
Generation 1
n:\Projects\RI_FS\Prichard_Creek\
prichard_creek.apr
V: Prichard Northern Half
E:Southern Half
L: Final RI PrichSeg03 southern SW
7/11/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 11, 2001

Table 4.1-1
Potential Source Areas Within Prichard Creek - segment PrichCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BLACKHORSE MINE	THO034	0.27	Floodplain Waste Rock (Above Cataldo No.& So.Fork)	SL 1 SW 1	SST: As-1, Cd-1, Pb-1 SWD: Cu-1, Pb-1 SWT: Cd-1	SST: Zn-1 SWD: Cd-1, Zn-1 SWT: Cu-1, Zn-1	
COEUR D ALENE MINING COMPANY	THO010	0.14					
PARAGON UPPER MINE	THO009	0.17	Upland waste rock				
PARAGON UPPER SHAFT	THO035	0.64	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
ST. PETER MINE	THO008	0.23	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				

Matrix Types

DR: Debris Rubble
GW: Groundwater
RK: Rock Cobbles Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1-2
Potential Source Areas Within Prichard Creek - segment PrichCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BEAR GULCH UNNAMED MILLSITE	THO036	0.59	Upland Concentrates and Process Wastes	SL 1 SW 1	SST: As-1, Cu-1	SST: Cd-1	SST: Pb-1, Zn-1
BEARTOP MINE	THO004	1.03	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
IONE MINE	THO005	0.29	Floodplain Waste Rock (Above Cataldo No.& So.Fork) Mine Workings/Water, Seeps, Springs and Leachate				
OROFINO MINE	THO007	0.30	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock				
SILVER CRYSTAL	THO003	0.20	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock	SW 1	SWD: Cu-1, Pb-1 SWT: Cd-1, Pb-1	SWD: Zn-1 SWT: Zn-1	
UNIDENTIFIED DISTURBANCE	THO002	0.30					
UNNAMED ADIT	THO006	0.35					
UNNAMED ADIT	THO033	0.62					
UNNAMED PROSPECT	THO001	0.46					

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1-3
Potential Source Areas Within Prichard Creek - segment PrichCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BEEHIVE PLACER	BUR001	0.69	Floodplain Waste Rock (Above Cataldo No.& So.Fork) Mine Workings/Water, Seeps, Springs and Leachate				
BEEHIVE PLACER	BUR002	0.47	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
BEEHIVE PLACER	OSB113	0.27	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
C AND R MINE	BUR080	0.30	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock	SW 2	SWD: Cu-1	SWD: Cd-1	
CHESTER MINE	BUR009	0.34	Upland waste rock				
FOUR SQUARE MINE	OSB110	0.16	Upland waste rock				
FRIDAY MINE	OSB011	0.43	Upland waste rock				
GIANT LEDGE MILLSITE	BUR157	0.34	Upland Concentrates and Process Wastes				
GIANT LEDGE MINE	BUR017	0.66	Upland waste rock				
GOLD BACK PROSPECT	BUR008	1.02	Floodplain Waste Rock (Above Cataldo No.& So.Fork) Mine Workings/Water, Seeps, Springs and Leachate				
GOLD CIRCLE	BUR003	1.33	Upland waste rock				
GOLD CLIFF	BUR007	0.25	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
GOLDEN CHEST MINE	BUR011	2.88	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock	SW 1	SWD: Cu-1, Mn-1, Zn-1 SWT: Fe-1, Mn-1	SWT: Zn-1	
HALPIN PLACER	BUR012	0.31	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
HAPPY DAY GROUP	BUR103	0.35	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
LILY PROSPECT	BUR019	0.20	Upland waste rock				
MONARCH MINE PRICHARD CK LOWER ADIT	BUR015	2.37	Upland waste rock	SW 1	SWD: Cu-1 SWT: Cd-1, Pb-1	SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-1	
MONARCH MINE PRICHARD CK UPPER ADIT	BUR016	0.81	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock				

Table 4.1-3
Potential Source Areas Within Prichard Creek - segment PrichCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
MOTHER LODE MINE	BUR005	4.34	Floodplain Waste Rock (Above Cataldo No.& So.Fork) Mine Workings/Water, Seeps, Springs and Leachate	SL 1 SW 1	SST: Cd-1, Cu-1, Fe-1, Zn-1 SWD: Mn-1 SWT: As-1, Cd-1, Mn-1	SST: As-1, Pb-1 SWD: Cu-1, Pb-1, Zn-1 SWT: Cu-1, Pb-1, Zn-1	
MOTHER LODE MINE	BUR006	0.76	Floodplain Waste Rock (Above Cataldo No.& So Fork)				
MOUNTAIN LION MINE	OSB112	0.73	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock				
MOUNTAIN LION MINE ADJ STAMP MILLSITE	OSB111	0.27	Upland Concentrates and Process Wastes				
PARAGON LOWER MILLSITE	BUR156	1.36	Upland Concentrates and Process Wastes	SL 2	SST: As-2, Cu-2	SST: Cd-2, Pb-2	SST: Zn-2
PARAGON LOWER MILLSITE JIG TAILINGS	BUR155	1.71	Upland Concentrates and Process Wastes				
PILOT GROUP	BUR004	0.65	Upland waste rock				
PRICHARD CK DREDGE TAILINGS	OSB012	45.55	Floodplain tailings (above Cataldo No.& So. Fork)	SW 3	SWD: Zn-3 SWT: Zn-3		
PRICHARD CK IMPACTED FLOODPLAIN	BUR013	130.26	Floodplain sediments (above Cataldo No.& So. Fork)	SW 3	SWD: Pb-3, Zn-2 SWT: Zn-3		
PRICHARD CK IMPACTED FLOODPLAIN	BUR014	13.31	Floodplain sediments (above Cataldo No.& So. Fork)	SL 1 SW 1	SST: As-1, Cu-1 SWD: Cu-1 SWT: Cd-1, Pb-1	SST: Cd-1, Pb-1 SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-1	SST: Zn-1
PRICHARD CK IMPACTED FLOODPLAIN	BUR152	20.48	Floodplain sediments (above Cataldo No.& So. Fork)	SW 2	SWD: Pb-1, Zn-1 SWT: Zn-2		
RAVEN MINE	BUR206	0.20	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
SABINA MINE	BUR025	0.30	Upland waste rock				
SILVER CIRCLE	BUR022	0.22	Upland waste rock				
SILVER STRIKE	BUR023	0.60	Upland waste rock				
SILVER STRIKE MINE	BUR021	1.84	Floodplain Waste Rock (Above Cataldo No.& So Fork) Mine Workings/Water, Seeps, Springs and Leachate	SL 2 SW 1	SST: As-1, Cd-1, Cu-1, Fe-1 SWD: Cu-1, Zn-1 SWT: Zn-1	SST: Pb-1, Zn-1	SST: As-1
ST JAMES MINE	BUR078	0.48	Floodplain Waste Rock (Above Cataldo No.& So.Fork) Mine Workings/Water, Seeps, Springs and Leachate	SW 1	SWD: Cu-1	SWD: Cd-1	
SUNRISE MINE	BUR079	0.54	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock	SW 1	SWD: Cu-1 SWT: Cd-1	SWD: Cd-1	

Table 4.1-3
Potential Source Areas Within Prichard Creek - segment PrichCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
UNIDENTIFIED DISTURBANCE	BUR024	0.36					
UNNAMED ADIT	BUR154	0.17		SW 2	SWT: Cd-1	SWD: Cd-1	
UNNAMED ADIT	BUR159	0.53					
UNNAMED ADIT	BUR181	0.22					
VENDETTA CHIEF MINE (LUCKY FOUR)	BUR018	1.01	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock				
WASHINGTON MINE	BUR020	0.52	Upland waste rock				
WASHINGTON MINING COMPANY	BUR104	0.28	Mine Workings/Water, Seeps, Springs and Leachate Upland waste rock				
WIBBERDING-GOLDEN SLIPPER MINES, INC	BUR010	0.41	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.2-1
Mass Loading Prichard Creek

						Total Lead		Dissolved Zinc	
Location	Sample No.	Segment No.	Sample Type	Sample Date	Flow (CFS)	Conc. (µg/L)	Load (lbs/day)	Conc. (µg/L)	Load (lbs/day)
Prichard Creek									
PR38	46425	3	RV	10-May-98	65.5	-	-	4 J	-
PR36	46416	3	RV	08-May-98	94.4	0.8	0	25	13
PR33	46422	3	RV	10-May-98	127	3.6	2	52.3	36
PR31	46421	3	RV	10-May-98	189	2.7 J	-	75.6	77
PR29	46420	3	RV	09-May-98	216	2.3	3	47.5	55
PR27	46419	3	RV	09-May-98	231	2.5	3	39.3	49
PR25	46409	3	RV	07-May-98	270	2.3 J	-	47.7	69
PR24	46410	3	RV	07-May-98	88.3	2.2 J	-	42.9	20
PR23	46418	3	RV	09-May-98	254	1.4	2	37.6	51
PR16	46401	3	RV	05-May-98	404	1.4	3	28	61
PR14	46405	3	RV	06-May-98	285	1.6	2	30.7	47
Contribution to Prichard Creek from Side Stream Upstream of Sampling Location PR33									
PR37	46427	3	SS	10-May-98	3.13	1.1 J	-	46.7	1
PR34	46423	3	SS	10-May-98	3.96	0.93 J	-	3.4 J	-
PR35	46424	3	SS	10-May-98	70.1	0.57 J	-	7 J	-
Contribution to Prichard Creek From Side Streams Above Sampling Location PC29									
PR32	46415	3	SS	08-May-98	57.8	3.8	1	38	12
PR30	46413	3	SS	08-May-98	24.8	0.2 U	-	10 U	-
Contribution to Prichard Creek From Side Streams or Seeps above Sampling Location PC24									
PR43	46429	3	SS	11-May-98	16.7	0.6	0	48	4
PR44	46430	3	SS	11-May-98	3.91	0.2 U	-	46	1
Contribution to Prichard Creek From West Fork Eagle Creek									
PR22	46290	3	EFEC	08-May-98	13.7	94.6	7	371	27
PR21	46289	3	EFEC	08-May-98	21.4	29.5	3	389	45
PR49	46443	3	EFEC	19-May-98	16.2	14.8	1	343 J	-
PR48	46442	3	EFEC	19-May-98	19	15	2	349 J	-
PR20	46408	3	WFEC	06-May-98	26.9	0.5 U	-	5 U	-
PR19	46407	3	WFEC	06-May-98	29.7	0.5 U	-	5 U	-
PR17	46406	3	WFEC	06-May-98	178	0.5 U	-	5 U	-
PR18	46403	3	WFEC	05-May-98	217	2.9	3	53	62

Table 4.2-1 (Continued)
Mass Loading Prichard Creek

						Total Lead		Dissolved Zinc	
Location	Sample No.	Segment No.	Sample Type	Sample Date	Flow (CFS)	Conc. (µg/L)	Load (lbs/day)	Conc. (µg/L)	Load (lbs/day)
Contribution to Prichard Creek From Side Streams Upstream of Sampling Location PC43									
PR26	46411	3	SS	08-May-98	0.0422	0.2 U	-	10 U	-
PR28	46412	3	SS	08-May-98	0.0005	0.6	0	896	0
PR45	46431	3	SS	12-May-98	2.13	0.5 U	-	41.3	0
PR42	46428	3	SS	11-May-98	2.87	0.9	0	48	1
PR41	46417	3	SS	09-May-98	21.8	0.5 U	-	49.1	6
PR46	46432	3	SS	12-May-98	2.88	0.5 U	-	46.4	1
PR47	46433	3	SS	12-May-98	1.68	0.5 U	-	43.8	0
Additional Measurements at Mouth of Prichard Creek (sorted by increasing stream discharge)									
PR14	186812	3	RV	20-Oct-98	17	1	0	62	6
PR14	202103	3	RV	08-Sep-99	28	0.32	0	27	4
PR14	202102	3	RV	12-Aug-99	46	0.39	0	24	6
PR14	186813	3	RV	18-Nov-98	52	1	0	25	7
PR14	186814	3	RV	10-Dec-98	72	1	0	28	11
PR14	186815	3	RV	29-Dec-98	113	1	1	34	21
PR14	202101	3	RV	13-Jul-99	124	0.66	0	25	17
PR14	186816	3	RV	25-Feb-99	243	2	3	25	33
PR14	186819	3	RV	04-May-99	520	1	3	30	84
PR14	186821	3	RV	15-Jun-99	659	4	14	30	107
PR14	186817	3	RV	24-Mar-99	803	3	13	31	134
PR14	186818	3	RV	21-Apr-99	984	7	37	34	180
PR14	186820	3	RV	24-May-99	1170	25	158	26	164

Notes:
- : Data not available or mass load not calculated
CFS: Cubic feet per Second
EFEC: Tributary Creek Sample Location - Flows into East Fork Eagle Creek
WFEC: Tributary Creek Sample Location - Flows into West Fork Eagle Creek
lbs/day: pounds per day
µg/L: Micrograms per liter
RV: River Sample Location
SS: Side Stream Sample Location
U: Not detected
J: Estimated Value

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Prichard Creek Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for each segment, as presented above in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in Prichard Creek is presented in Section 5.4.

5.1 INTRODUCTION

Prichard Creek contributes minor quantities of cadmium, lead, zinc, and other metals to the North Fork. The lowest and highest dissolved cadmium and zinc and total lead loadings measured during three sampling events (May 1998, April 1999, and May 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

Segment PrichCrkSeg01 contains the headwaters of Prichard Creek down to just above the Paragon mill site. The BLM identified five mining-related sites (source areas of potential metals contamination) in this segment; however, Prichard Creek does not receive significant metals input from this segment since the area is relatively undisturbed.

Segment PrichCrkSeg02 contains Bear Gulch, a tributary to Prichard Creek. The BLM identified nine source areas in this segment. Slightly elevated concentrations of dissolved lead have been observed in the lower part of Bear Gulch. The area is relatively undisturbed.

Segment PrichCrkSeg03 contains Prichard Creek, below the Paragon mill site, to its confluence with the North Fork. The BLM identified 44 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than ambient water quality criteria.

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2. Model results are summarized in Table 5.2-1. All modeling results are included in Appendix C.

Data were evaluated for one sampling location, PR14, located near the mouth of Prichard Creek and the town of Prichard. There was only one sampling location with 10 or more individual data points for each parameter of interest in Prichard Creek. This sampling location is shown on Figure 4.1-7. Sampling location PR14 lies within segment PrichCrkSeg03.

5.2.1 Estimated Discharge

An example of the lognormal distribution of discharge data at sampling location PR14 near Prichard is shown in Figure 5.2-1. This was the only location in Prichard Creek with sufficient data to conduct a probabilistic analysis.

In Figure 5.2-1, the discharge in cubic feet per second is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a variable (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative distribution function is plotted versus the normal standard variate in Figure 5.2-2. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-1, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-2. For example, for a discharge of 1,000 cfs, the normal standard variate is approximately 1.2 (Figure 5.2-1). Referring to Figure 5.2-2, this value corresponds to a cumulative probability of approximately 0.88; therefore, approximately 88 percent of the time, discharges at this location will be 1,000 cfs or less.

The probability distribution function (PDF) shown in Figure 5.2-1 is a predictive tool that can be used to estimate the expected discharge and provide a quantitative estimate of the probability that the observed discharge will not exceed a given value. Conversely, one can find the estimated

discharge rate having a specified probability of exceedance or non-exceedance by the observed discharge.

As shown in Figure 5.2-1, there is a good fit of the lognormal regression line (solid line in Figure 5.2-1) to the data. This goodness of fit, as evidenced by a high coefficient of determination ($r^2 = 0.96$) (significant at $\alpha < 0.0001$), supports the assumption that discharges are lognormally distributed. The dotted line represents the true (ideal) lognormal distribution having the same mean (365) and coefficient of variation (1.03) as the actual data. The estimated expected value of the discharge (534 cfs) is also indicated on the plot of the discharge data. Prichard Creek is a major contributor of flow to the North Fork.

5.2.2 Estimated Zinc, Lead, and Cadmium Concentrations and Mass Loading

Dissolved cadmium and zinc and total lead concentrations and loads were evaluated using the probabilistic model at the single sampling location that contained a minimum of ten data points, PR14.

To illustrate the lognormal distribution of dissolved zinc and total lead concentrations and dissolved zinc and total lead loads at sampling location PR14 on Prichard Creek, Figures 5.2-3 through 5.2-6 are provided. Dissolved cadmium concentrations were typically below the reporting limit of 0.5 μg/L. Consequently, dissolved cadmium concentrations and loads were not plotted; however, they were addressed probabilistically.

The high r-squared values (r^2) for the concentrations and loads when plotted lognormally attest to the fact that the data follow a lognormal distribution. For dissolved zinc concentrations, the r-squared value was 0.72. The r-squared value for the total lead concentration was 0.91. The corresponding values for dissolved zinc and total lead loads were 0.94 and 0.97, respectively.

To aid in interpreting and placing in context these results screening levels, expected values (EV), and total maximum daily loads (TMDLs) are shown on the figures where appropriate. The TMDLs are given at the 90th percentiles. The TMDLs used were those presented for the North Fork at Enaville in the Technical Support Document of August 2000 (USEPA 2000). Strictly speaking, TMDLs for non-point sources are for dissolved loads. The purpose of this exercise was to provide a reference value and point of discussion for lead because of the importance of the total lead load. Often, most of the lead will be in the particulate, as opposed to the dissolved, form. Because a high percentage of zinc load is in the dissolved form, zinc was compared to its dissolved TMDL loading capacity.

All except one of the measured and plotted total lead concentrations were less than the screening level (15 µg/L, Figure 5.2-3). The estimated expected total lead concentration (approximately 3.5 µg/L) was also less than the screening level (15 µg/L).

One of the observed dissolved zinc concentrations was greater than the screening level (Figure 5.2-4). The estimated dissolved zinc concentration (approximately 31 µg/L) is less than the screening level (42 µg/L).

The estimated total lead load at PR14 is approximately 43 pounds/day. The estimated expected value is greater than the 90th percentile TMDL value (16.3 pounds/day) for dissolved lead at Enaville (Figure 5.2-5).

As seen on Figure 5.2-6, none of the measured zinc loads exceeded the 90th percentile TMDL (886 pounds/day) for the dissolved zinc load at Enaville on the North Fork. The estimated value (approximately 84 pounds/day) fell between the 10th percentile (44.1 pounds/day) and 50th percentile (147 pounds/day) TMDLs at Enaville.

Figures 5.2-3 through 5.2-6 are examples of predictive tools that were developed to estimate and characterize dissolved zinc and total lead concentrations and loads with a specified probability or cumulative frequency. The form of the model is mathematically tractable in that concentrations and loads can be readily aggregated or disaggregated to the level of resolution desired and the estimates and their associated uncertainties can be tracked, propagated, and accumulated throughout the basin.

The results of these and additional analyses are presented in Appendix C. The calculations were performed in the same manner as described in the discharge section (Section 5.2.1).

5.2.3 Summary of Modeling Results for Sampling Location PR14

Prichard Creek was divided into three segments. Segment PrichCrkSeg01 is above the Paragon mill site and has few potential source areas and little indication of metal release. Segment PrichCrkSeg02, which is above Bear Gulch, also has few potential source areas; however, slightly elevated concentrations of dissolved lead have been measured in the lower portion of Bear Gulch. Segment PrichCrkSeg03 of Prichard Creek is below the Paragon mill site. This segment has numerous potential source areas. At times, concentrations of dissolved metals approach, or slightly exceed, the ambient water quality criteria at the downstream portion of this segment.

The estimated value of dissolved zinc (approximately 31.2 μg/L) was less than its screening level of 42 μg/L. Estimated total lead concentrations (approximately 3.5 μg/L) were less than the screening level of 15 μg/L. The estimated value of the dissolved zinc load (approximately 84 pounds/day) falls between the 10th and 50th percentile TMDLs established for the North Fork at Enaville. Total lead loads predicted by the probabilistic model (approximately 43 pounds/day) are greater than the 90th percentile TMDL for dissolved lead loads at Enaville.

Probabilistic modeling indicated that approximately 99 percent of the zinc concentration and 47 percent of the lead concentration would reside in the dissolved phase. Based on evaluation of data at PR14, estimated values of the total loadings at the mouth of Prichard Creek for zinc and lead are, approximately, 83.6 pounds/day and 43 pounds/day, respectively. Potential contributors to the dissolved and total metal concentrations and loads include the Paragon mining complex, Monarch adit, the Mother Lode Mine, and the Four Square Mine.

5.2.4 Concentrations Versus Discharge

There is a decrease in dissolved zinc concentrations with increased discharge (log-log plot of concentrations versus discharge which is significant at $\alpha < 0.22$ (α is the probability the correlation is due to chance). Total lead concentrations increased with increasing discharge ($\alpha = 0.0003$). The regressions permit estimation of dissolved and total zinc and lead concentrations and loads at various discharge rates (Appendix C).

5.3 SEDIMENT FATE AND TRANSPORT IN PRICHARD CREEK WATERSHED

Sediment fate and transport processes were presented in Section 3. Results of the sediment transport evaluation presented in Section 3 are summarized in this section.

The Prichard Creek Watershed has a drainage area of approximately 97.8 square miles with approximately 45 miles of mapped channel length. Sediment derived in Prichard Creek is transported to the North Fork. Sediment sources and transport processes were evaluated based on review and interpretation of aerial photographs. The review focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system. USGS sediment transport and stream discharge data are not available for Prichard Creek; therefore, estimates of sediment yield are not included in this discussion.

Likely sediment sources in the Prichard Creek Watershed include mining waste, channel bed remobilization and minor bank erosion. Sediment from the Prichard Creek Dredge Tailings in contact Prichard Creek, logging and drill exploration roads, and numerous small rock debris piles and dredge spoil piles in tributaries, are sources of sediment to Prichard Creek. Though suspended and bedload sediment samples were not collected and analyzed for metals, suspended and bedload sediment concentrations may be represented by metals concentrations reported for soil and sediment samples collected in the Prichard Creek. As presented in Section 4.1, Nature and Extent, metals concentrations in surface soil and sediment in segments PrichCrkSeg01 and PrichCrkSEg02 were generally low with low frequency of screening level exceedances. Metals concentrations in surface soils and sediment in segment PrichCrkSeg03 exceed screening levels for arsenic, cadmium, copper, iron, lead, manganese and zinc. The BLM identified 44 potential source areas in this segment.

5.4 SUMMARY OF FATE AND TRANSPORT IN PRICHARD CREEK

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading contributed to the North Fork by Prichard Creek.

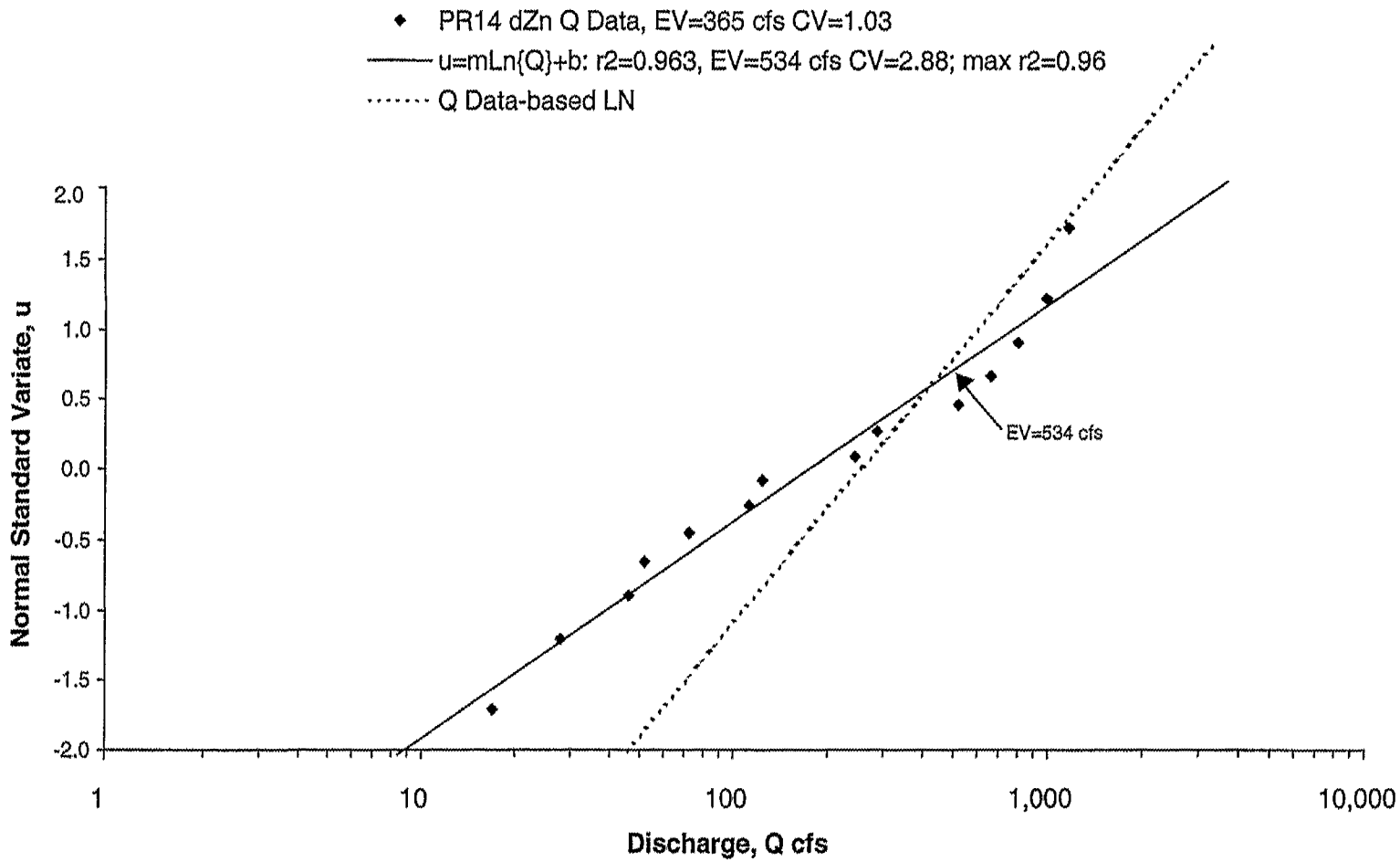
Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal PDFs at one sampling location in Prichard Creek. Only results for cadmium, lead and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends in concentrations and mass loading with changing discharge rates. The percentages of dissolved and particulate forms of metals were computed from the estimated expected values predicted by the model.

Results of the probabilistic modeling indicate:

- None of the modeled parameters exceeded screening levels.
- Probabilistic modeling indicated that approximately 99 percent of the zinc concentration and 47 percent of the lead concentration would reside in the dissolved phase.
- Based on evaluation of data at PR14, estimated values of the total loadings at the mouth of Prichard Creek for zinc and lead are, approximately, 83.6 pounds/day and 43 pounds/day, respectively.

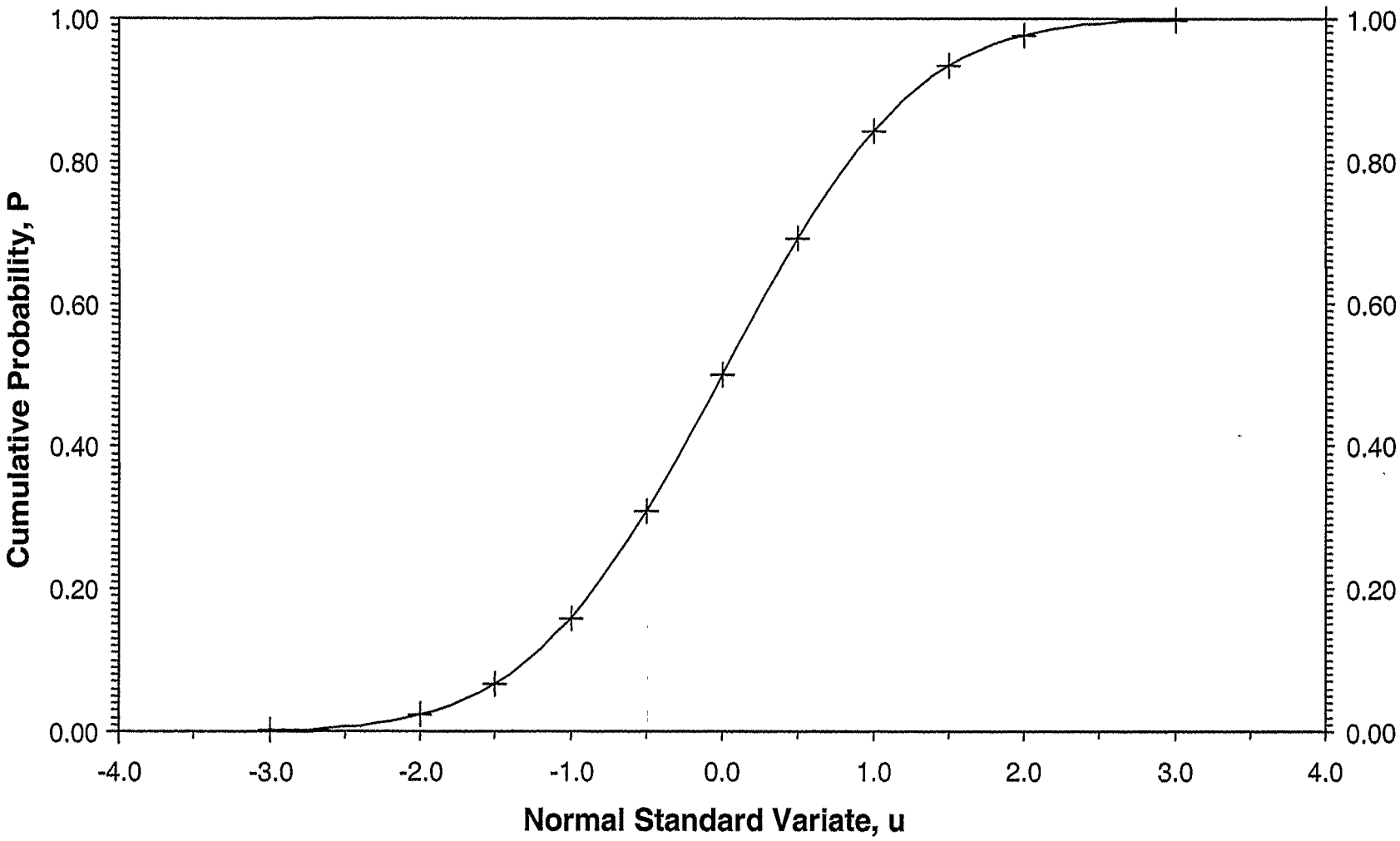
- Dissolved zinc concentrations decreased with increased discharge. Total lead concentrations increased with increased discharge rates.

Probabilistic Modeling Results for Discharge at PR14



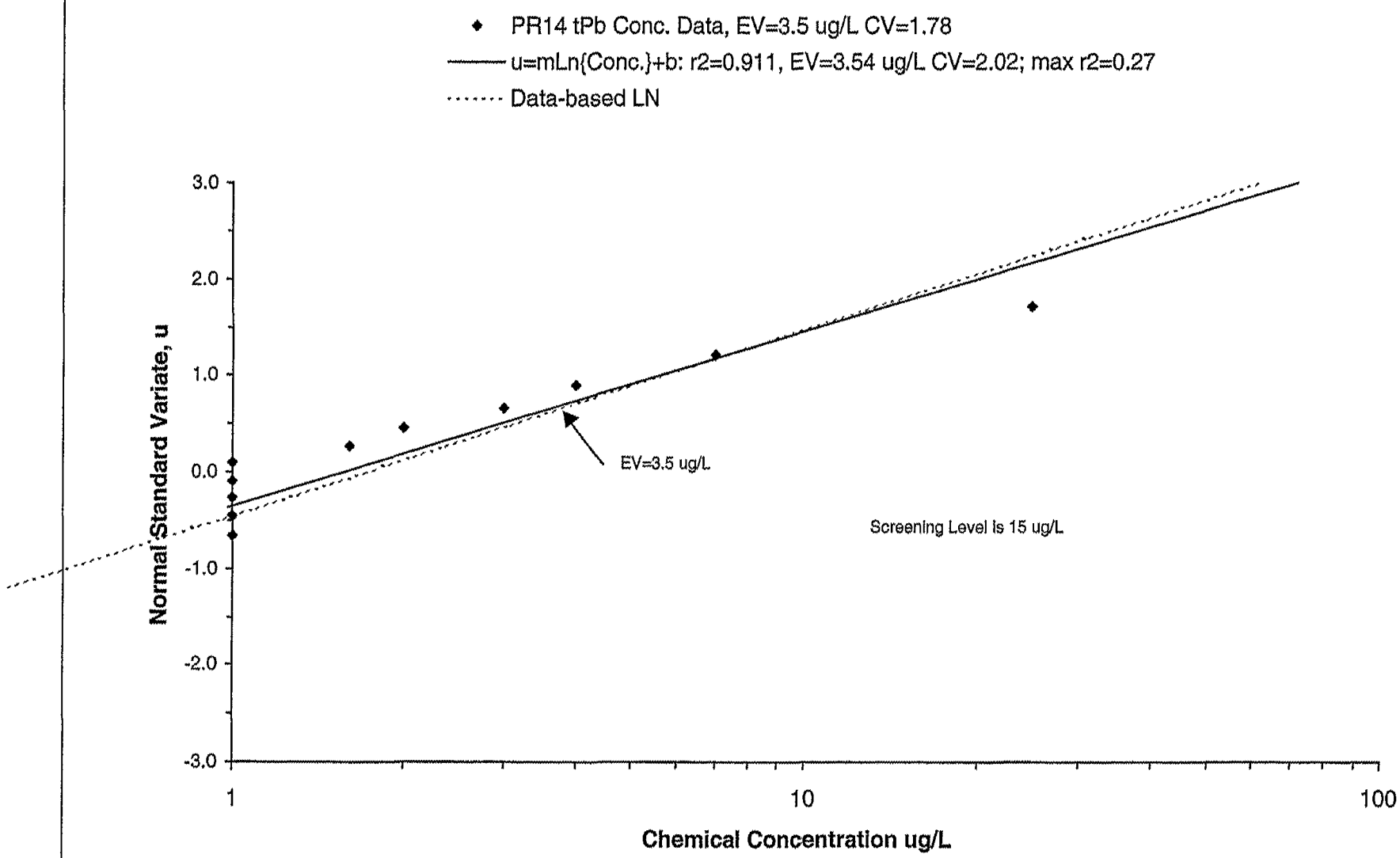
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.8615.05.a Generation: 1 Prichard Creek Series 07/11/01	Figure 5.2-1

Cumulative Probability Values Corresponding to Normal Standard Variate Values



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Prichard Creek Series 07/11/01	Figure 5.2-2

Probabilistic Modeling Results for Total Lead Concentrations at PR14



EPA REGION 10

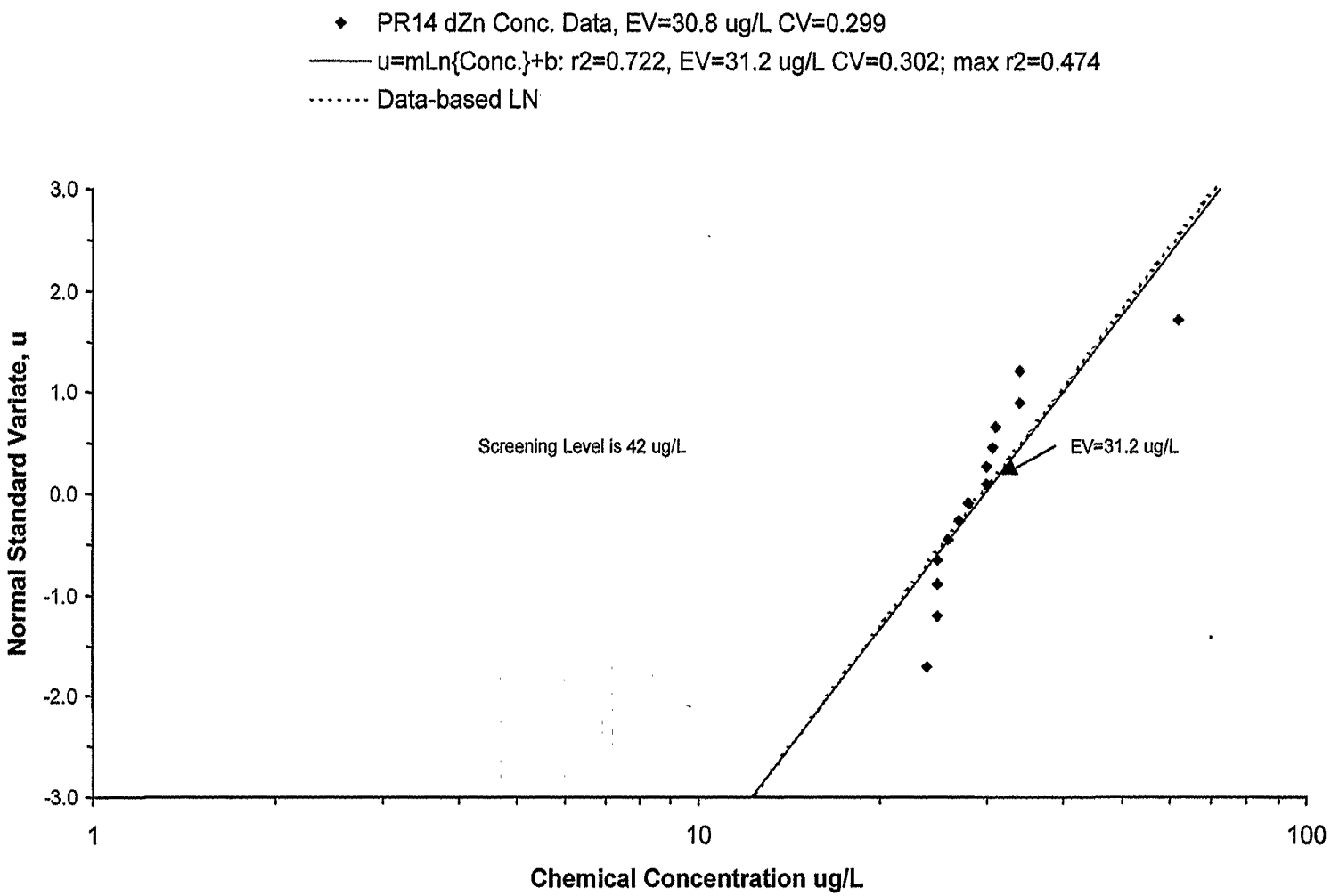
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Prichard Creek Series
07/11/01

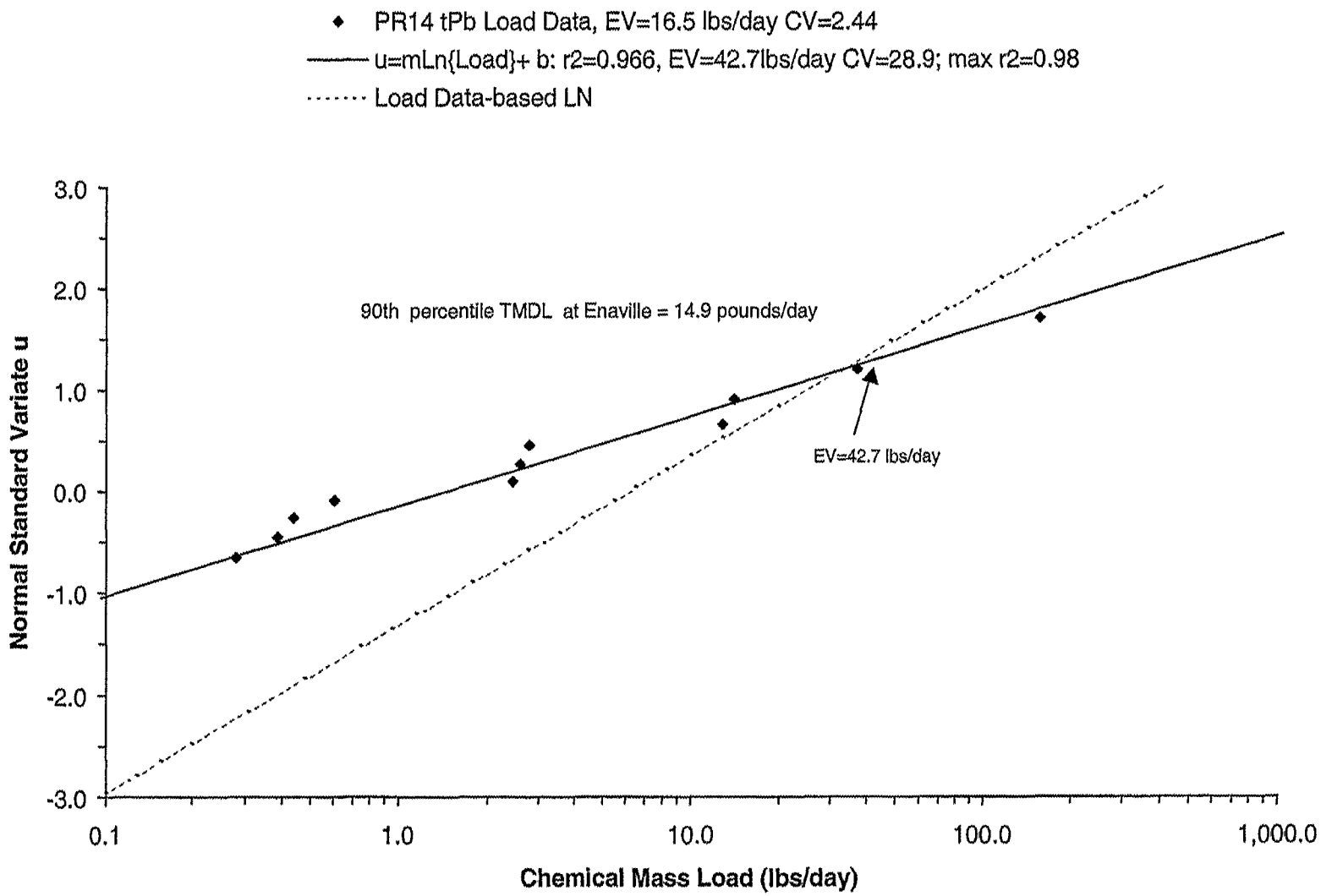
Figure 5.2-3

Probabilistic Modeling Results for Dissolved Zinc Concentrations at PR14



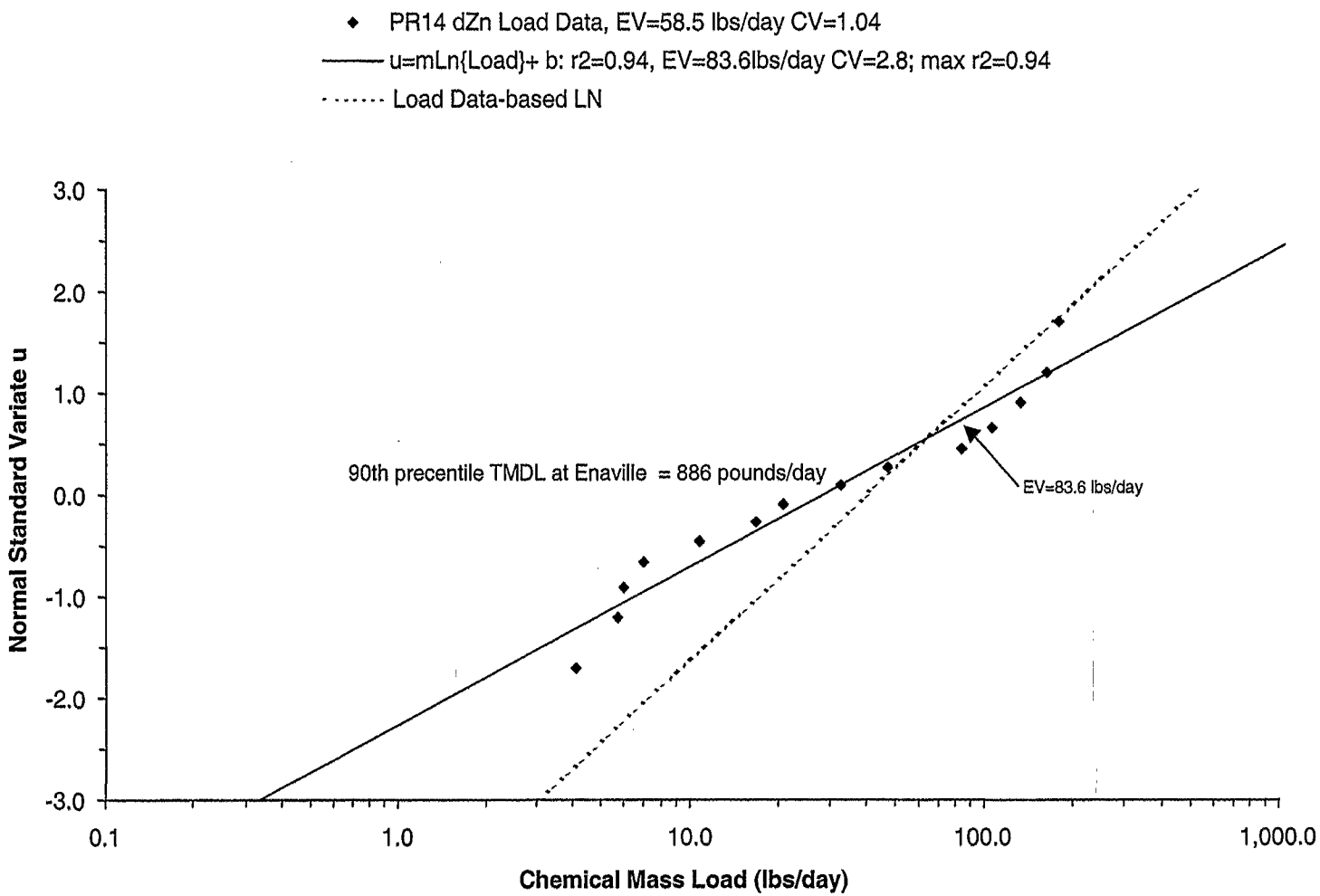
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Prichard Creek Series 07/11/01	Figure 5.2-4

Probabilistic Modeling Results for Total Lead Mass Loading at PR14



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Prichard Creek Series 07/11/01	Figure 5.2-5

Probabilistic Modeling Results for Dissolved Zinc Mass Loading at PR14



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Prichard Creek Series 07/11/01	Figure 5.2-6

Table 5.1-1
Low and High Instantaneous Metal Loading Values for Three Sampling Events (May 1998, April 1999, and May 1999)

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.184	0.87
Total Lead	0.4	158
Dissolved Lead	0.46	3.6
Dissolved Zinc	11.8	180

Table 5.2-1
Estimated Expected Values and Coefficients of Variation for Discharge, Concentrations, and Mass Loading at PR14

Estimated Parameter (Number of samples)	Estimated Expected Value (Coefficient of Variation)	Screening Level or TMDL[a]
Discharge in cfs		
Discharge (14)	534 (2.88)	Not applicable
Concentrations in µg/L		
Dissolved Cadmium (14)	0.42 (0.686)	0.38
Total Lead (14)	3.54 (2.02)	15
Dissolved Zinc(14)	31.2 (0.3)	42
Mass loading in pounds/day		
Dissolved Cadmium (14)	0.874 (2.34)	10.1
Total Lead (14)	42.7 (28.9)	16.3[b]
Dissolved Zinc(14)	83.6 (2.8)	886

[a]TMDLs are the 90th percentile values for the North Fork at Enaville (USEPA 2000).
[b]The total lead TMDL equals the dissolved lead TMDL x 1.1

6.0 REFERENCES

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ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
7	IDEQ Historical Data	IDEQ Water Quality Data	Idaho Department of Environmental Quality. 1998. Assortment of files from Glen Pettit for water years 1993 through 1996
			Idaho Department of Environmental Quality. 1998. E-mail from Glen Pettit October 6, 1998 Subject: DEQ Water Quality Data Files Attached: 1998 trend Samples.xls, 1997 trend Samples.xls

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
			Environmental Protection Agency. 1998. E-mail from Ben Cope August 5, 1998. Subject: State of Idaho Lat/Longs File Attached: PAT.DBF
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: PCSDATA.WK4
10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. I, Prichard Creek and Eagle Creek Drainages
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. III, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages)

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. IV, Prichard Creek and Eagle Creek Drainages
13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
			US Forest Service. 1995. Pilot Inventory of Inactive and Abandoned Mine Lands, East Fork Pine Creek Watershed, Shoshone County, Idaho
14	Historical Sediment Core Data: University of Idaho (Thesis papers)	Historical Lateral Lakes Sediment Data from F. Rabbi and M.L. Hoffman	Characterization of Heavy Metal Contamination in Two Lateral Lakes of the Lower Coeur d'Alene River Valley, A thesis by M.L. Hoffmann, May 1995
			Trace Element Geochemistry of Bottom Sediments and Waters from the Lateral Lakes of Coeur d'Alene River, A Dissertation by F. Rabbi, May 1994
15	URS FSPA No. 9	Source Area Characterization; Field XRF Data	CH2M Hill and URS Greiner. 1998. Field Sampling Plan Addendum 9 Delineation of Contaminant Source Areas in the Coeur d'Alene Basin using Survey and Hyperspectral Imaging Techniques
16	Historical Sediment Data	Electronic Data compiled by USGS	U.S. Geological Survey. 1992. Effect of Mining-Related Activities on the Sediment-Trace Element Geochemistry of Lake Coeue d'Alene, Idaho, USA--Part 1: Surface Sediments, USGS Open-File Report 92-109, Prepared by A.J. Horowitz, K.A. Elrick, and R.B. Cook
			US Geological Survey. 2000. Chemical Analyses of Metal-Enriched Sediments, Coeur d'Alene Drainage Basin, Idaho: Sampling, Analytical Methods, and Results. Draft. October 13, 2000. Prepared by S.E. Box, A.A. Bookstrom, M. Ikramuddin, and J. Lindsey. Samples collected from 1993 to 1998.

Data Source References (Continued)

Data Source References*	Data Source Name	Data Source Description	Reference
17	USGS Spokane River Basin Sediment Samples	Surface Sediment Samples Collected by USGS in the Spokane River Basin	Environmental Protection Agency. 1999. Data Validation Memorandum and Attached Table from Laura Castrilli to Mary Jane Nearman dated June 9, 1999. Subject: Coeur d'Alene (Bunker Hill) Spokane River Basin Surface Sample Samples, USGS Metals Analysis, <63 um fraction, Data Validation, Samples SRH7-SRH30
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured on the Ascending and Descending Limbs of the 1999 Snomelt Runoff Hydrograph at Nine Stations, Coeur d'Alene River Basin Idaho
22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
28	USGS National Water Quality Assessment database	Surface water data for sampling location NF50 at Enaville, Idaho.	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur d'Alene River at Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are shown in the Data Summary Tables in the "Ref" column.

Data Summary Table
Prichard Creek - segment PrichCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PR8085	TL	13	—			140	26	86	40000	860	1200			6500
Surface Water - Total Metals (ug/l)														
PR8051	AD	13	—			2.9 U	5	86	68	8.7	6	0.5 U		2200
PR8079	RV	13	—			2.9 U	3 U	35 U	75	1.5 U	6	0.5 U		15
Surface Water - Dissolved Metals (ug/l)														
PR8051	AD	13	—			2.9 U	14	9	11	4	3	0.5 U		2000

Data Summary Table
Prichard Creek - segment PrichCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PR8083	TL	13	—			85 U	21	86	68000	6300	490			2700
PR8091	TL	13	—			160	250	850	15000	* 40000	680			* 53000
Surface Water - Total Metals (ug/l)														
PR8002	RV	13	—			2.9 U	3 U	35 U	36	1.5 U	2 U	0.5 U		4
PR8052	AD	13	—			2.9 U	4	35 U	59	15	2	0.5 U		420
PR8053	AD	13	—			2.9 U	3 U	35 U	66	58	4	0.5 U		230
PR8080	RV	13	—			2.9 U	3 U	35 U	24	1.5 U	2 U	0.5 U		6
Surface Water - Dissolved Metals (ug/l)														
PR8052	AD	13	—			2.9 U	4 U	12	4 U	6	2 U	0.5 U		470
PR8053	AD	13	—			2.9 U	4 U	7 U	4 U	36	2 U	0.5 U		210

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PR8082	TL	13	—			1300	14	760	91000	4200	580			1700
PR8084	TL	13	—			100	2.5	50	47000	170	410			100
PR8086	TL	13	—			85 U	2.5	53	43000	400	5100			46
PR8087	TL	13	—			* 2400	16	180	77000	8100	1000			3300
PR8088	TL	13	—			110	2.9	45	33000	120	590			140
PR8089	TL	13	—			160	230	660	30000	7100	1100			* 65000
PR8090	TL	13	—			100	160	300	28000	8400	1300			* 43000
PR8092	TL	13	—			2100	3.3	72	54000	2800	1800			290
PR8093	TL	13	—			170	330	250	28000	3000	1200			* 68000
Surface Water - Total Metals (ug/l)														
PR14	RV	18	10/20/1998				1 UJ			1				
PR14	RV	18	11/18/1998				1			1				20
PR14	RV	18	12/10/1998				1 UJ			1				
PR14	RV	18	12/29/1998				1 UJ			1				
PR14	RV	18	02/25/1999				1 UJ			2				40
PR14	RV	18	03/24/1999				1 UJ			3				40
PR14	RV	18	04/21/1999				1 UJ			7				40
PR14	RV	18	05/04/1999							1				30
PR14	RV	18	05/24/1999						690	25	29			40
PR14	RV	18	06/15/1999							4				30
PR14	RV	18	07/13/1999				0.13			0.66				25.4
PR14	RV	18	08/12/1999				0.12			0.39				22.8
PR14	RV	18	09/08/1999				0.13			0.32				24.1
PR14	RV	3	05/06/1998		0.5 U	1 U	0.15	3 U	20 U	1.6	5 U	0.2 U	0.3 U	30.6
PR16	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U		1.4	5 U	0.2 U	0.2 U	29
PR16	RV	3	05/05/1998						43					
PR17	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR18	RV	3	05/05/1998		0.2 U	2 U	0.3	2 U	38	2.9	5 U	0.2 U	0.2 U	50
PR19	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR20	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR21	RV	3	05/08/1998		0.4	2 U	1.9	3	24	29.5	5 U	0.2 U	0.2 U	364
PR22	RV	3	05/08/1998		0.4	2 U	2.1	2	20 U	94.6	5 U	0.5 U	0.2 U	370
PR23	RV	3	05/09/1998		0.5 U	1 U	0.16	3 U	38.6	1.4	5 U	0.2 UJ	0.3 U	37.9
PR24	RV	3	05/07/1998		0.032 U	0.4 J	0.094 J	0.44 U	14.8 J	2.2 J	1.3 J	0.16 U	0.042 U	36.9
PR25	RV	3	05/07/1998		0.032 U	0.26 J	0.096 J	0.44 U	15.5 J	2.3 J	1.2 J	0.16 U	0.042 U	45.6

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PR26	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.5 U	0.2 U	10 U
PR27	RV	3	05/09/1998		0.5 U	1 U	0.18	3 U	25.9	2.5	5 U	0.2 UJ	0.3 U	39.6
PR28	RV	3	05/08/1998		0.2 U	2 U	3.4	2 U	20 U	0.6	5 U	0.5 U	0.2 U	858
PR29	RV	3	05/09/1998		0.5 U	1 U	0.19	3 U	126	2.3	18.6	0.2 UJ	0.3 U	48.5
PR30	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.5 U	0.2 U	10 U
PR31	RV	3	05/10/1998			0.3 J	0.2 U	0.5 J	14.7 J	2.7 J	1 J	0.2 U		45.1
PR32	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	3.8	5 U	0.2 U	0.2 U	36
PR33	RV	3	05/10/1998			0.2 U	0.2 U	0.4 U	24.7 J	3.6	1.6 J	0.2 U	0.4 U	47.4
PR34	RV	3	05/10/1998		0.032 U	0.23 U	0.042 U	0.51 J	13.5 J	0.93 J	0.79 J	0.16 U	0.042 U	3.5 J
PR35	RV	3	05/10/1998		0.032 U	0.46 J	0.042 U	0.4 U	18.2 J	0.57 J	0.97 J	0.16 U	0.042 U	6.8 J
PR36	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	32	0.8	5 U	0.2 U	0.2 U	24
PR37	RV	3	05/10/1998		0.032 U	0.31 J	0.14 J	0.44 U	6.8 J	1.1 J	0.21 J	0.16 U	0.042 U	38.3
PR38	RV	3	05/10/1998		0.032 U	0.23 U	0.042 U	0.44 U				0.16 U	0.042 U	
PR38	RV	3	05/10/1998						20.2 J	0.25 J	2 J			4.1 J
PR41	RV	3	05/09/1998		0.5 U	1 U	0.2	3 U	20 U	0.5 U	5 U	0.2 UJ	0.3 U	48.8
PR42	RV	3	05/11/1998		0.2 U	2 U	0.3	2 U	28	0.9	5 U	0.2 U	0.2 U	48
PR43	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	24	0.6	5 U	0.2 U	0.2 U	49
PR44	RV	3	05/11/1998		0.2 U	2 U	0.2	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	48
PR45	RV	3	05/12/1998		0.5 U	1 U	0.17	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	42.3
PR48	RV	3	05/19/1998		0.38 U	0.23 U	1.6 J	0.93 J	19.5 J	15	0.47 J	0.16 U	0.042 U	345
PR49	RV	3	05/19/1998		0.38 U	0.23 U	1.5 J	1.6 J	19.9 J	14.8	0.54 J	0.16 U	0.042 U	350
PR8000	RV	13	—			2.9 U	3 U	35 U	320	1.5 U	13	0.5 U		26
PR8001	RV	13	—			2.9 U	3 U	35 U	86	2.6	7	0.5 U		31
PR8003	RV	13	—			2.9 U	3 U	35 U	49	1.5 U	3	0.5 U		3 U
PR8004	RV	13	—			2.9 U	3 U	35 U	37	1.5 U	2 U	0.5 U		5
PR8005	RV	13	—			2.9 U	3 U	35 U	58	1.5 U	2	0.5 U		5
PR8006	RV	13	—			2.9 U	3 U	35 U	75	6.9	4	0.5 U		250
PR8007	RV	13	—			2.9 U	4	35 U	46	1.5 U	3	0.5 U		51
PR8008	RV	13	—			2.9 U	3 U	35 U	400	1.5 U	2	0.5 U		3 U
PR8009	RV	13	—			2.9 U	3 U	35 U	27	1.5 U	2	0.5 U		3 U
PR8010	RV	13	—			2.9 U	3 U	35 U	46	1.5 U	26	0.5 U		3 U
PR8011	RV	13	—			2.9 U	6	35 U	40	1.5 U	2 U	0.5 U		31
PR8013	RV	13	—			2.9 U	3 U	35 U	53	1.5 U	2 U	1		21
PR8015	AD	13	—			2.9 U	3 U	35 U	61	3		0.5 U		
PR8015	AD	13	—								7			29
PR8016	AD	13	—			2.9 U	3 U	35 U	64		8	0.5 U		16
PR8016	AD	13	—							1.5 U				

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PR8017	AD	13	—			2.9 U						0.5 U		
PR8017	AD	13	—				7	* 770	170	2	10			10
PR8018	RV	13	—			2.9 U	3 U	35 U	610		7	0.5 U		24
PR8018	RV	13	—							1.5 U				
PR8019	AD	13	—			2.9 U	3	35 U	12 U		3	0.63		8
PR8019	AD	13	—							1.5 U				
PR8020	AD	13	—			4.1	4	35 U	1900		500	0.5 U		14
PR8020	AD	13	—							1.5 U				
PR8021	AD	13	—			2.9 U	5	35 U	690	5	86	0.5 U		15
PR8022	AD	13	—			2.9 U	3	35 U	27		2 U	0.5 U		3 U
PR8022	AD	13	—							1.5 U				
PR8024	RV	13	—			2.9 U	3 U	35 U	89		4	0.5 U		15
PR8024	RV	13	—							2.3				
PR8025	RV	13	—			2.9 U	3 U	35 U	99		7	0.5 U		17
PR8025	RV	13	—							1.5 U				
PR8026	AD	13	—			2.9 U	3 U	35 U	43		3	0.5 U		3 U
PR8026	AD	13	—							1.5 U				
PR8027	AD	13	—			2.9 U	4	35 U	12 U		4	0.5 U		8
PR8027	AD	13	—							1.5 U				
PR8029	RV	13	—			2.9 U	3 U	35 U	32	2 U	2 U	0.5 U		3 U
PR8030	AD	13	—			2.9 U	6	35 U	51		18	0.5 U		14
PR8030	AD	13	—							1.5 U				
PR8034	RV	13	—			2.9 U	3 U	35 U	49	1.5 U	3	0.5 U		3 U
PR8035	RV	13	—			2.9 U	3 U	35 U	37	1.5 U	2 U	0.5 U		5
PR8045	AD	13	—			2.9 U	12	35 U	22	33	15	0.5 U		2800
PR8046	AD	13	—			2.9 U	3 U	35 U	43	100	7	0.5 U		570
PR8047	SP	13	—			2.9 U	8	35 U	110	9	20	0.5 U		2100
PR8050	SP	13	—			2.9 U	3 U	35 U	1800	4.3	200	0.5 U		390
PR8054	AD	13	—			110	6	62	190	190	130	0.5 U		470
PR8055	AD	13	—			2.9 U	3 U	35 U	56	3	2 U	0.5 U		7
PR8056	AD	13	—			2.9 U	3 U	35 U	210	1.5 U	40	0.5 U		110
PR8059	RV	13	—			2.9 U	7	35 U	100	1.5 U	5	0.32		33
PR8060	AD	13	—			3.1	11	35 U	12 U	18	6	0.35		920
PR8061	RV	13	—			2.9 U	13	35 U	12 U	74	4	0.5 U		1500
PR8064	AD	13	—			2.9 U	12	35 U	12 U	1.9	14	0.5 U		1400
PR8070	SP	13	—			2.9 U	3	35 U	3400	4	570	0.5		490
PR8071	RV	13	—			2.9 U	3 U	35 U	130	1.5 U	7	0.5 U		20

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PR8073	AD	13	---			2.9 U	3	35 U	290	5	22	0.67		17
PR8074	AD	13	---			3.6	3 U	35 U	220	4	10	0.77		6
PR8075	AD	13	---			2.9 U	3 U	35 U	770	1.5 U	6	0.5 U		3 U
PR8078	SP	13	---			2.9 U	3 U	35 U	370	28	15	0.5 U		90
Surface Water - Dissolved Metals (ug/l)														
PR14	RV	18	10/20/1998				1 UJ			1 UJ				62
PR14	RV	18	11/18/1998				1 UJ							25
PR14	RV	18	12/10/1998				1 UJ			1 UJ				28
PR14	RV	18	12/29/1998				1 UJ			1 UJ				34
PR14	RV	18	02/25/1999				1 UJ			1				25
PR14	RV	18	03/24/1999				1 UJ			1				31
PR14	RV	18	04/21/1999				1 UJ			1				34
PR14	RV	18	05/04/1999				1 U			1 U				30
PR14	RV	18	05/24/1999				1 U		6	1 U	1.8			26
PR14	RV	18	06/15/1999				1			1				30
PR14	RV	18	07/13/1999				1 U			1 U				25
PR14	RV	18	08/12/1999				1 U			1 U				24
PR14	RV	18	09/08/1999				1 U			1 U				27
PR14	RV	3	05/06/1998		0.5 U	1 U	0.12	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	30.7
PR16	RV	3	05/05/1998		0.2 U	2 U	0.2	2 U	20 U	0.6	5 U	0.2 U	0.2 U	28
PR17	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR18	RV	3	05/05/1998		0.2 U	2 U	0.3	2 U	20 U	1.4	5 U	0.2 U	0.2 U	53
PR19	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	48.7 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR20	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PR21	RV	3	05/08/1998		0.4	2 U	1.8	2 U	20 U	18	5 U	0.2 U	0.2 U	389
PR22	RV	3	05/08/1998		0.4	2 U	2	2 U	20 U	72.1	5 U	0.2 U	0.2 U	371
PR23	RV	3	05/09/1998		0.5 U	1 U	0.16	3 U	20 U	0.5 U	5 U	0.2 UJ	0.3 U	37.6
PR24	RV	3	05/07/1998		0.032 U	0.26 J	0.12 J	0.44 U	5.6 U	0.82 J	0.23 J	0.16 U	0.042 U	42.9
PR25	RV	3	05/07/1998		0.032 U	0.23 U	0.16 J	0.92 J	5.6 U	1.2 J	0.37 J	0.16 U	0.042 U	47.7
PR26	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	1	5 U	0.2 U	0.2 U	10 U
PR27	RV	3	05/09/1998		0.5 U	1 U	0.16	3 U	20 U	2.1	5 U	0.2 UJ	0.3 U	39.3
PR28	RV	3	05/08/1998		0.2 U	2 U	3.4	2 U	20 U	0.3	5 U	0.2 U	0.2 U	896
PR29	RV	3	05/09/1998		0.5 U	1 U	0.17	3 U	20 U	1.1	5 U	0.2 UJ	0.3 U	47.5
PR30	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
PR31	RV	3	05/10/1998			0.2 U	0.3 UJ	0.4 U	6.9 J	1.9 J	0.9 J	0.2 U		75.6
PR32	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	2.3	5 U	0.2 U	0.2 U	38

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PR33	RV	3	05/10/1998			0.2 U	0.2 UJ	0.4 U	12.7 J	1.8 J	0.4 U	0.2 U		52.3
PR34	RV	3	05/10/1998		0.032 U	0.23 U	0.063 J	0.45 J	5.6 U	0.37 J	0.47 J	0.16 U	0.042 U	3.4 J
PR35	RV	3	05/10/1998		0.032 U	0.29 J	0.042 U	0.44 U	6.1 J	0.12 J	0.18 J	0.16 U	0.042 U	7 J
PR36	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.9	5 U	0.2 U	0.2 U	25
PR37	RV	3	05/10/1998		0.032 U	0.27 J	0.2 J	0.4 U	5.6 U	0.72 J	0.034 U	0.16 U	0.042 U	46.7
PR38	RV	3	05/10/1998		0.032 U	0.24 J	0.042 U	0.44 U	5.6 U	0.11 U	0.2 J	0.16 U	0.042 U	4 J
PR41	RV	3	05/09/1998		0.5 U	1 U	0.2	3 U	20 U	0.5 U	5 U	0.2 UJ	0.3 U	49.1
PR42	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	48
PR43	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	48
PR44	RV	3	05/11/1998		0.2 U	2 U	0.2	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	46
PR45	RV	3	05/12/1998		0.5 U	1 U	0.16	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	41.3
PR48	RV	3	05/19/1998		0.41 U	0.23 U	1.5 J	0.94 J	13.1 J	13	0.31 J	0.16 U	0.042 UJ	349 J
PR49	RV	3	05/19/1998		0.4 U	0.23 U	1.6 J	1.2 J	15.5 J	12	0.94 J	0.16 U	0.042 UJ	343 J
PR8000	RV	13	—			2.9 U	4 U	12	6	2	2 U	0.5 U		8 U
PR8001	RV	13	—			2.9 U	4 U	7 U	9	1.5 U	2 U	0.5 U		8 U
PR8015	AD	13	—				4 U		4 U		2 U	0.5 U		8 U
PR8015	AD	13	—					24						
PR8015	AD	13	—			2.9 U				1.5 U				
PR8016	AD	13	—				4 U	13	14		5	0.5 U		8 U
PR8016	AD	13	—			2.9 U				1.5 U				
PR8017	AD	13	—				4 U	10				0.5 U		
PR8017	AD	13	—						10		2			15
PR8017	AD	13	—			2.9 U				1.5 U				
PR8018	RV	13	—				4 U	10	4 U		2 U	0.5 U		8 U
PR8018	RV	13	—			2.9 U				1.5 U				
PR8019	AD	13	—				5	7 U	7		2 U			8 U
PR8020	AD	13	—				5	7 U	1800		490			50
PR8021	AD	13	—				4 U	7 U	32		71			20
PR8021	AD	13	—							1.5 U				
PR8022	AD	13	—				4 U	7	7		2 U			15
PR8024	RV	13	—				4 U	21	19		2 U	0.5 U		8 U
PR8024	RV	13	—			2.9 U				1.5 U				
PR8025	RV	13	—				4 U	22	7		2 U	0.5 U		8 U
PR8025	RV	13	—			2.9 U				1.5 U				
PR8026	AD	13	—				9	23	6		2 U			8 U
PR8027	AD	13	—				5	7 U	10		2 U			110
PR8045	AD	13	—			2.9 U	15	19	4 U	22	8	0.5 U		2600

Data Summary Table
Prichard Creek - segment PrichCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PR8046	AD	13	—			2.9 U	7	15	4 U	89	2 U	0.5 U		570
PR8047	SP	13	—			2.9 U	13	20	6	48	13	0.5 U		2200
PR8050	SP	13	—			2.9 U	4 U	11	4.4 U	1.5 U	170	0.5 U		280
PR8054	AD	13	—			86	4 U	44	4 U	41	110	0.5 U		470
PR8055	AD	13	—			2.9 U	4 U	15	4 U	1.5 U	2 U	0.5 U		8 U
PR8056	AD	13	—			2.9 U	4 U	16	4 U	1.5 U	8	0.5 U		79
PR8059	RV	13	—				6	16	15		2 U			14
PR8060	AD	13	—				11	17	4 U	16	2 U			780
PR8061	RV	13	—				15	17	4 U	63	2 U			1300
PR8064	AD	13	—				11	7 U	10		12			1300
PR8070	SP	13	—			2.9 U	4 U	27	10	1.5 U	2	0.5 U		23
PR8071	RV	13	—			2.9 U	4 U	7 U	9	1.5 U	2	0.5 U		8 U
PR8073	AD	13	—				6	16	4 U	1.5 U	2 U			8 U
PR8074	AD	13	—				8	12	4 U	1.5 U	2 U			8 U
PR8075	AD	13	—				6	16	5		2 U			8 U

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PrichCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	1	1	140	140	140	< 0.001	22	1	0	0
Cadmium	1	1	26	26	26	< 0.001	9.8	1	0	0
Copper	1	1	86	86	86	< 0.001	100	0	0	0
Iron	1	1	40,000	40,000	40,000	< 0.001	65,000	0	0	0
Lead	1	1	860	860	860	< 0.001	171	1	0	0
Manganese	1	1	1,200	1,200	1,200	< 0.001	3,597	0	0	0
Zinc	1	1	6,500	6,500	6,500	< 0.001	280	1	1	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PrichCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Cadmium	2	1	5	5	5	< 0.001	2	1	0	0
Copper	2	1	86	86	86	< 0.001	1	1	1	0
Iron	2	2	68	75	71.5	0.07	300	0	0	0
Lead	2	1	8.7	8.7	8.7	< 0.001	15	0	0	0
Manganese	2	2	6	6	6	< 0.001	50	0	0	0
Zinc	2	2	15	2,200	1,110	1.4	30	1	1	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PrichCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Cadmium	1	1	14	14	14	< 0.001	0.38	1	1	0
Copper	1	1	9	9	9	< 0.001	3.2	1	0	0
Iron	1	1	11	11	11	< 0.001	1,000	0	0	0
Lead	1	1	4	4	4	< 0.001	1.09	1	0	0
Manganese	1	1	3	3	3	< 0.001	20.4	0	0	0
Zinc	1	1	2,000	2,000	2,000	< 0.001	42	1	1	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PrichCrkSeg02
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	2	1	160	160	160	< 0.001	22	1	0	0
Cadmium	2	2	21	250	136	1.19	9.8	2	1	0
Copper	2	2	86	850	468	1.15	100	1	0	0
Iron	2	2	15,000	68,000	41,500	0.9	65,000	1	0	0
Lead	2	2	6,300	40,000	23,200	1.03	171	2	2	1
Manganese	2	2	490	680	585	0.23	3,597	0	0	0
Zinc	2	2	2,700	53,000	27,900	1.28	280	2	1	1

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PrichCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Copper	2	1	12	12	12	< 0.001	3.2	1	0	0
Lead	2	2	6	36	21	1.01	1.09	2	1	0
Zinc	2	2	210	470	340	0.54	42	2	1	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PrichCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Cadmium	4	1	4	4	4	< 0.001	2	1	0	0
Iron	4	4	24	66	46.3	0.42	300	0	0	0
Lead	4	2	15	58	36.5	0.83	15	1	0	0
Manganese	4	2	2	4	3	0.47	50	0	0	0
Zinc	4	4	4	420	165	1.21	30	2	1	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PrichCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	9	8	100	2,400	805	1.22	22	8	3	1
Cadmium	9	9	2.5	330	84.6	1.47	9.8	5	3	0
Copper	9	9	45	760	263	1.03	100	5	0	0
Iron	9	9	28,000	91,000	47,900	0.47	65,000	2	0	0
Lead	9	9	120	8,400	3,810	0.88	171	7	6	0
Manganese	9	9	410	5,100	1,450	0.99	3,597	1	0	0
Zinc	9	9	46	68,000	20,200	1.47	280	6	4	3

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PrichCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	31	2	0.4	0.4	0.4	< 0.001	2.92	0	0	0
Arsenic	51	5	0.24	86	17.4	2.2	150	0	0	0
Cadmium	77	35	0.063	15	3.88	1.2	0.38	20	14	0
Copper	64	27	0.45	44	15.1	0.61	3.2	23	1	0
Iron	65	25	5	1,800	82.1	4.36	1,000	1	0	0
Lead	68	30	0.12	89	13.9	1.73	1.09	18	10	0
Manganese	65	21	0.18	490	42.8	2.59	20.4	4	1	0
Zinc	77	57	3.4	2,600	236	2.15	42	30	8	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PrichCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	31	2	0.4	0.4	0.4	< 0.001	6	0	0	0
Arsenic	79	9	0.26	110	13.6	2.66	50	1	0	0
Cadmium	89	41	0.094	13	3.21	1.17	2	20	0	0
Copper	79	8	0.5	770	105	2.57	1	5	2	1
Iron	80	63	6.8	3,400	226	2.38	300	10	1	0
Lead	92	56	0.25	190	13.1	2.43	15	9	1	0
Manganese	80	51	0.21	570	36.4	2.97	50	5	1	0
Mercury	79	7	0.32	1	0.606	0.4	2	0	0	0
Zinc	89	75	3.5	2,800	200	2.37	30	44	14	0

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram

CSM Unit 1, Upper Watersheds

Upper South Fork Coeur d'Alene River

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ABBREVIATIONS AND ACRONYMS

AWQC	Ambient Water Quality Criteria
Belt	Belt Supergroup
BLM	Bureau of Land Management
cfs	cubic foot per second
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
EPA	U.S. Environmental Protection Agency
EV	expected value
FS	feasibility study
IDEQ	Idaho Division of Environmental Quality
MCL	maximum contaminant level
MFG	McCulley, Frick & Gilman, Inc.
µg/L	microgram per liter
msl	mean sea level
NPDES	National Pollution Discharge Elimination System
PDF	probability density function
PRG	preliminary remediation goal
RI/FS	remedial investigation/feasibility study
RI	remedial investigation
SFCDR	South Fork Coeur d'Alene River
SFCDRSeg	South Fork Coeur d'Alene River Segment
SL	screening level
South Fork	South Fork Coeur d'Alene River
TMDL	total maximum daily load
Upper South Fork	Upper South Fork Coeur d'Alene River
URSG	URS Greiner, Inc.
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Upper South Fork Watershed is located within the Coeur d'Alene River basin and encompasses the headwaters of the South Fork Coeur d'Alene River (South Fork). The Bureau of Land Management (BLM) has identified 229 source areas (e.g., mining waste rock dumps, adits, and jig and flotation tailings piles) within the watershed (BLM 1999). The watershed has been affected by mining activities and hazardous substances have been and continue to be released into the environment.

Several clean-up actions have been implemented in the upper South Fork Coeur d'Alene River watershed above Wallace. These actions include several local actions identified to protect human health, and other response actions as implemented by the mining companies and the Union Pacific Railroad. During the 1998 and 1999 field seasons, the USACE on behalf of USEPA performed several residential soil cleanups determined to be necessary to protect human health. These actions include removals at 5 residential properties within this portion of the watershed, and a localized removal at the Mullan City Park (USEPA 1999, and USEPA 2000b). In addition, localized removals with replacement by wood chips were conducted beneath the play equipment at the Mullan Elementary School (USEPA 2000c). Material from these removal actions was disposed of at the CIA (USEPA 1999 and USEPA 2000a).

In 1989, Hecla directed adit drainage from the Morning Mine No. 6 Adit to a subsurface flow rock-bed filter treatment system located on top of the Morning Mine waste rock dump. Water quality data indicates variable effectiveness (Harvey 2000).

As a part of the Consent Decree for the Union Pacific Railroad (UPRR) Wallace-Mullan Branch, contaminated soils and right of way ballast within the UPRR (ROW) along the SFCDAR above Wallace are to be covered with an asphalt, gravel or soil barrier, depending upon location. This action also includes limited removals of contaminated materials within selected railroad sidings in Mullan, and near the Lucky Friday Waste Impoundment. Thirty-two (32) residential areas that are located within or encroaching onto the UPRR ROW are to be sampled as a part of this action; depending upon sample results, any residual contamination adjacent to these homes will be addressed. This action also includes fencing as access control around encroachments onto the ROW by the Hecla Lucky Friday Tailings Pond and the Morning Mine Waste Dump. A channel with wetlands planting is also included to collect identified seeps from the toe of the Morning Mine Waste Dump which discharges to the South Fork through a National Pollutant Discharge and Elimination System (NPDES) outfall (MFG 1999). Implementation of this portion of the UPRR Response Action is also planned for the year 2000/2001 (MFG 2000).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself is entirely within one segment (Figure 1.1-1). A brief description of the Upper South Fork Watershed is presented in this section.

1.1 SEGMENT DESCRIPTION

This segment is the easternmost portion of land studied in the basin. It starts at the headwaters of the South Fork and continues to the confluence with Canyon Creek (Figure 4.1-1). The eastern portion of this segment, containing the headwaters, has limited impacts from mining-related activities. Mining-related impacts to the floodplain and stream banks become increasingly apparent downstream from Larson. Throughout this segment, the Upper South Fork is located adjacent to Interstate 90. Between the Lucky Friday Mining Complex and Wallace, the river has been extensively channelized, resulting in degraded water quality and ecological habitat conditions.

Water quality also declines from the headwaters to Wallace. Above Larson, metals concentrations rarely exceed ambient water quality criteria (AWQC). From Larson down to Wallace, AWQC are regularly exceeded. The effects of degraded habitat and water quality are reflected in the observed fish populations. Trout populations throughout the segment are comparable to those observed in reference streams and other less modified watersheds in the basin. However, densities of sculpin, a species demonstrated to be sensitive to metals contamination and habitat disturbance, are highest in the headwaters and decrease to zero near Wallace, at the confluence of the South Fork with Canyon Creek (Maret 2001).

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Upper South Fork Watershed is one of eight reports contained within Part 2 presenting the remedial investigation (RI) results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on the U.S. Environmental Protection Agency's (EPA) *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (USEPA 1988). This report contains the following sections:

- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology.

- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination, includes a summary of chemical results and estimates of mass loading from source areas
- Section 5–Fate and Transport, includes chemical and physical transport processes for metals
- Section 6–References

Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment, the ecological risk assessment, and the feasibility study (all under separate cover).

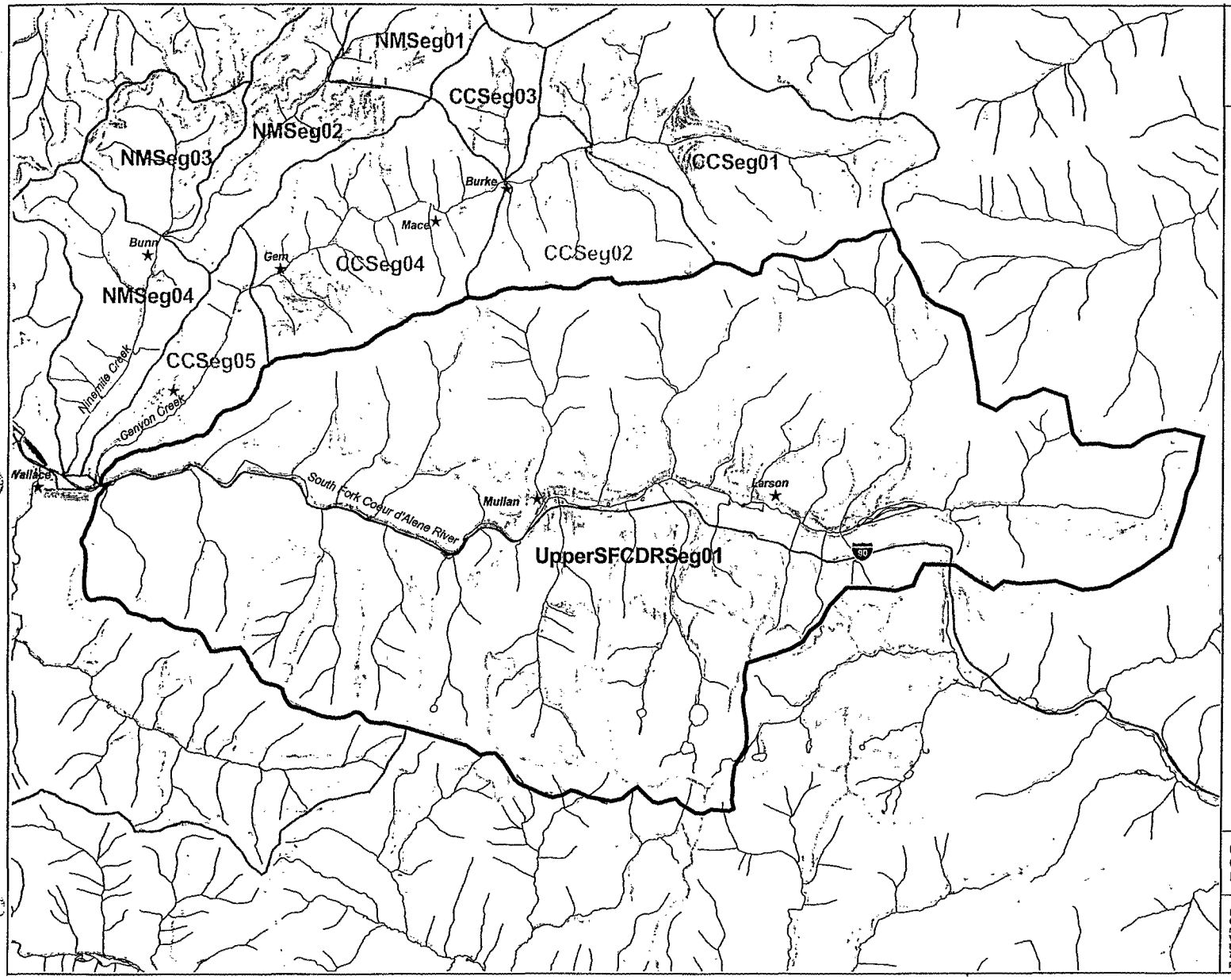

Figure 1.1-1
Upper South Fork Coeur d'Alene River Watershed

LEGEND

- Stream
- Road
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Watershed
- River Segment
- Lake/River

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

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Coeur d'Alene Basin RI/FS
RI/FS REPORT

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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Upper south Fork Watershed are discussed in this section.

2.1.1 Geomorphic Setting

The Upper South Fork Watershed encompasses the headwaters of the South Fork Coeur d'Alene River (South Fork) (Part 1, Figure 1.2-2). The South Fork flows westerly and is the principal drainage of the watershed. Tributaries to the South Fork are roughly north-south-trending, typically 2 to 3 miles in length. The headwaters of the tributaries are typically located at elevations ranging from 5,700 to 6,800 feet. The elevation of the South Fork ranges from 6,000 feet above mean sea level (msl) near Mullan Pass to about 3,000 feet above msl near Wallace (Part 1, Figure 1.2-2). Floodplain development along the South Fork starts east of Larson. Downstream of Larson or westerly, the floodplain widens to about 0.25 mile (Part 1, Figure 3.2-2).

2.1.2 Bedrock Geology

Weakly metamorphosed sedimentary rocks assigned to the Precambrian Belt Supergroup are the dominant rocks within the Upper South Fork Watershed (Part 1, Figure 3.2-2). The Wallace Formation (argillite and quartzite, often carbonate-bearing) and St. Regis Formation (consisting of either argillite, quartzite, or lesser amounts of limestone) are the most prevalent formations in the watershed. Lesser amounts of Revett Formation (quartzite) and Burke Formation (dominantly a quartzite) are also present in the watershed.

Roughly parallel to the South Fork channel is the Osburn Fault. The geologic contact between the Wallace Formation and outcrops of Burke, Revett, and St. Regis Formations is controlled by the Osburn Fault (Part 1, Figure 3.2-2).

2.1.3 Structural Geology

Faults that dominate the structural fabric of the watershed are roughly east-west trending. The Osburn Fault is the principal structure of the watershed (Hobbs et al. 1965). Approximately 16 miles of right-lateral displacement has occurred along this fault. The Osburn Fault is roughly paralleled by the Paymaster Fault to the north; the D-6 Fault about 2 miles to the south; and the

Placer Creek Fault about 3 miles to the south (Part 1, Figure 3.2-2). The Golconda, Friday, Reindeer, National, and Snowstorm faults are the ore-controlling structures for the Golconda, Lucky Friday, Reindeer Queen, National, and Snowstorm Mines, respectively (Part 1, Figure 3.2-3). These ore-controlling faults are all east-west-trending with the exception of the northwest-trending National Fault (Part 1, Figure 3.2-2).

Two distinct patterns of folding (which predates the faulting [Hobbs and Fryklund 1968]) are evident in the watershed. The weakly metamorphosed sedimentary units are folded along north-south fold axes to the north of the Osburn Fault throughout the watershed (Hobbs et al. 1965). To the south of the Osburn Fault, the sedimentary rocks are folded along east-west fold axes throughout the watershed (Hobbs et al. 1965). Folding in the basin is not depicted on the geologic map presented in Part 1, Figure 3.2-2.

2.1.4 Soils

Soils of the Upper South Fork Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay, generally less than 2 feet thick (MFG 1992; Camp Dresser & McKee 1986). Valley soils are found within and along the flanks of the South Fork, particularly in the vicinity of Mullan (Part 1, Figure 3.2-2). The valley soils typically consist of gravel, sand, and silt deposited on valley bottoms; in some areas.

2.1.5 Ore Deposits

The Upper South Fork Watershed drains the following mineral belts: Rex-Snowstorm, Gem-Gold Hunter, Golconda-Lucky Friday, and Moe-Reindeer (Part 1, Figure 3.2-3). Ore deposits in the Upper South Fork Watershed are primarily lead-zinc-silver-copper-gold fissure-vein deposits, which typically occur as steeply dipping veins. In some deposits in this watershed, ore also occurs as replacement deposits along bedding planes. Quartzite of either the Wallace, St. Regis, Burke, or Revett Formations hosts the largest deposits in the watershed.

The principal ore minerals are the sulfides galena, sphalerite, tetrahedrite, and chalcopyrite. Galena is the main ore mineral of lead, and also yields considerable silver. Tetrahedrite also yields considerable silver, along with copper. Chalcopyrite is the principal ore mineral of copper, and sphalerite is the main ore mineral of zinc. Associated non-ore sulfide minerals are pyrite and pyrrhotite, and volumetrically these sulfides are probably routinely less than 2 to 3 percent of the mineralogical content of the orebodies (Ransome and Calkins 1908; Umpleby and Jones 1923).

Non-ore gangue minerals are quartz, siderite (an iron carbonate), barite (in some mines such as the Morning-Star and Gold Hunter), cerrusite (a lead carbonate, abundant in the Morning-Star), and very minor amounts of calcite (calcium carbonate) and magnetite (Ransome and Calkins 1908; Umpleby and Jones 1923). Compared to the mineralogy of ore deposits in other watersheds, the carbonate mineral content of the ore deposits in the Upper South Fork Watershed is relatively high.

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

Mining in the Upper South Fork began in the 1880s. Like the rest of the Coeur d'Alene district, the mines of the Upper South Fork were known mainly for silver, lead, and zinc production. Some copper mines were also located in this area (Quivik 1999).

One of the first and most important mines located in this area was the Gold Hunter. By 1888, the Gold Hunter was extracting sufficient volumes of ore to justify construction of a mill to concentrate its ores. Concentration of the ore consisted of removing low-grade material from the ore, which yielded a product of high-grade material that could be more economically shipped for smelting. Typical of milling operations of its time, the Gold Hunter used gravity separation equipment such as jigs and vanners to remove low-grade waste products from the high-grade ore. Power for many of the early mills was provided by water of the South Fork and its tributaries. These surface waters also provided a convenient disposal method for the tailings that resulted from the concentration process (Quivik 1999).

At the beginning of the twentieth century, the Morning and Gold Hunter mills were the only concentrators operating in the vicinity of Mullan. The Gold Hunter, being upstream of the Morning Mill, received clear water at the mill's intake while it was reported that water received by the Morning Mill was opaque with slimes discharged by the Gold Hunter Mill. As early as 1901, mining companies began to respond to complaints about the discharge of tailings to the river. Although no efforts were made to contain tailings above the confluence with Canyon Creek, mining companies in the Upper South Fork did contribute to the construction and maintenance of tailings impoundments at Osburn and Pine Creek (Quivik 1999).

By 1909, companies were already erecting mills to reprocess tailings deposited in the Upper South Fork. The Northern Idaho Metals Company reportedly impounded an estimated 10,000 tons of tailings in its settling pond during the summer of 1917 at a location midway between Wallace and Mullan. This material contained approximately 5.5 percent lead, 5.5 percent zinc, and 2 oz of silver per ton. In 1917, the company shipped retreated tailings concentrates worth $40,000 (Quivik 1999).

Production records for the Upper South Fork Watershed indicate that an estimated 24 million tons of ore were mined in the area from 1895 to 1990 (Mitchell and Bennett 1983; SAIC 1993). This included an estimated 1.7 million tons of lead, 0.8 million tons of zinc, 0.4 million tons of copper, 5,000 tons of silver and 1.4 tons of gold. Tailings production for the watershed has been estimated at nearly 20 million tons (SAIC 1993). In decreasing order, the largest producing mines were the Morning-Star, Lucky Friday, Gold Hunter, Snowstorm, and National (SAIC 1993).

The following sections provide historical details of the mining history of the Upper South Fork Watershed and information for specific mines and mills that operated within this area.

2.1.6.1 Mines

The mines that operated in the Upper South Fork Watershed for which ore production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity and the segment in which the mine is (or was) located. Only mines with documented ore production are listed.

2.1.6.2 Mills

Table 2.1-2 lists the mills with operations in the Upper South Fork Watershed for which there are available records. This table includes the operating years of the mill and a summary of ownership, and the segment in which the mill is located.

2.1.7 Mine Workings

Underground workings in many mines are very extensive and act as collection and distribution systems for groundwater. Individual mine workings in this watershed are typically located within a single, relatively steep ridge. Recharging water infiltrates at the highest levels of a mountain ridge and discharges on the same ridge. This is referred to as a local flow system,

characterized by short groundwater flow paths (a flow path is the route by which the water enters and exits the groundwater system) (Toth 1963).

Many adits and tunnels in this watershed act as discharge points for groundwater. Typically, adit drainage discharges directly to surface water or first infiltrates waste rock piles before discharging to surface water from seeps. Approximately 153 adits are present in the Upper South Fork Watershed, and 25 of these adits are known to discharge mine drainage (Ridolfi 1999).

2.2 HYDROGEOLOGY

2.2.1 Conceptual Hydrogeologic Model

The Upper South Fork Coeur d'Alene River (Upper South Fork) Watershed is an aggraded, alluvial valley which occupies approximately 50 square miles and is fed by numerous tributary streams (Part 1, Figure 1.2-2). Elevations in the watershed range from 2,700 feet above msl along the South Fork at Wallace to 6,400 feet msl at the headwaters of the South Fork near Mullan Pass and at tributary streams in the eastern portion of the watershed (Part 1, Figure 1.2-2).

The groundwater system consists of unconsolidated sediments overlying less permeable rocks of the Belt Supergroup (Belt). This system occurs primarily in an elongate trough along the South Fork, and varies in shape between V-shaped (e.g., as occurs between Wallace and Mullan) to U-shaped (e.g., as occurs in the vicinity of Mullan). The width of the trough is as narrow as about 200 feet between Wallace and Mullan, and is as wide as approximately 1,200 feet in the vicinity of Mullan.

Faulting and fracturing by natural tectonic processes, and human activity (e.g., see mine workings discussion in Section 2.1.7) have increased the otherwise low permeability in the Belt rocks in some areas. The unconsolidated sediments overlying the Belt rocks are the principal hydrostratigraphic unit in the Upper South Fork Watershed. The conceptual hydrogeologic model for the watershed assumes that a single unconfined aquifer is present in the unconsolidated sediments.

Very little specific hydrogeologic data are available for the Upper South Fork Watershed. Near Wallace, the alluvium consists of "sand and gravel with a considerable percentage (10 to 20 percent) of rounded to subrounded cobbles and boulders"(Norbeck 1974). The alluvium is

approximately 30 feet thick near Wallace (Norbeck 1974). In general, moving eastward up the South Fork, sediments become increasingly coarser-grained with less silt (Norbeck 1974).

Groundwater levels in wells completed in unconfined aquifers west of the Upper South Fork Watershed (e.g., in the Kellogg and Smelterville areas, and in the lower Canyon Creek Watershed) fluctuate seasonally (Part 1, Figure 1.2-2). Levels are generally highest in the spring and lowest during winter and early spring when precipitation rates are lowest and snowmelt is not occurring. (MFG 1992; MFG 1998). It is assumed that similar groundwater fluctuations occur in the unconfined aquifer in the Upper South Fork Watershed.

2.2.2 Aquifer Parameters

Aquifer parameters are not available from the Upper South Fork Watershed for the presumed single unconfined aquifer in the unconsolidated sediments overlying bedrock. However, based on reported lithologic similarities between the presumed single unconfined aquifer and the upper aquifer of the Smelterville Flats-Bunker Hill aquifer system, it is reasonable to expect that aquifer parameters presented in Table 2.2-1 are similar to the presumed single unconfined aquifer of the Upper South Fork Watershed.

The range of horizontal hydraulic conductivities presented in Table 2.2-1 are typical of clean sand and gravels (Freeze and Cherry 1979). Due to the high degree of variability in available aquifer parameter data, site-specific data will be gathered if necessary to support the design of cleanup alternatives.

2.2.3 Flow Rates and Directions

Groundwater flow direction in the unconsolidated valley-fill deposits is assumed to be generally from east to west with minor north and south components near the mouths of tributary watersheds. There is very little groundwater data available for the Upper South Fork Watershed and this assumption is based on topographic consideration and conditions encountered in other watersheds in the basin.

2.2.4 Surface Water/Groundwater Interaction

Previous studies (MFG 1992; Williams 1989) have reported that the South Fork has both gaining reaches (where groundwater flows into the river) and losing reaches (where surface water flows into the single unconfined aquifer east of Kellogg). The prevailing conceptual hydrologic model holds that the distribution of gaining and losing reaches on the South Fork is governed by the

cross-sectional area of the valley-fill deposits. Specifically, where the valley-fill is narrow and/or thin (i.e., constricted valley) net gain to the river from the shallow aquifer is observed; and where the valley fill is wide and/or thick (e.g., at Mullan) net loss from the river to the shallow aquifer is observed. Just as surface (river) water can act as a pathway to the shallow aquifer, this aquifer can recharge surface water at downgradient locations.

It is reasonable to expect that areal limits and net flow rates of gaining and losing reaches on the South Fork will vary from season to season and year to year as a result of variations in recharge-discharge conditions. Currently, mass load measurements are too sparse to indicate potential reaches of gain or loss.

2.2.5 Water Quality and Water Chemistry

Water quality parameters (temperature, pH, specific conductance, salinity, turbidity, and oxidation-reduction [redox] potential) and water chemistry data (e.g., chloride, sulfates, and sulfides) are discussed further in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2.6 Groundwater Use

Groundwater use by humans in the Upper South Fork watershed is extremely limited. The majority of the population living in the Upper South Fork Watershed does not use groundwater as a drinking water source. The municipal water supplier in this area is the East Shoshone County Water District that serves the towns of Mullan and Burke. The source of East Shoshone's municipal water is all surface water. Some individual residences not connected to the municipal water system are likely on private wells. Information on the number and location of private wells is not available. In the Drinking Water sections of Part 2 of the Feasibility Study, the number of private, unregulated water sources in Canyon Creek, Ninemile Creek, and Mullan was estimated to be 178; many of these sources are likely to be surface water. The Feasibility Study estimated that five (3 percent) of the unregulated sources in this area might be private wells requiring abandonment because of exceedences over MCLs. The number of wells potentially requiring abandonment is based on percent exceedences in previous tap water sampling events throughout the entire Basin.

The Human Health Risk Assessment (Terragraphics 2000), evaluated shallow groundwater sampled from monitoring wells near chemical source areas in Ninemile and Canyon Creeks. This shallow groundwater could not be used as a drinking water source because of the high concentrations of metals in the water.

2.3 SURFACE WATER HYDROLOGY

The following sections describe the surface water hydrology of the Upper South Fork. The Upper South Fork Watershed has a drainage area of approximately 50 square miles with approximately 13.3 miles of mapped channel length, and a drainage density of 0.3 miles per square mile.

2.3.1 Available Information

The available hydrologic information for the Upper South Fork includes U.S. Geological Survey (USGS) stream flow data for the Upper South Fork near Mullan, for water year 1999, climatological data for Wallace, ID, and instantaneous discharge data obtained during water quality sampling by a variety of consultants between 1991 and 1999. In addition, historic USGS discharge data is available for several other gages in the area from which historic discharge estimates can be made.

The USGS began reporting stream flow discharge data from Station Number 12413040, South Fork Coeur d'Alene River above Deadmans Creek near Mullan, ID, on October 1, 1998 (USGS 2000). This station records water stage at 15-minute intervals. Discharge is calculated from the stage data based on a rating curve developed for the specific gage. The rating curve is developed through time by measuring discharge at known stages to relate stage to discharge. Once a rating curve is developed, a discharge can be calculated by comparing a known stage to the rating curve. One complete year of discharge data, water year 1999, is available for the South Fork at Mullan at this time. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Wallace, Woodland Park were collected for the same period (WRCC 2000). This precipitation gage is the nearest gage to the Upper South Fork. The mean daily discharge hydrograph and precipitation data are presented in Figure 2.3.1-1. The maximum discharge recorded during water year 1999 was 466 cubic feet per second (cfs), on May 26, 1999. The minimum recorded discharge for this period of record was 9.2 cfs.

In addition to the USGS gage on the Upper South Fork, the USGS has several gages in the area with historical stream flow data, most notably USGS station number 12413140, Placer Creek at Wallace, ID and USGS Station number 12413150, the South Fork at Silverton. The Placer Creek gage has a drainage area of 14.9 square miles and a period of record from November 1967 to September 1995, October 1996 to September 1997, and water year 1999. The South Fork at Silverton has a drainage area of 108 square miles and period of record from November 9, 1967, to September 30, 1988, and water year 1999 (USGS 2000). These data and other estimates of

discharge from other tributaries can be used to estimate historical hydrographs of the Upper South Fork at Wallace.

Stream discharge measurements were taken in association with water quality sampling events completed by McCulley, Frick & Gilman, Inc. (MFG), URS, Idaho Division of Environmental Quality (IDEQ), and USGS. These measurements have occurred since 1991. These data can be used to evaluate the adequacy of the historical hydrographs developed from the Placer Creek data. These data are summarized in Table 2.3.1-1.

In addition to the USGS hydrologic information, the U.S. Department of Housing and Urban Development, Federal Insurance Administration completed a flood insurance study for the City of Wallace, Idaho (FIA 1979). Peak discharges were computed for 10-year (2,190 cfs), 50-year (3,475 cfs), 100-year (4,535 cfs) and 500-year (6,695 cfs) events for the South Fork upstream of the Canyon Creek confluence. Although these values reported might be dated and coefficients used to calculate these discharges may contain some error, they do provide some basis for selecting a design discharge for remedial actions. The bankful discharge, the approximately 1.5 year event, is estimated to be approximately 1,200 cfs.

2.3.2 Hydrologic Description

The hydrology of the Upper South Fork based on water year 1999 stream discharge, precipitation data, and estimates of historical discharge based on other USGS discharge data and estimates of historical discharge are presented in this section. Base flow discharge is estimated at approximately 30 cfs, maximum discharge is estimated at 2,450 cfs; however, it is likely larger discharges have occurred. This estimate is based on historical discharge data and extrapolation of estimates of discharge from nearby watersheds.

2.3.2.1 Historical Description

Continuous discharge data for the downstream end of the Upper South Fork Watershed are not available; therefore, an estimate of mean daily discharge for the Upper South Fork Watershed was developed from historical data from Placer Creek, the South Fork at Silverton, and estimates of historical discharges in Ninemile and Canyon Creek. The Silverton gage is located downstream of the Upper South Fork Watershed. Between Silverton and the Upper South Fork, three major tributaries enter the South Fork: Canyon, Ninemile, and Placer Creeks. Mean daily discharge estimates for Ninemile and Canyon Creek have been made based on Placer Creek data. These estimates are described in other reports. For the available period of record, an estimate of mean daily discharge of the Upper South Fork was obtained by subtracting the measured

discharge from Placer Creek, the estimated discharge from Ninemile and Canyon Creek from the measured discharge at Silverton. This estimate neglects discharge from one other tributary between Silverton and the Upper South Fork, Lake Creek, because gage data are not available. Further, as described in the Canyon and Ninemile Creek reports, the discharge estimates for these two tributaries likely overestimate discharge from these two tributaries from 20 to 45 percent. As such, the estimates for the Upper South Fork are likely underestimated by similar magnitudes. However, these estimates do provide insight to discharges that may be expected in the Upper South Fork Watershed.

The historical estimates of mean daily discharge are presented in Figure 2.3.2-1. The maximum mean daily discharge is estimated at 2,455 cfs and occurred on January 16, 1974. Base flow is estimated to be 30 to 40 cfs. Average annual discharge is estimated at approximately 133 cfs.

2.3.2.2 Flood Frequency

Table 2.3.2-1 presents the estimated discharges for specified flood frequency recurrence intervals for the Upper South Fork. Because historical discharge data are not available for the Upper South Fork, and the estimates of mean daily discharge are already subject to uncertainty, additional manipulation to obtain flood frequency estimates was not completed. Instead, flood frequency developed in the flood insurance study is presented.

2.3.2.3 Water Year 1999

A similar analysis was completed for water year 1999 to estimate mean daily discharge at the Upper South Fork at Wallace as was completed for the historical estimates. The measured discharge at Canyon, Ninemile, and Placer Creeks was subtracted from the measured discharge at Silverton to estimate the mean daily discharge of the Upper South Fork at Wallace for water year 1999. This calculation does not rely on discharge estimates from Ninemile and Canyon as the historic estimates do. These estimates are presented in Figure 2.3.2-2 with the measured precipitation from the Wallace Woodland Park Precipitation gage.

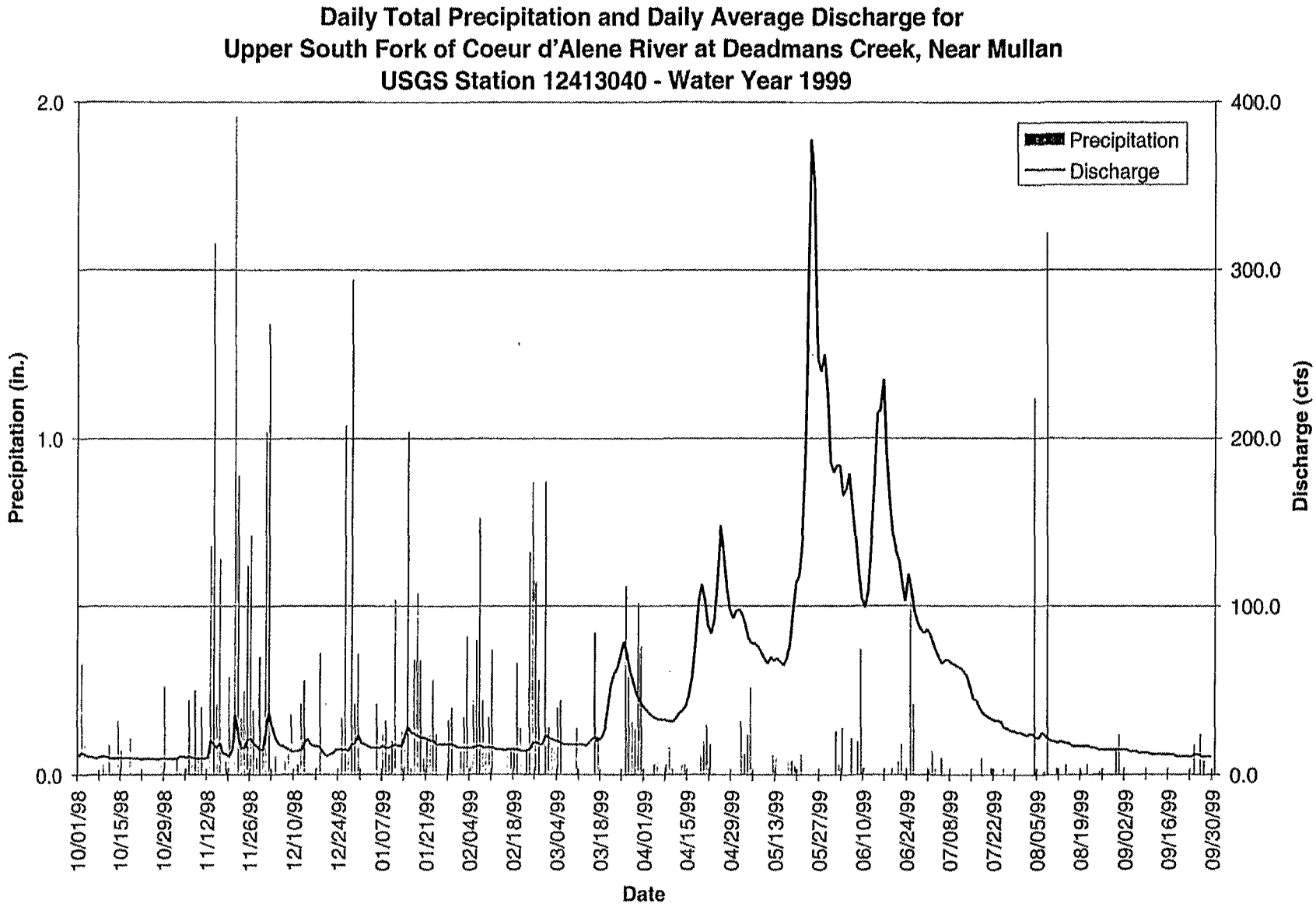
Total annual average precipitation at the WRCC Wallace at Woodland Park Station for the 51-year period of record is 37.7 inches, while for water year 1999 the total precipitation was 39.8 inches (WRCC 2000). Total annual average snowfall for the WRCC station is 83.7 inches while for water year 1999 the total snowfall was 82.2 inches. While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was typical.

The mean monthly flows, for the Upper South Fork at Wallace, the Upper South Fork at Mullan, mean monthly precipitation (rain and snow water content), and total snowfall at the WRCC station at Wallace, Woodland Park are summarized in Table 2.3.2-2. Table 2.3.2-2 and Figures 2.3.1-1 and 2.3.2-2 indicate the majority of precipitation, 83 percent, occurred from October to March. Much of this precipitation was in the form of snow and did not runoff into the channel immediately.

As indicated in Table 2.3.2-2, stream discharges remained relatively low through February 1999. Small increases in discharge are noticeable in response to precipitation events, shown in Figures 2.3.1-1 and 2.3.2-2, through the end of March 1999.

The majority of discharge in the Upper South Fork during water year 1999 was produced during spring and summer. The increase in discharge during the spring and summer is attributed to increased runoff caused by snowmelt. Increased discharges began in late March and continued through July 1999. Maximum daily temperature and mean daily discharge for water year 1999 are presented in Figure 2.3.2-3 for the Upper South Fork at Mullan and Figure 2.3.3-4 for the Upper South Fork at Wallace. In both figures, four periods of increases in maximum temperature correspond very well with the increased discharge, March 20 to April 5, April 17 to May 8, May 23 to June 6, and June 11 to July 3. Increased temperatures over these periods melted much of the snow in the upper basin. Rain on snow also contributed to these increased discharges as indicated in Figures 2.3.2-3 and 2.3.2-4.

In summary, water year 1999 was typical from a total snowfall and total water budget perspective in the Upper South Fork Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the peak discharges.



EPA REGION 10

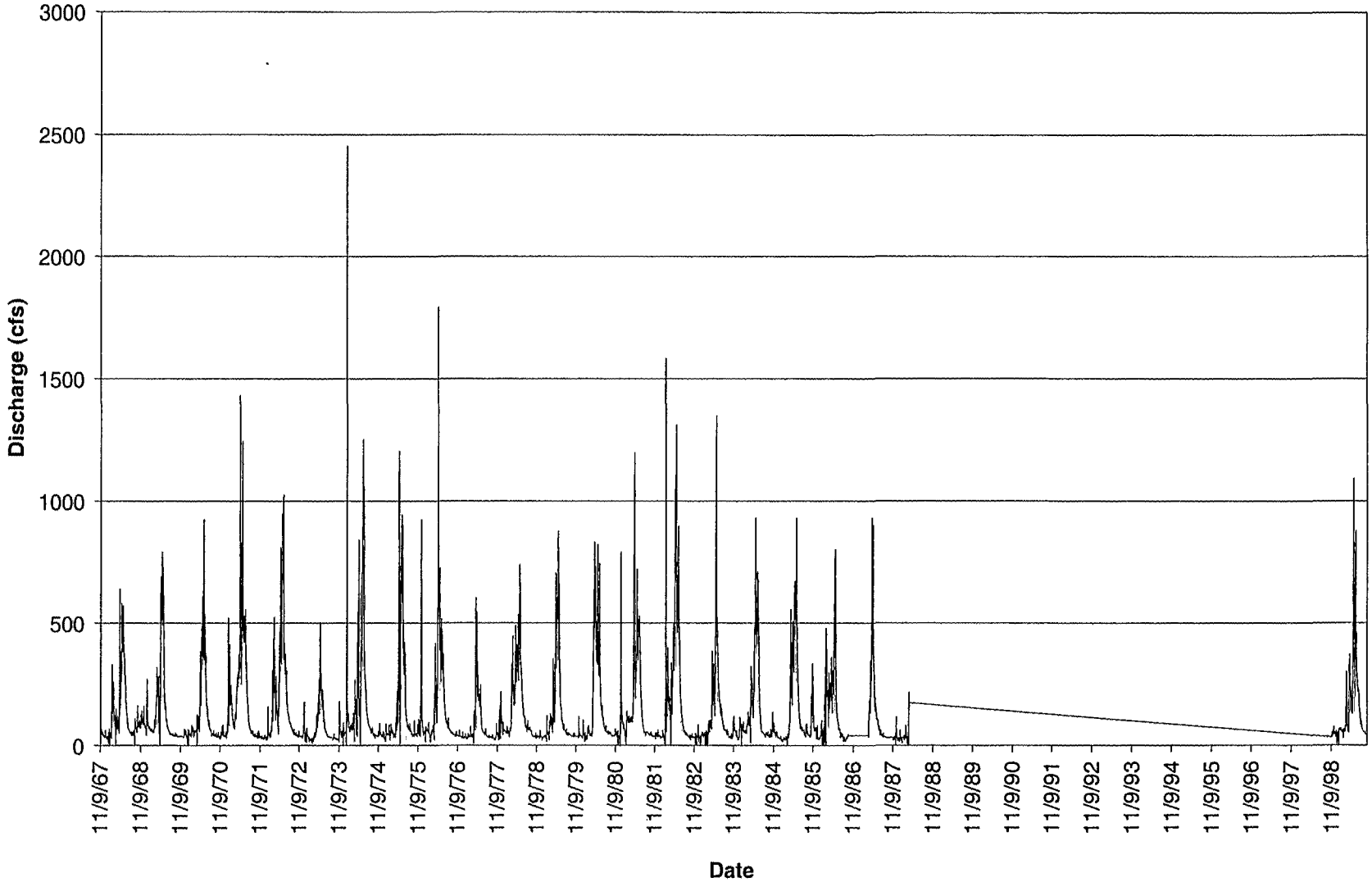
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Upper South Fork Series
7/12/01

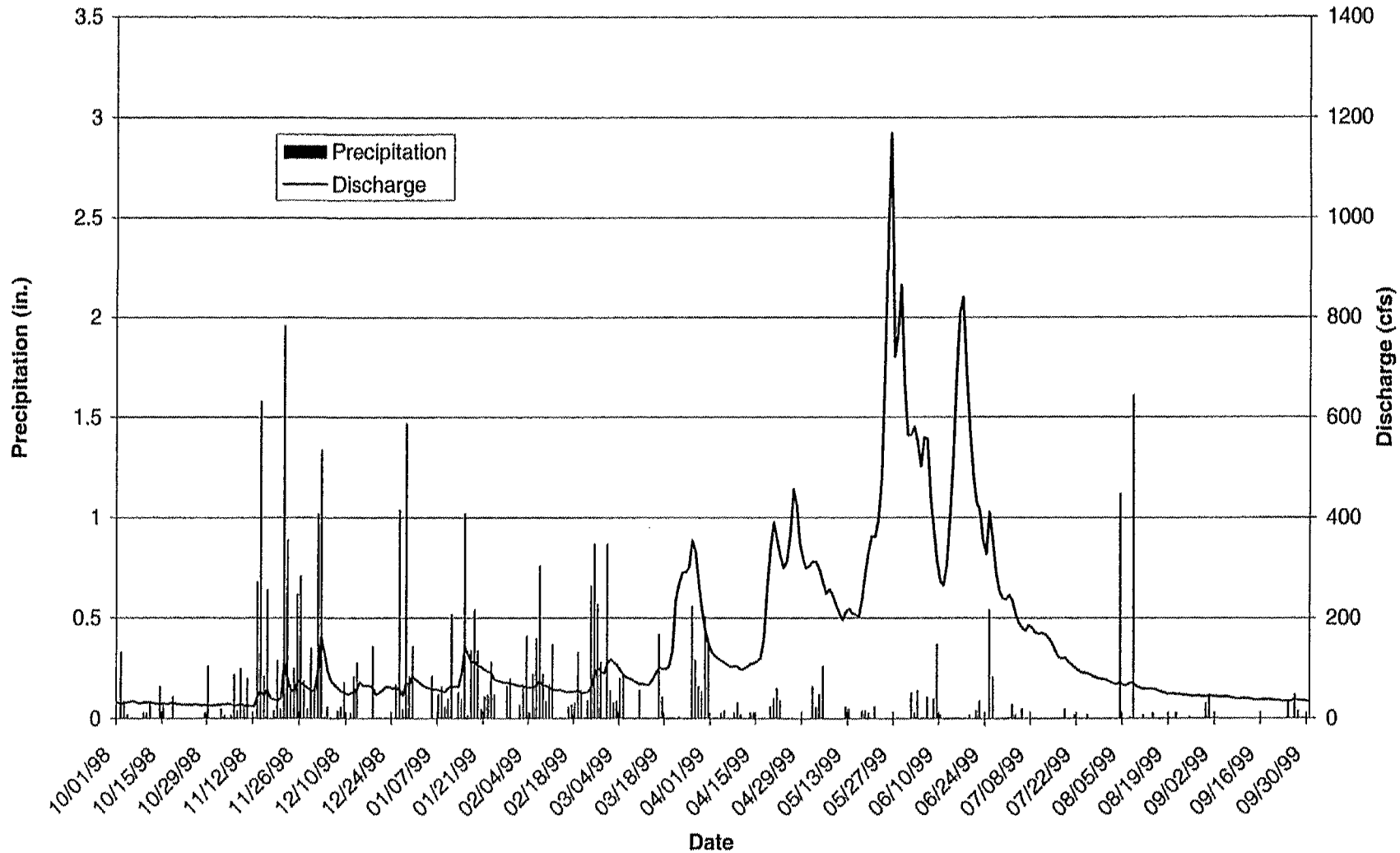
Figure 2.3.1-1

Estimated Historical Mean Daily Discharge for Upper South Fork at Wallace



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 2.3.2-1

Daily Total Precipitation and Estimated Mean Daily Discharge for South Fork at Wallace, Water Year 1999



EPA REGION 10

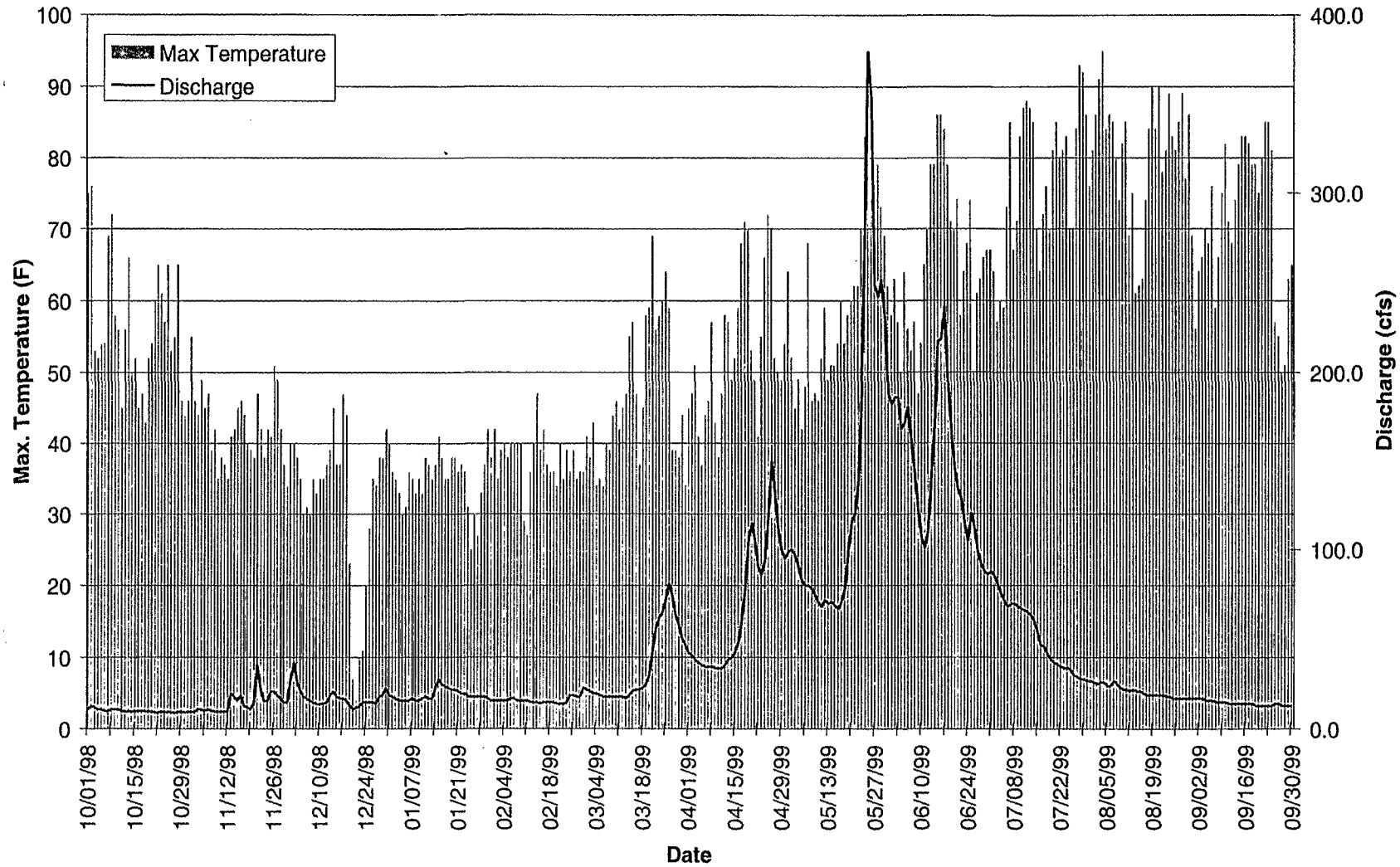
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Upper South Fork Series
7/12/01

Figure 2.3.2-2

Daily Maximum Temperature and Daily Average Discharge for Upper South Fork of Coeur d'Alene River at Deadmans Creek, Near Mullan USGS Station 12413040 - Water Year 1999



EPA REGION 10

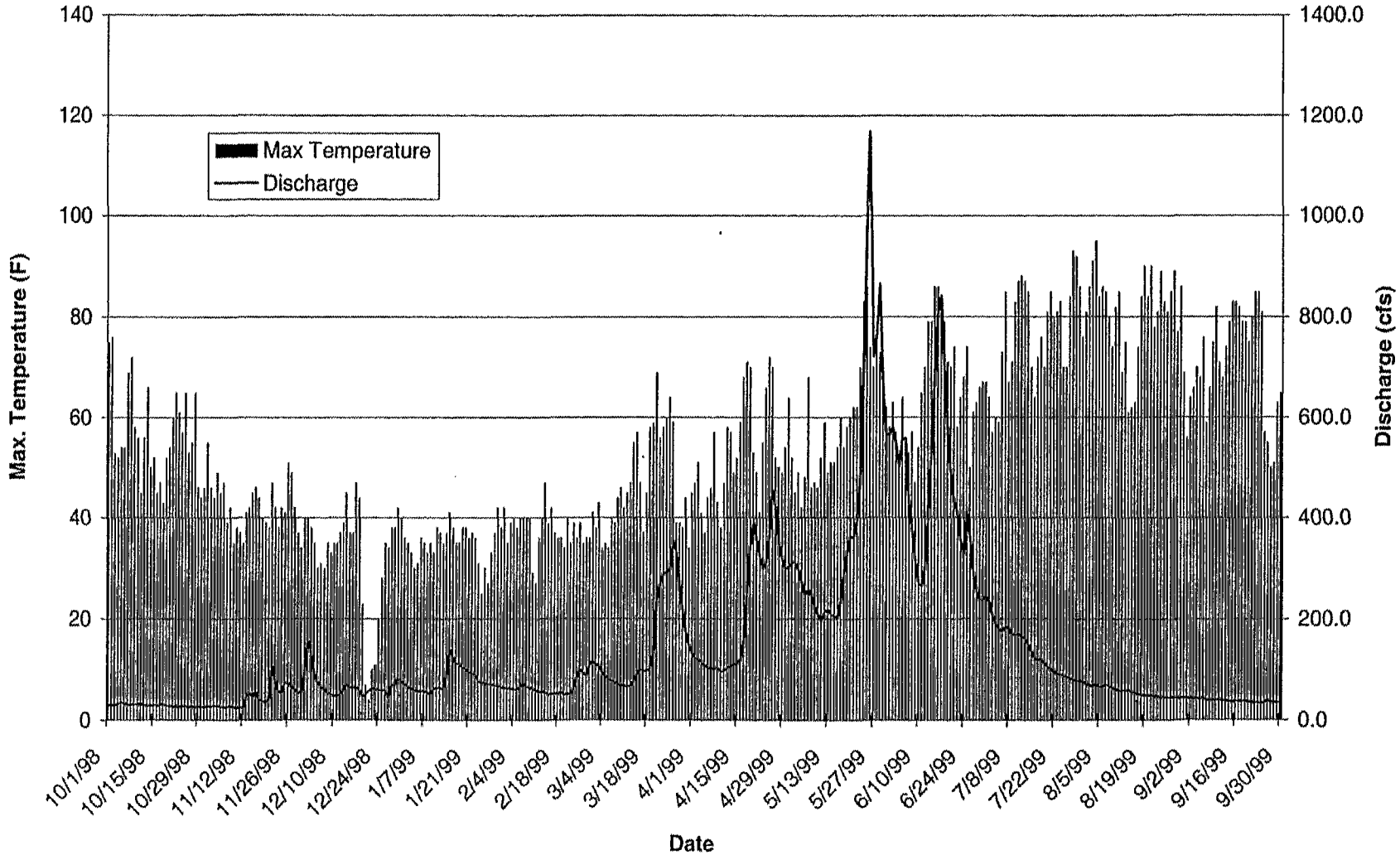
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Upper South Fork Series
7/12/01

Figure 2.3.2-3

Daily Maximum Temperature and Estimated Mean Daily Discharge for Upper South Fork at Wallace, Water Year 1999



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 2.3.2-4

Table 2.1-1
Mines in the Upper South Fork Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Alice					
UpperSFSeg01	1909-1926	49,419	Alice	45,861	The Alice Mine was being operated by about the turn of the century. The mine produced several small shipments of ore about this time. In 1908, the Alice Mining Company reported an important discovery of galena at the mine. A mill was built soon after. Prior to that, the mine shipped several small amounts of ore, some of which was milled at the Mammoth Mill. By 1911, the mine was being operated by leasers. The mine was operated by leasers again in 1915 and then apparently closed (Quivik 1999). Equipment for the mill was purchased from the Formosa Mill, which operated for a short time on Canyon Creek (Quivik 1999).
Atlas (Carbonate Hill)					
UpperSFSeg01	1930-1970	6,936	Gold Hunter	6,351	The claims of the Carbonate Hill Mine (later renamed Atlas Mine) were acquired by the Carbonate Hill Mining Company about 1906. By 1918, the mine consisted of approximately 3,000 feet of workings and had been acquired by the Idaho Carbonate Hill Consolidated Mining Company. The Atlas Mining Company acquired the property in 1924. The Hecla Mining Company acquired a 5-year option on the property in 1940, and the Zanetti Brothers also produced ore from the Bird vein during WWII. In 1951, Hecla acquired another option on the property, in association with Newmont Mining Company and the New Jersey Zinc Company. Newmont surrendered its option in 1953 and Hecla and New Jersey Zinc surrendered their options in December 1954 (IGS 1999).
Butte & Coeur d'Alene (Idaho Silver)					
UpperSFSeg01	1926	35		NA	Small producer

Table 2.1-1 (Continued)
Mines in the Upper South Fork Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Golconda					
UpperSFSeg01	1926-1967	339,228	Golconda	274,299	The Golconda Lead Mines Company was incorporated in January 1927. The company consolidated the properties of the Hector Mining Company and the Mayflower Mining & Development Company. Prior to construction of the Golconda Mill, ore for concentration were processed at the Hercules custom mill. The mine was closed in March of 1930 due to low metals prices. The mine was reopened sometime during the 1930s and continued to produce ore until its closure in 1945 (Quivik 1999).
Gold Hunter					
UpperSFSeg01	1901-1954	3,260,750	Gold Hunter	3,065,496	The Gold Hunter was one of the first mines in the Coeur d'Alene mining district. The mine was a regular producer during most of the 1890s. Ore from the mine was shipped to the mill by an aerial tramway. About 1900, the mine was producing about 150 tons of ore per day. During the 1920s, the mine was leased to others. The mine was closed in April 1949 (Quivik 1999).
Lucky Friday					
UpperSFSeg01	1938-1990	5,674,668	Lucky Friday, Golconda	4,485,010	J.F. Ingalls and others staked the original claims of the Lucky Friday Mine about 1900. The mine was operated by the Lucky Friday Mines Company from 1906 to 1912 and by the Lucky Friday Mining Company from 1914 to 1926. The mine did not show much promise until 1938, when the mine was leased by John Sekulic. Sekulic organized the Lucky Friday Silver-Lead Mines Company and was able to generate sufficient financial backing for an ambitious development plan. An important discovery of lead-silver ore was made and within three years the mine was paying a dividend. In 1958, Hecla acquired a portion of the Lucky Friday Mine. In 1961, the mine was reported to have reached a depth of 5,000 feet. It continues to operate during the present day (Quivik 1999).

Table 2.1-1 (Continued)
Mines in the Upper South Fork Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Morning					
UpperSFSeg01	1895-1952	14,136,333	Morning	11,163,230	The Morning Mine was located some time before 1887. Charles Hussey purchased the mine from its original locators during that year. In November 1891, the Morning Mining Company was formed to acquire the Morning Mine and mill. Due to financial difficulties resulting from Hussey's ownership of the mine, stockholders of the Morning Mining Company reorganized the company as the Morning Mining & Milling Company. The mine and mill were being leased by Thomas Greenough and Peter Larson by late 1895. By about the mid-1890s, the mine had become one of the most important producers of the Coeur d'Alenes. In 1897, Greenough and Larson purchased the mine, mill and associated properties. By this time, the mine was producing about 500 tons of ore per day. In 1905, the mine and mill were sold to the Federal Mining & Smelting Company. In 1917, production at the mine had reached a rate of 1500 tons per day, some of which had to be treated at the Mammoth Mill. Later mine output was returned to 1,000 tons per day when the Star Mining Company brought suit against Federal for operating in Star ground. The mine experienced periods of reduced activity during the 1930s due to the Great Depression. By the late 1930s, production had returned to pre-Depression levels. The Federal Mining & Milling Company merged with ASARCO in 1953. The Morning Mine was closed during October of that year.

Table 2.1-1 (Continued)
Mines in the Upper South Fork Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
National					
UpperSFSeg01	1914-1922	170,008	National	164,316	An important discovery of copper ore was made a the National Mine (also referred to as the National Copper Mine) in 1913. The discovery was significant enough to justify the construction of a 500-ton flotation plant. In 1918, the National property was the most important producer of copper in Shoshone County. Production at the mine between 1915 and 1918 netted a profit of $59,080. The mine and mill were also operated for several months in 1919. In 1923, the Independent Copper Mining & Milling Company and its successor the Consolidated Independent Calumet Mining Company did some prospecting at the mine. This arrangement continued until 1931 (IGS 1999).
Reindeer Queen					
UpperSFSeg01	1910-1916	147		116	The Reindeer and Copper Queen mines were consolidated in 1913, thus forming the Reindeer Queen Mining Company. Both mines had been extensively developed by as early as 1909. By 1915, the mine consisted of approximately 7,000 feet of workings. Production records indicate that the mine made shipments of copper ore in 1910 and 1916. The mine went idle for the next several years until development work resumed in 1924. After 1928, the company did only assessment work for the next several years and then remained idle thereafter. In the early 1980s, the Anaconda Minerals Co. undertook a deep "wildcat" exploration of the area. Anaconda drilled a 3,500-foot-deep hole at the Reindeer Queen in 1984. This project was later terminated by Anaconda's parent company ARCO (IGS 1999).

Table 2.1-1 (Continued)
Mines in the Upper South Fork Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Snowstorm					
UpperSFSeg01	1904-1943	826,580	Snowstorm	706,612	The Snowstorm Mine was producing by 1901. During that year, the mine became the first in the Coeur d'Alenes to ship copper. The ore was shipped to the Tacoma smelter. During the winter of 1904/1905, the mine was shipping as much as 160 tons of first class copper ore per day. J.H. Howard & Company was leasing the upper workings of the mine at this time. Thomas Greenough, one of the owners of the Morning Mining Company, purchased the Snowstorm in mid 1905. J.H. Howard & Company continued to lease the upper workings of the mine while Greenough concentrated on developing the lower workings. The mine produced as much as 500 tons per day of smelting ore in 1909. The mine was closed in 1917 (Quivik 1999).
UpperSFCDRSeg01					
Vindicator	1922-1938	28		NA	Small producer

Notes: Blank cells indicate that there was most likely no mill located on site, and ores were probably shipped elsewhere for milling. No records were found identifying the mill to which the ores were shipped. Estimated tailings produced by each mine were not necessarily disposed of within the reach where the ores were mined.

Source: Stratus 1999, unless otherwise noted.

Table 2.1-2
Mills With Documented Operations in the Upper South Fork Watershed

Segment	Operating Years	Ownership	Comments
Alice			
UpperSFCDRSeg01	1909-1913	Alice Mining Company	The Alice Mining Company reported a rich strike of galena at the Alice Mine in 1908. Prior to that, the mine shipped several small amounts of ore, some of which was milled at the Mammoth Mill. With the 1908 galena strike, the company decided to construct a mill. Equipment for the mill was purchased from the Formosa Mill, which operated for a short time on Canyon Creek. The mill was operating by late 1909 and was closed by July 1910. The mill ran briefly for a period between 1912 and 1913 and was then apparently closed (Quivik 1999).
Golconda			
UpperSFCDRSeg01	1928-1959	Golconda Lead Mines Company	The Golconda Mill was built in 1928 by the newly incorporated Golconda Lead Mines Company. The mill was located on the north bank of the South Fork, below the mouth of Trowbridge Gulch. The mill used selective flotation to treat up to 200 tons of ore per day. Prior to the mills' construction, mine ores had been treated at the Hercules custom mill. In 1929 the mill treated 65,600 tons of ore. Zinc concentrates from the mill were sent to the Anaconda smelter and lead concentrates were sent to East Helena. The mill and mine were closed in March of 1930 due to falling metals prices caused by the Great Depression. The mill apparently reopened during the 1930s and began to serve as a custom mill treating tailings and dump material from the Interstate-Callahan and Amazon-Manhattan properties as well as tailings from Canyon Creek. The mill also continued to treat ore of the Golconda Mine. The capacity of the mill had been increased to 250 tons per day about this time. During the 1940s, the mill was used to treat ore from the Sunshine, Sunset, Lucky Friday and several other mines as well as ore from the Golconda. After closure of the Golconda Mine in 1945, the mill continued to treat ores of other mines and tailings until it was closed in 1959, after construction of the Lucky Friday Mill (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in the Upper South Fork Watershed

Segment	Operating Years	Ownership	Comments
Gold Hunter			
UpperSFCDRSeg01	1889-1949	Gold Hunter Company	Construction of the original Gold Hunter Mill was begun in the fall of 1888. The mill was located at the mouth of Hunter Gulch, about a half mile upstream of Mullan. The mill was designed for a capacity of 150 tons per day. Operation of the mill began the following spring. Ore was shipped to the mill via an aerial tramway from the mine. The mill was destroyed by fire during the summer of 1897. Construction of a new mill was begun late in 1899. The mill began operation in the spring of 1900. At that time, the mill capacity was 300 tons per day, although the mill typically operated at a rate of about 150 tons per day. By 1912, the capacity of the mill had been increased to 400 tons per day. In 1914, the Gold Hunter Company began experimenting with flotation processes at the mill. A Callow flotation plant was installed during November of that year. During the mid 1920s a tailings impoundment was constructed to settle coarse tailings from the mill waste. Finer slimes continued to be dumped in the river. Also about this time, the mill capacity was increased to 500 tons per day. In addition to treating Gold Hunter ore, the mill was also being used for reprocessing of historical tailings waste. The mill was used to treat ore of the Atlas mine beginning in 1930. Later the mill was inactive for some time before it was reopened by lessees in 1935. The mill continued to be operated by lessees through most of the 1940s. The mill was finally closed in October 1949 (Quivik 1999).
Lucky Friday			
UpperSFCDRSeg01	1960-present day	Lucky Friday Silver-Lead Mines Company	The Lucky Friday Mill was built near the portal of the Lucky Friday Mine in 1959. The 350-ton per day mill was operating by February 1960, and capacity was quickly expanded to 700 tons per day. The mill was designed with both lead and zinc circuits, resulting in a cleaner lead concentrate. The mill was reported to be operational in 1999 (Quivik, 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in the Upper South Fork Watershed

Segment	Operating Years	Ownership	Comments
UpperSFCDRSeg01	1914-1920	National Copper Mining Company	The National Copper Mining Company began construction of a 500-ton mill at the mouth of Deadman Gulch in 1913. Construction of the mill was spurred by an important discovery of copper ore made in the mine. The new mill began operation in April 1914. The mill is said to have been the first copper concentrator to use the Callow pneumatic flotation process. The mill was closed after two months of operation due to a lack of processing ore from the mine. It was reopened in 1915 and operated intermittently until being closed in April 1920. The mill was disassembled soon after (Quivik 1999).
Morning			
UpperSFCDRSeg01	Approxi-mately 1889-1891 1891-1956	Charles Hussey, Morning Mining Company, Federal Mining & Smelting Company, ASARCO	Charles Hussey began construction of the original Morning Mill in 1889. The mill was fed ore by an aerial tramway from the mine and water was supplied by the South Fork via a flume. The mine and mill were acquired by the newly formed Morning Mining Company in November 1891. The Morning Mining Company built a new mill downstream of Hussey's mill in an area that was apparently better situated. The new mill did not operate on a regular basis until about 1895. The mill was leased to the Longmaids and later to Thomas Greenough and Peter Larson, who later purchased the mine and mill in 1897. About this time, the mill was shipping about 2,500 tons of concentrates per month and treating about 500 tons of ore per day. The mill was destroyed by fire in 1898. A new mill with a capacity of 700 tons per day was operating by August of the same year. By 1905, when the mine and mill were purchased by the Federal Mining & Smelting Company, mill capacity had been increased to 1,000 tons per day. The mill became one of the first in the Coeur d'Alenes to experiment with flotation. The mill continued to operate at a rate of 1,000 tons per day until 1921. By 1924, all concentration was being done by selective flotation. Capacity of the mill was 1,200 tons per day. The mill experienced reduced operation during the Great Depression. During WW II the mill was also used to process ore of the Frisco Mine.

Table 2.1-2 (Continued)
Mills With Documented Operations in the Upper South Fork Watershed

Segment	Operating Years	Ownership	Comments
UpperSFCDRSeg01 (Continued)	Approximately 1889-1891 1891-1956	Charles Hussey, Morning Mining Company, Federal Mining & Smelting Company, ASARCO	Operations slowly reduced through the remainder of the 1940s and early 1950s. The mill was apparently closed by ASARCO shortly after the closure of the Frisco Mine in 1956. The mill burned in 1957 and was later dismantled in 1960 (Quivik 1999). The mill was never rebuilt and the Morning Property was leased to Hecla in 1962 (Bull 1999).
Snowstorm			
UpperSFCDRSeg01	1905-1907 1912-1917	J.H. Howard & Company	This first mill associated with the Snowstorm Mine was built about 1904 by J.H. Howard & Company, which was leasing the upper workings of the mine at this time. The leaching plant began operation in 1905 but did not begin operating on a regular basis until 1907. Capacity of the leaching plant was 200 tons per day. It was closed later the same year due to an accident and falling copper prices. In 1912, a new 100-ton mill began to treat ore using conventional gravity concentration. The mill capacity was increased to 200 tons per day later in the same year. The mill operated at full capacity through 1913 and for the first nine months of 1914. The mill operated for a short time in 1917 before it was ultimately closed (Quivik 1999).
Northern Idaho Metals Tailings Retreating			
UpperSFCDRSeg01	1917-unknown	Northern Idaho Metals Company	In the late 1910s, C.L. Hewitt managed the Northern Idaho Metals Company which had a tailings re-treating operation on the South Fork roughly midway between Mullan and Wallace. The Northern Idaho Metals Company established a settling pond near it plant, and in the summer 1917, impounded about 10,000 tons of tailings from the river. The material collected assayed about 5.5 percent lead, 5.5 percent zinc, and 2 oz. silver per ton. The Northern Idaho Metals Company had a flotation plant capable of treating about 90 tons of tailings per day, producing both a lead concentrate and a lead-zinc concentrate. In 1917, Northern Idaho Metals shipped concentrates worth $40,000. It is not known how long its tailings re-treating plant operated (Quivik 1999).

Table 2.2-1
Summary of Aquifer Parameters of the Smelterville Flats-Bunker Hill Upper Aquifer

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Vertical Hydraulic Conductivity (ft/day)	Transmissivity 2 (ft/day)	Storativity (unitless)	Effective Porosity
Upper Aquifer	500 - 10,790	0.0025[a]	10,002-216,852	0.0015-0.09	23.6-29.0

[a]Based on one test conducted on a sample of upper aquifer alluvium from borehole GR-26U at 13.5 feet below ground surface. No units given in original source document.

Source: MFG (1992)

Table 2.3.1-1
Summary of Discharge Data From Project Database
Segment UpperSFCDRSeg01

Segment Name	Site Location	Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
UpperSFCDRSeg01	SF 10	MFG	1	10/03/91	10/03/91	24.1	24.1	cfs
UpperSFCDRSeg01	SF 201	URS	2	11/11/97	05/09/98	6.11	7.14	cfs
UpperSFCDRSeg01	SF 202	URS, USGS	3	11/11/97	05/22/99	6.41	66.8	cfs
UpperSFCDRSeg01	SF 203	URS	2	11/10/97	05/05/98	0	0	cfs
UpperSFCDRSeg01	SF 204	URS	2	11/10/97	05/09/98	0.533	6.51	cfs
UpperSFCDRSeg01	SF 205	IDEQ, MFG, URS, USGS	48	05/16/91	05/22/99	1.36	146	cfs
UpperSFCDRSeg01	SF 206	URS	2	11/10/97	05/08/98	1.09	4.33	cfs
UpperSFCDRSeg01	SF 207	URS	2	11/10/97	05/08/98	0.936	7.3	cfs
UpperSFCDRSeg01	SF 208	MFG, URS, USGS	19	05/16/91	08/31/99	5	366	cfs
UpperSFCDRSeg01	SF 209	URS	2	11/10/97	05/08/98	1.25	27.2	cfs
UpperSFCDRSeg01	SF 210	URS	2	11/10/97	05/08/98	7.34	80.7	cfs
UpperSFCDRSeg01	SF 211	URS	2	11/09/97	05/08/98	0.134	0.914	cfs
UpperSFCDRSeg01	SF 212	URS	2	11/09/97	05/08/98	0.337	22.9	cfs
UpperSFCDRSeg01	SF 213	URS	2	11/10/97	05/08/98	0.0152	0.027	cfs
UpperSFCDRSeg01	SF 214	URS	2	11/09/97	05/11/98	4.98	81	cfs
UpperSFCDRSeg01	SF 215	MFG, URS	4	05/15/91	05/10/98	17.8	428	cfs
UpperSFCDRSeg01	SF 216	URS	1	11/09/97	11/09/97	2.24	2.24	cfs
UpperSFCDRSeg01	SF 217	URS	2	11/09/97	05/08/98	0	0	cfs
UpperSFCDRSeg01	SF 218	URS	2	11/09/97	05/08/98	0.14	0.401	cfs
UpperSFCDRSeg01	SF 219	URS	2	11/08/97	05/06/98	0.285	0.4	cfs
UpperSFCDRSeg01	SF 220	IDEQ, MFG, URS, USGS	48	05/15/91	05/10/98	16.45	432	cfs
UpperSFCDRSeg01	SF 221	URS	2	11/08/97	05/06/98	2.81	46.8	cfs
UpperSFCDRSeg01	SF 222	URS	2	11/08/97	05/06/98	1.55	30.6	cfs
UpperSFCDRSeg01	SF 223	URS	2	11/08/97	05/06/98	1.47	7.89	cfs
UpperSFCDRSeg01	SF 224	URS	2	11/08/97	05/06/98	0.204	3	cfs
UpperSFCDRSeg01	SF 225	URS	2	11/07/97	05/05/98	1.29	41.4	cfs
UpperSFCDRSeg01	SF 226	URS	2	11/07/97	05/05/98	1	1.2	cfs
UpperSFCDRSeg01	SF 227	MFG, URS, USGS	5	05/15/91	05/24/99	26.6	466	cfs
UpperSFCDRSeg01	SF 228	IDEQ, MFG, URS, USGS	60	05/16/91	12/31/99	22.25	859	cfs
UpperSFCDRSeg01	SF 229	URS	2	11/07/97	05/05/98	0.477	0.6	cfs
UpperSFCDRSeg01	SF 230	URS	2	11/06/97	05/05/98	0.497	12.3	cfs
UpperSFCDRSeg01	SF 231	URS	1	11/06/97	11/06/97	0.067	0.067	cfs
UpperSFCDRSeg01	SF 275	URS	1	05/07/98	05/07/98	8.01	8.01	cfs
UpperSFCDRSeg01	SF 316	URS	1	05/08/98	05/08/98	0.0068	0.0068	cfs
UpperSFCDRSeg01	SF 317	URS	1	05/07/98	05/07/98	0.141	0.141	cfs
UpperSFCDRSeg01	SF 318	URS	1	05/07/98	05/07/98	8.88	8.88	cfs
UpperSFCDRSeg01	SF 319	URS	1	05/07/98	05/07/98	3.9	3.9	cfs
UpperSFCDRSeg01	SF 320	URS	1	05/07/98	05/07/98	0.00675	0.00675	cfs
UpperSFCDRSeg01	SF 321	URS	1	05/07/98	05/07/98	2.42	2.42	cfs
UpperSFCDRSeg01	SF 650	USGS	1	05/24/99	05/24/99	466	466	cfs

Table 2.3.2-1
Estimated Recurrence Intervals, Upper South Fork

Recurrence Interval (Years)	Flood Insurance Study Above Canyon Creek Estimated Peak Flow (cfs)
10	2,190
50	3,475
100	4,535
500	6,695

Note:
cfs - cubic feet per second

Table 2.3.2-2
Precipitation Summary and Discharge Comparison for Water Year 1999,
Wallace Woodland Park, Idaho
NOAA Cooperative Station 109498

Climate Indicators	Monthly Totals												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Precipitaiton (in.)	1.2	9.7	6.9	4.7	6.9	3.5	0.7	0.9	1.8	0.2	3.0	0.3	39.8
Total Snowfall (in.)	0.0	6.3	8.7	18.9	26.4	21.3	0.6	0.0	0.0	0.0	0.0	0.0	82.2
Average Precipitation for Period of Record (in.)	2.9	4.9	5.2	5.0	3.9	3.4	2.8	2.7	2.6	1.3	1.4	1.9	37.7
Average Snowfall for Period of Record (in.)	0.5	8.3	22.6	24.0	15.0	10.5	2.5	0.3	0.0	0.0	0.0	0.0	83.7
Mean Monthly Discharge (cfs) (Upper South Fork Near Mullan)	10.1	14.7	17.6	18.9	16.1	34.9	68.4	137.4	146.5	51.7	20.8	14.3	45.9
Estimated Mean Monthly Discharge (cfs) (Upper South Fork at Wallace)	29.3	45.4	68.5	78.6	65.5	151.1	213.7	412.7	453.5	137.5	55.9	38.3	145.8

Note:
cfs - cubic feet per second

3.0 SEDIMENT TRANSPORT PROCESSES

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movements incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing provides exposed soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. For purposes of this report, sediment yield will be referred to in units of tons per square mile per year. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bed load. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bed load consists of larger and heavier particles that move downstream by rolling sliding or hopping on the channel bed (Dunne and Leopold 1978).

All sediment motion downstream is dictated by the shear and gravitational forces acting at a given time and place within the channel. For sediment transport purposes, gravitational forces are essentially constant. Shear forces, however are dynamic through space and time and are dependent upon the location, depth of water, and slope of the water surface. Sediment transport occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et. al 1992).

Sediment derived in the Upper South Fork of the Coeur d'Alene River is transported through the system and into the South Fork. Sediment sources in the Upper South Fork are mining waste, rock debris situated adjacent to channels, mobilization of channel bed sediment, bank erosion, and sediment derived from road drainage. In this discussion, the available information, analyses, and likely sediment sources are identified.

3.1 AVAILABLE INFORMATION

Sediment transport data are not available for the Upper South Fork. One year of sediment transport gaging data is available for Canyon and Ninemile Creeks, drainages of similar size that are located near the Upper South Fork. In addition, the Upper South Fork has similar topography and land use practices as Canyon and Ninemile Creeks. Therefore, the sediment data from Canyon and Ninemile Creeks may be used to provide useful insight into the likely magnitude of sediment transport from the Upper South Fork.

In addition to the sediment gaging data for Canyon and Ninemile Creeks, historical and current aerial photographs are available. For the Upper South Fork, 1998 photographs by URS Greiner, Inc. (URSG and CH2M HILL 1999), 1991 photographs by U.S. Department of Agriculture (USDA) (USDA 1991), and 1984 photographs by USDA (USDA 1984) were reviewed.

3.2 ANALYSES

3.2.1 USGS Sediment Gaging Data

Because no sediment transport data were collected for the Upper South Fork, estimates of sediment transport for 1999 were made using the sediment transport analysis from Canyon and Ninemile Creeks. The USGS sediment transport data for Canyon and Ninemile Creeks were analyzed in general accordance with the Army Corps of Engineers Engineering Manual EM 1110-2-4000. These analyses are presented in the Canyon and Ninemile reports.

These analyses produced annual sediment yields for Canyon and Ninemile Creeks for three size classes of particles, fines, sand, and bedload, expressed as tons per square mile of drainage area. As land use in these watersheds is similar to the land use in the Upper South Fork, these sediment yields were used to estimate sediment yield in the Upper South Fork. The sediment yield per drainage area was averaged for each size class and applied to the Upper South Fork to estimate an annual sediment yield. The results are presented in Table 3.2-1.

This simplistic analysis only provides guidance to approximate quantities of sediment transported by the Upper South Fork in water year 1999 based on the watershed size and estimates of sediment transport from watersheds with similar land use. Sediment yields can vary significantly from year to year and basin to basin based on hydrologic conditions, sediment inputs, changing land use, and other conditions. There have been remedial actions in both

Canyon and Ninemile Creeks that may alter sediment transport. The sediment yields developed after the Upper South Fork watershed should be considered as very general estimates.

3.2.2 Channel Classification

Channel classifications may provide a level of understanding and description of a channel's behavior. Some channel classification systems require fieldwork and in depth study while others only require topographic map and aerial photograph interpretation. The level of information provided by a classification based solely on topographic map and aerial photograph interpretation is limited but does provide a basic framework for channel processes and conditions. Channel classifications, slopes, and profiles are shown in Figure 3.2-1 through 3.2-3.

Rosgen (Rosgen and Silvey 1996) proposed a classification that delineates channel types based on plan-view morphology, cross-section morphology, channel sinuosity, channel slope, and bed features to provide a broad level delineation. Aerial photograph and topographic map interpretation can be used for this type of classification, Level 1. The Rosgen methodology builds from this broad classification when combined with more detailed information. The Rosgen Level 1 classification was used for this study to identify broad reach-level channel morphologies.

Additional information on stream channel classifications available from the Idaho Division of Environmental Quality's Beneficial Use Reconnaissance Project (IDEQ/BURP) was also reviewed. IDEQ/BURP information is based on field surveys and offer greater resolution, for the limited areas surveyed, than available topographic maps and aerial photographs. IDEQ/BURP channel classifications are shown in Figure 3.2-1.

Electronic USGS 7 ½ minute quadrangle maps containing three-dimensional topographic data were analyzed using AutoCAD Land development software. Plots of channel profile and slope were produced for the Upper South Fork Watershed (Figure 3.2-3). In general, the divisions between segments were established based on changes in channel type or other morphologic feature, as such, each segment contains one or two channel types. However, the Upper South Fork watershed was only divided into one segment, as a result the Upper South Fork contains several channel types. The channel type was determined based on channel slope and observation of aerial photographs from 1998.

Channel stationing was established from the confluence of the Upper South Fork with Canyon Creek as 100-foot stations upstream from the confluence for ease of locating specific features. This stationing is indicated on Figures 3.2-1 through 3.2-3. This stationing is approximate and is

intended for general locating of discussed areas, more detailed stationing and survey should be used for precise locating, and project construction.

In the Upper South Fork Watershed, four Rosgen stream types occur, "Aa+", "A", "B", and "C". The following paragraphs briefly summarize these four types of channel and the mapping effort of channel classification.

"Aa+" streams are very steep, greater than 10 percent, well entrenched, and laterally confined. Sediment supply is often high due to the high energy, steep channel slopes and narrow channel cross sections. Bedforms associated with this channel type include waterfalls, cascades, and step-pools. Debris flows often initiate in "Aa+" type channels. Structural control from joints, faults, or bedding may influence the locations of "Aa+" type channels.

"A" stream types are similar to "Aa+" in that similar bedforms and channel characteristics are common to both types; however, "A" stream types have slopes which range from 4 to 10 percent. Generally, "A" stream types have high sediment transport potential with little in channel sediment storage capacity due to the channel slope. Large woody debris can play a major role in the bedform and channel stability in "A" type streams.

"B" stream types are moderately steep to gently sloped channels, 2 to 4 percent. Faults, joints, contacts often influence "B" type channels by restricting the development of wide floodplains. Stream erosion rates, aggregation and degradation rates are generally low. Lateral movement of "B" type channels is typically low. Rapids and scour pools are typical bed forms in type "B" channels.

"C" stream types generally are located in valleys constructed from alluvial deposition, with well-developed floodplains with slopes generally less than 2 percent. Primary morphologic features of the "C" stream type are the sinuous low relief channel, and the well-developed floodplain built of sediment derived from the river. Lateral migration, aggregation and degradation rates in "C" type channels are dependent on the stability of the banks, discharge and sediment supply from upstream. "C" type channels may be significantly altered by changes in bank stability, discharge, or sediment supply.

The channel types within the Upper South Fork are identified on the topographic maps, Figures 3.2-1 and 3.2-2. The steep channels at the headwaters of the Upper South Fork contain "Aa+" channel types. These steep channels grade through type "A" and "B" channels to "C" channels at approximately station 627+00. The remainder of the Upper South Fork, from station 0+00 to

627+00, contains type "C" channels. However, based on aerial photograph interpretation, much of the channel is constrained in position by roads and dikes making lateral migration unlikely.

IDEQ developed a Rosgen classification for a 120-meter reach of the Upper South Fork, approximately 0.5 miles west of Shoshone Park under the BURP project (see Figures 3.2-1 and 3.2-3). This reach was selected to be representative of general conditions in that area of the watershed. This reach was classified as Rosgen type B in the BURP study (IDEQ 1998, 1999). The differences between the classifications are likely due to differences in the methods used to classify the channel. The classification presented in this study is based on maps, elevation profiles derived using a GIS-based analysis, and aerial photographs. The BURP study relied primarily on field observations and channel measurements. Both classifications are preliminary in nature and are presented here for baseline characterization purposes only. They are not intended for use in the design phase of remediation planning. Detailed, site-specific hydrologic studies may be needed to guide actual remedial design development.

3.2.3 Channel Descriptions

The 1998 set of aerial photographs by URS Greiner, Inc. (URSG) and CH2M HILL, the 1991 and 1984 set by USDA, and the topographic maps and profiles presented in Figures 3.2-1 and 3.2-2 were reviewed to further describe the Upper South Fork. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system. These features are mapped on Figures 3.2-1 and 3.2-2. The following paragraphs provide further description.

The Upper South Fork contains one segment, UpperSFCDRSeg01. It has approximately 70,000 feet, or 13.3 miles, of channel as indicated on Figure 3.2-1. Channel slope varies from less than 1 percent at the downstream portions to over 15 percent at the headwaters.

From station 0+00 to 57+00, the channel slope is 0.5 to 1 percent and the channel appears to be channelized and confined in position by I-90 and secondary road embankments. The total valley width is approximately 200 feet. The channel is in the same general location in the 1991 and 1984 photographs. Vegetation is sparse on the channel banks. An exposed cut in the hillslope in the north valley wall from approximate station 8+00 to 15+00 is apparent in all three years of photographs reviewed. Because the channel is constrained and few sediment sources exist within this reach, the only likely sediment sources are channel bed remobilization, minor bank erosion, and runoff from the I-90 embankment.

The Upper South Fork from station 57+00 to 95+00 has a channel slope of 1 to 2 percent and is constrained in location by embankments from I-90 and secondary roads. The banks are moderately vegetated with conifers. The photos reviewed indicate the channel has been in the same general location since 1984. An exposed cut in the north valley wall above the channel exists from approximately station 88+00 to 93+00. As in the lower reaches, the only likely sediment sources in this reach are channel bed remobilization, minor bank erosion, and runoff from the I-90 embankment.

From station 95+00 to 125+00, the channel alignment moves away from the roadway embankments; however, the channel still appears channelized and constrained. Through this reach, the channel flows adjacent to the Mary D Claim workings, Golconda Tailing and Golconda Mine and Millsite with exposed sediment surrounding these areas. Vegetation on the channel banks has become larger and better established since the 1984 and 1991 photographs were taken. Because the channel appears to be constrained, lateral migration is unlikely; as such, likely sediment sources in this reach are remobilization of channel bed material and minor bank erosion. Sediment could be contributed from the mine and mine workings if surface water drainage from these deposits flows into the Upper South Fork; however, from review of the photographs, no channels are obvious.

The Upper South Fork from station 125+00 to 150+00 has a slope of approximately 1 percent and is constrained to a valley approximately 400 feet wide. A high floodplain is situated between the channel and I-90 embankment. The channel has been in the same general location since 1984 based on the photographs reviewed. Vegetation along the channel banks has become better established through time. Sediment sources in this reach are likely channel bed remobilization and minor bank erosion with some potential for erosion into the floodplain deposits between the channel and I-90.

From station 150+00 to 282+00, the Upper South Fork is confined in its location by steep hillslopes, and the I-90 and other roadway embankments. Some areas of channel bank are moderately well vegetated with conifers while other areas have no vegetation apparent. Due to the confined nature of this reach, likely sediment sources are remobilization of channel bed material and minor bank erosion.

The Upper South Fork from station 282+00 to 400+00 flows through the town of Mullan with a slope of approximately 1 percent. The channel location appears to be in the same location in the 1984 and 1991 photographs. The alignment of the channel is situated adjacent to the mill, mine, and tailings dams from the Lucky Friday Mine among others; however, surface drainage is not visible in the photographs reviewed. Likely sediment sources in this reach are remobilization of

channel bed material and minor bank erosion. Sediment from the exposed areas around the mines, mills, and tailings dams could also enter the Upper South Fork, if surface water drainage from these sites flows into the Upper South Fork.

From station 400+00 to 447+00, the channel slope appears to increase from 1 to 5 percent. Well vegetated channel banks obscure the channel from direct observation in the photographs reviewed. It appears the channel is constrained in location by embankments from secondary roadways. Likely sediment sources in this reach include minor bank erosion and channel bed remobilization.

The Upper South Fork from station 447+00 to 475+00 is confined in location by road embankments and a Lucky Friday Tailings Pond, with a slope of approximately 1 percent. The banks of the channel are moderately well vegetated. The channel location has been in the same location in the photographs from 1984, 1991, and 1998. Sediment sources in this reach include minor bank erosion and channel bed remobilization. If surface water drainage from the tailings pond is connected to the Upper South Fork, it also may be a sediment source; however, evidence of a connection was not observed in the photographs reviewed.

From station 475+00 to 600+00, the end of photographic coverage, the channel meanders through a valley typically 700 feet wide. Few anthropogenic constraints such as roads exist in this reach of channel. Moderate to heavy vegetation obscures the channel from view over much of this reach. The channel location appears to be in the same general location in the 1984, 1991 and 1998 photographs. Likely sediment sources include minor bank erosion and channel bed remobilization with possible migration of channel location.

3.3 SUMMARY

Based on the information discussed above, approximately 2,400 tons, or about 48 tons per square mile, is estimated to have been transported from the Upper South Fork to the South Fork in 1999. This estimate may be high or may be low, as no sediment transport data are available. Sediment yields vary year to year based on sediment input, hydrologic condition, land use and other factors. Nevertheless, whatever sediment is generated in the Upper South Fork is transported downstream to the South Fork Watershed. Based on interpretation of aerial photographs from 1984, 1991, and 1998, few point sources for sediment supply to the Upper South Fork exist. Sampling location and source areas are shown in figures in Section 4.1. Lateral migration of the Upper South Fork appears to be unlikely throughout its length based on photographic review.

Channelization and embankments provide a stable location for the channel; however, little variability exists in such channels.

These observations were based on a limited review of the available data, photographs, and topographic maps at the time of review. Not all potential sediment sources were identified as potential sediment sources literally cover the entire watershed. Primary sources were identified based on review of the available information.

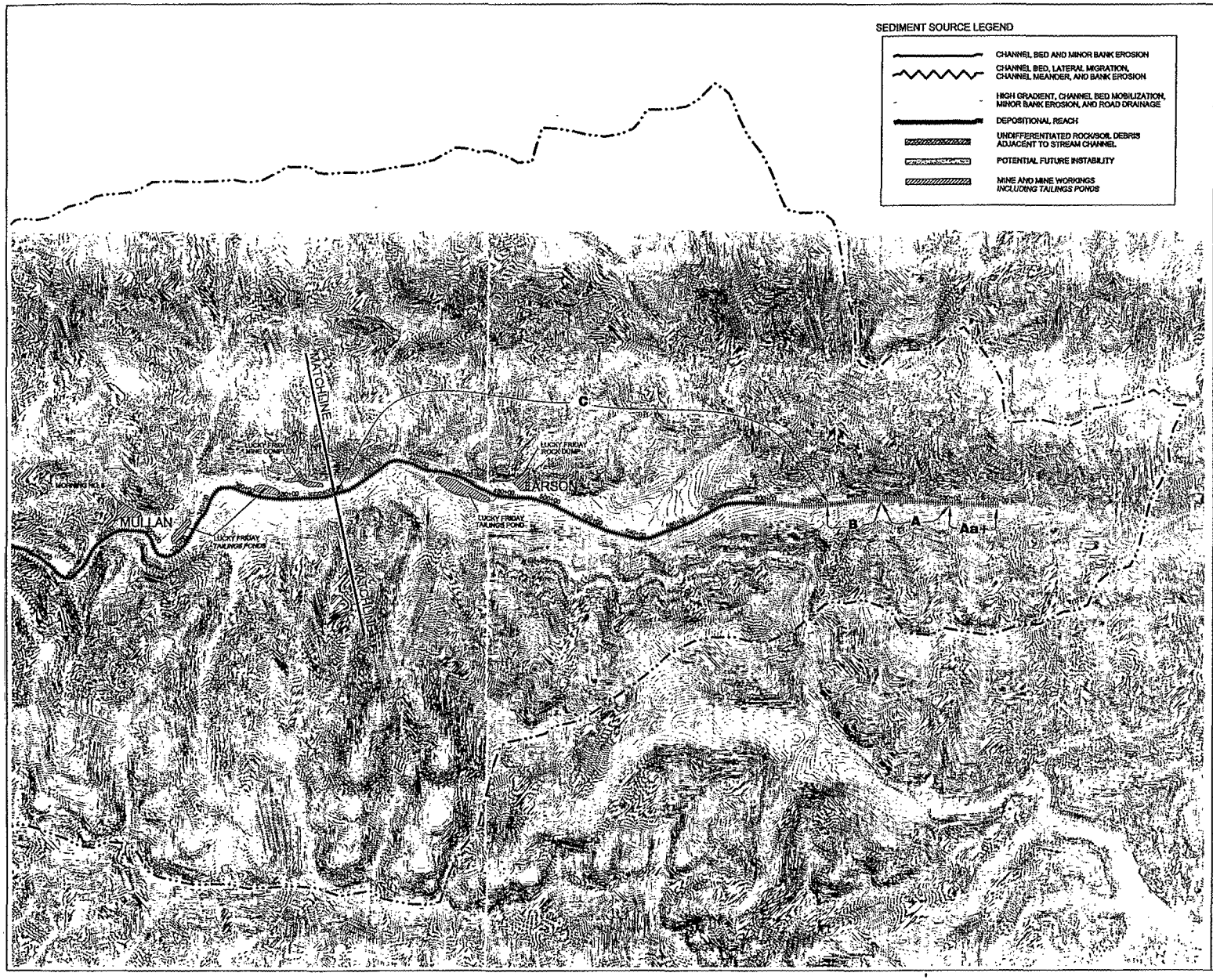
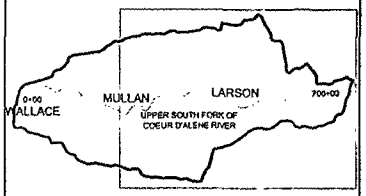


Figure 3.2-1
Upper South Fork Coeur d'Alene River Segment 01 Site Plan East Portion

UPPERSFCDRSEG01



LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE IO-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N W E S

0 4000 8000
Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

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08/04/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 5, 2001

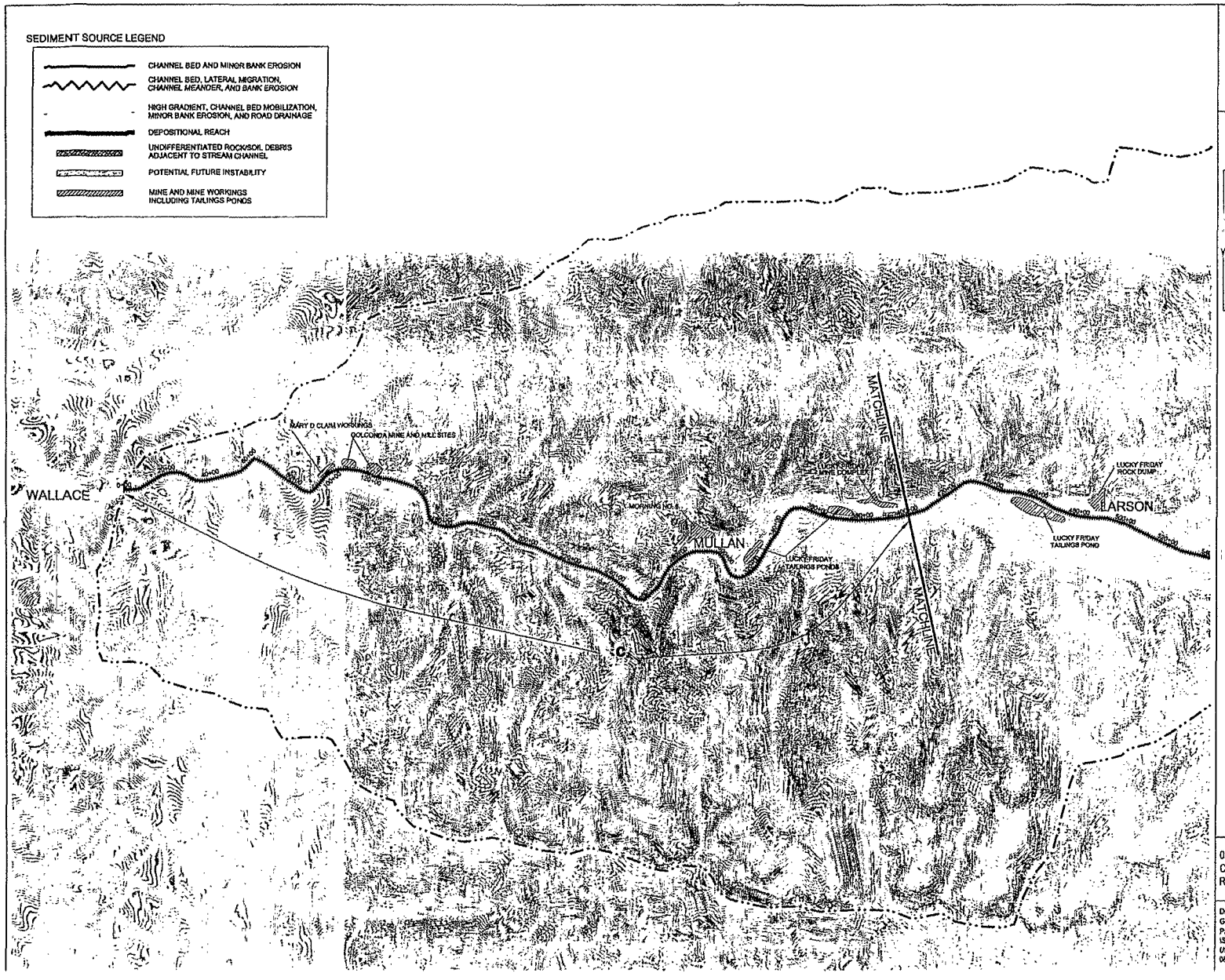
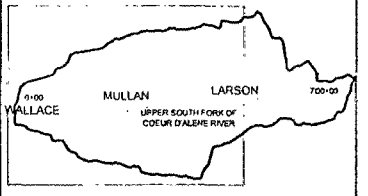


Figure 3.2-2
Upper South Fork Coeur d'Alene River
Segment 01 Site Plan
West Portion

UPPERSFCDRSEG01



LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N W E S

0 4000 8000
Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

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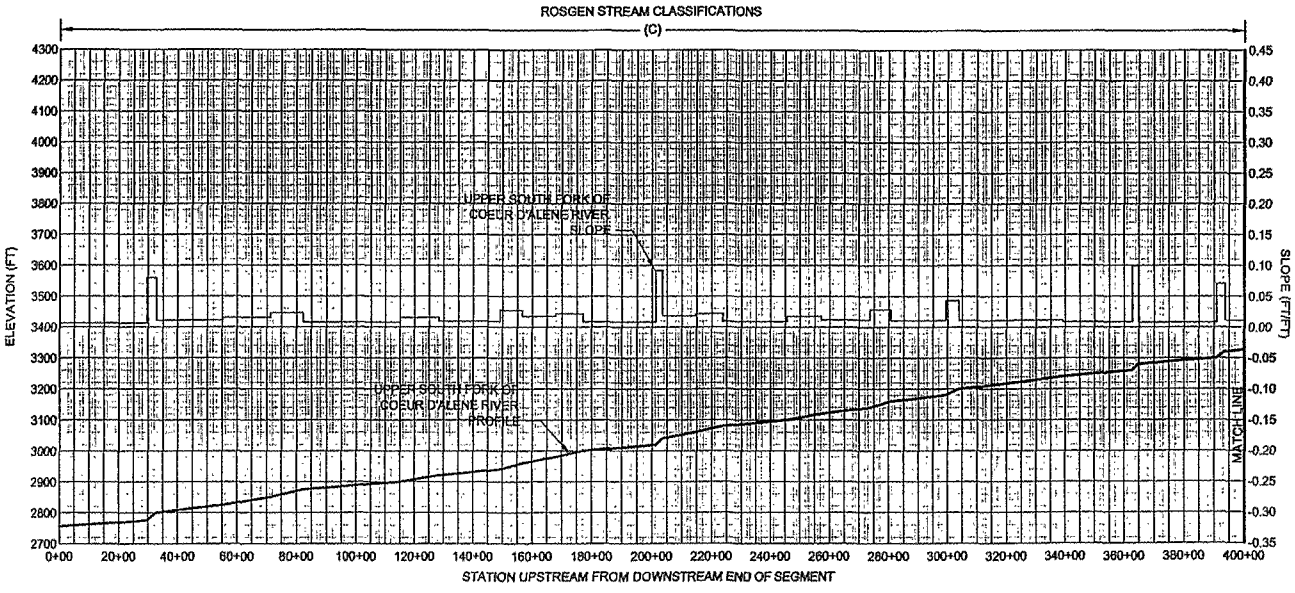
08/09/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: August 6, 2001



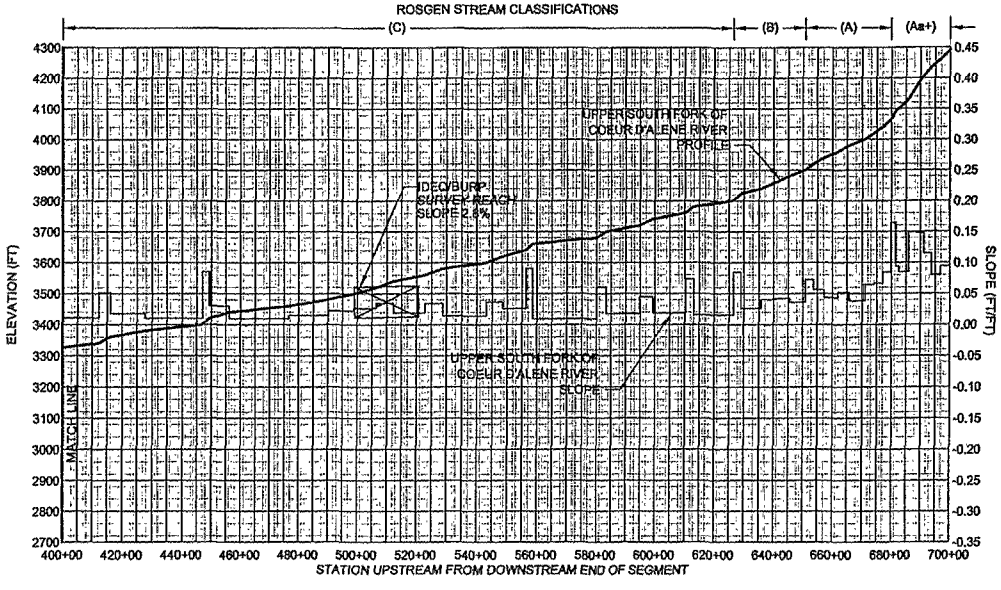
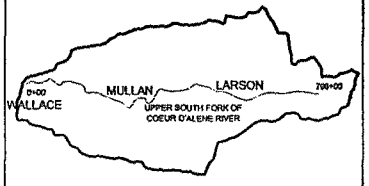


Figure 3.2-3
Upper South Fork Coeur d'Alene River
Segment 01
Rosgen Stream Classification

UPPERSFCDRSEG01



LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA REGION 10

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1SouthForkUpperSFCDA_Section.dwg
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09/05/2001

Table 3.2-1
Estimated Total Sediment Transport Upper South Fork

	Estimated Sediment Yield Ninemile Creek (Tons/Year/ Square Mile)	Estimated Sediment Yield Canyon Creek (Tons/Year/ Square Mile)	Average Sediment Yield Ninemile and Canyon (Tons/Year/ Square Mile)	Estimated Sediment Yield Upper South Fork (Tons/Year)
Fines	14	37	25	1,273
Sand	11	23	17	840
Bedload	10	2	6	300
Total	34	62	48	2,413

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the Upper South Fork watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels (Part 1, Section 5.1); and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x) and 100 times (100x) the screening level were identified and presented in the following data summary tables. The magnitudes of exceedance (10x and 100x) were arbitrarily selected to delineate exceedance areas of contamination. Metals identified in this evaluation are further evaluated in either the human health or ecological risk assessments (under separate cover).

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4. Data source references are included as Attachment 1. Chemical data collected in the Upper South Fork and used in this evaluation are summarized and included as Attachment 2. Data summary tables include sampling location, data source reference, collection date, depth, and reported concentration. Screening level exceedances are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-4.

The nature and extent of contamination were evaluated by screening chemical results against applicable risk-based screening criteria and available background concentrations. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the feasibility study (FS).

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening

level (SL) to which the detected concentration is compared. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional baseline or background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1.

Source areas within the Upper South Fork are presented in Table 4.1-1. These sites are based source areas initially identified by the BLM (1999) and further refined by CH2M HILL and URS during the RI/FS process. The table includes source area names, source ID, source area acres, description, number of samples by matrix type, and metals exceeding 1x, 10x, and 100x the screening levels in surface soil, subsurface soil, sediment, groundwater, and surface water.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-4) are included in Table 4.1-1; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Table 4.1-1.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment UpperSFCDRSeg01

4.1.1.1 Surface Soil

Thirty-five surface soil samples were collected in segment UpperSFCDRSeg01 from a depth of 0 to 0.5 feet and analyzed for total metals. Antimony, arsenic, cadmium, copper, lead, and zinc were detected at multiple sampling locations at concentrations greater than 10x the screening levels. Antimony, arsenic, lead and zinc were also detected at concentrations greater than 100x the screening levels.

4.1.1.2 Subsurface Soil

Fifteen subsurface soil samples were collected and analyzed for total metals. An additional 30 subsurface samples were analyzed for lead. Antimony, arsenic, cadmium, lead and zinc were

detected at concentrations greater than 10x the screening levels at several locations. Arsenic, lead and zinc were also detected at concentrations greater than 100x the screening levels at multiple locations.

4.1.1.3 Sediment

Nineteen sediment samples were collected and analyzed for total metals. Antimony, arsenic, cadmium, lead, manganese, mercury, silver, and zinc were detected at one to many sampling locations at concentrations that exceeded 10x the screening levels. Lead and mercury were also detected in sediment samples at concentrations that exceeded 100x the screening levels.

4.1.1.4 Surface Water

Four hundred and thirty-three surface water samples for total metals and three hundred and sixteen surface water samples for dissolved metals were collected and analyzed in Upper SFCDRSeg01. Results for total metals showed concentrations for cadmium, copper, lead, manganese, and zinc at one to many sampling locations that exceeded 10x the screening levels, with concentrations of cadmium and zinc that exceeded 100x the screening levels. Results for dissolved metals also showed numerous samples with concentrations of antimony, cadmium, copper, lead, manganese and zinc that exceeded 10x the screening levels, along with concentrations of cadmium, copper, lead, manganese, and zinc that exceeded 100x the screening levels at least one location. Lead, manganese, and zinc were the metals detected most frequently above screening levels in surface water.

4.1.1.5 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment UpperSFCDRSeg01 that may be significant contributors of metals to the Upper South Fork. Summary source area data are presented in Table 4.1-1.

Twenty-two of 309 source areas in this segment were sampled. Cadmium, copper, lead, manganese, and zinc were detected at concentrations greater than 10x the screening levels at many locations in this segment. Surface water collected from the South Fork Coeur d'Alene River Impacted Floodplain showed concentrations of dissolved antimony and lead, along with numerous concentrations of zinc that exceeded 100x and 10x the screening levels. Sediment samples also collected from the South Fork Coeur d'Alene River Impacted Floodplain showed

concentrations of cadmium, lead, manganese, mercury, and zinc that exceeded 10x the screening levels.

4.1.1.6 Major Source Areas

Based on a cumulative assessment of chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water (URS 2000, Appendix G), major source areas of concern were identified. The technical memorandum identified discrete mine/mill sites and tailings impoundments. Evaluation of potential source areas conducted for this RI/FS resulted in addition of floodplain reaches and other specific source areas. The six major source areas identified in segment UpperSFCDRSeg01 include:

- Grouse Gulch Mines (Star 1200 Level and West Star Mine)
- Morning No. 6 Mine and Mill
- Golconda Mine and Mill
- Upper South Fork Coeur d'Alene River Impacted Floodplain
- Lucky Friday Mine and tailings ponds
- Gold Hunter No. 6

These source areas are known to have high concentrations of metals resulting from historical mining activities. Figures 4.1-5 through 4.1-8 illustrate significant features for the first four major source areas listed above. Common features highlighted in the figures include tailing piles, waste rock piles, mine adits of known location, mining and mill-related structures, residential properties, the river, major roads and additional site-specific details.

The Upper South Fork Coeur d'Alene River Impacted Floodplain is shown in Figures 4.1-9 and 4.1-10. Major source areas identified in floodplains were mapped at a larger scale than the figures depicting discrete source areas. Both figures illustrate regional location, the river and associated floodplains, and major cities. Figure 4.1-9 includes the source area boundary as provided by the BLM for the Upper South Fork Coeur d'Alene River Impacted Floodplain and Figure 4.1-10 includes surficial geology units obtained from the U.S. Geological Survey (Box et al. 1999). Based on a comprehensive list created by Box et al. (1999), seven surficial geologic units of interest were identified and combined into a single area for this report. The seven geologic units include the following source material types:

- Fcgos: Flotation-era channel gravels and overlying overbank sediments
- JFti: Jig- and early flotation-era tailings impoundments
- JFms: Jig- and early flotation-era ore concentration millsite

- Joscu: Jig-era overbank sediments, copper impacted
- Jos: Jig-era overbank sediments over pre-mining channel gravel
- Jcgos: Jig-era channel gravels and overlying jig-era overbank sands
- Jrrf: Jig-era railroad embankment fill

These geology units form the basis of estimates of contaminated sediment volumes within the historical floodplain. Volume estimates are included in the Feasibility Study (URS 2001).

4.1.2 Adit and Seep Summary

Most adits and seeps with drainage that have been identified and sampled have flows under 1 cfs and relatively low concentrations of metals. However, very high concentrations of total zinc were measured in one of the adits identified in the Upper South Fork watershed (Gearheart et al. 1999). A total of twenty-seven adits and one seep were identified. Available adit and seep data for the Upper South Fork are summarized in Table 4.1.2 -1. Discharge, average total zinc concentration, average total zinc mass loading, and associated source areas are listed. Zinc mass loading from the Star 1200 Level and Morning No. 6 adits and the seep at the Morning No. 6 Waste Rock pile were greater than 1 pound per day. Total zinc mass loading for all adits and seeps identified in the Upper South Fork watershed is estimated to be approximately 20 pounds per day.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and Extent further discussed the use of plotting discrete sampling events versus the probabilistic analysis of the mass loading data in Fate and Transport.

This section presents the discrete mass loading measurements made during several low- and high-flow sampling events. The locations sampled during each event are plotted on a map of the watershed (Figure 4.2-1 through 4.2-10). Each sampling location shows the cumulative mass loading of lead or zinc and the difference in mass load from the next upstream location. The difference in mass load is indicated on the maps by the term "delta." The events were selected to show variations in mass loading throughout the stream system relative to source areas. To help with understanding mass loading in the South Fork, the figures show loading data along the Upper South Fork from above Larson to below Pinehurst. This includes mass loading data from tributaries to the South Fork. The events selected are not intended to represent all the available

mass loading data. The remainder of this section presents the indicator metal correlation and selected maps with a discussion of discrete sampling events on a watershed basis.

4.2.1 Indicator Metal Correlation

In Section 4.2 of the Canyon Creek Watershed Nature and Extent, the correlation of chemical concentrations for 8 chemicals of potential concern (COPCs) are evaluated for total lead and dissolved zinc. These two metals appear to be reasonable indicators of the other chemicals of potential concern. The following mass loading discussion is limited to total lead and dissolved zinc.

4.2.2 Upper South Fork Watershed Mass Loading

Of the available sampling data, five sampling events were selected and mapped. Table 4.2-1 summarizes the sampling events, sampling locations and calculated mass loads for total lead and dissolved zinc. The low-flow events used were October 1991 (Figures 4.2-1 and 4.2-6), November 1997 (Figures 4.2-2 and 4.2-7) and November 1998 (Figures 4.2-3 and 4.2-8). The high flow events used were May 1991 (Figures 4.2-4 and 4.2-9) and May 1998 (Figure 4.2-5 and 4.2-10). Data from these sampling events is summarized in Table 4.2-1. The following sections discuss observations made from plotting the low- and high-flow mass loading data.

4.2.2.1 Total Lead Mass Loading

Loading observations are as follows:

Sampling location SF205 is located upstream of Larson near the boundary of segment UpperSFCDRSeg01. Low-flow total lead loading in the October 1991 and November 1997 sampling events were less than 1 pound per day. Down stream of sampling location SF205 lead load increases just above Mullan (SF215) and below Mullan (SF220). The changes in loading from the next upstream sampling location were 2 to 6 pounds per day. Downstream of sampling location SF220, the differences in mass load are low. Sampling location SF10, located near the downstream boundary of the segment, had a loading of 1 pound per day (October 1991). CC288, located in segment MidGradSeg01 but near the boundary of segment UpperSFCDRSeg01, had a measured loading of 10 pounds per day (November 1998). Overall the largest increase in total lead mass loading increases noted in the segment occurred downstream of the Gold Hunter mine and the Lucky Friday mine and tailings ponds. However, there are many other mines and potential sources in this area as noted in Section 4.1.

Under high-flow conditions, the most upstream sampling location (SF205, east of Larson) had a total lead loading of 3 pounds per day (May 1998). The highest down stream loading in the segment was 24 pounds per day (SF228, May 1998). As under low flow conditions, lead loads increase downstream of the Lucky Friday Mine and tailing ponds and the Gold Hunter No. 6. An additional increase of 12 pounds per day (May 1991) was observed downstream of the Golconda mill and mine site at sampling location SF228.

4.2.2.2 Dissolved Zinc Mass Loading

Loading observations are as follows:

Low-flow total zinc loadings in the October 1991 and November 1997 sampling events were less than 1 pound per day at SF205. Downstream, the zinc load increases with a difference of 31 pounds per day measured below Mullan (SF220, November 1997). Further downstream zinc loading again increases at sampling locations SF227 and SF228 with differences in mass load of 17 to 29 pounds per day (November 1997), respectively. SF10 is the furthest downstream point in the segment for the sampling events plotted. This location had a loading of 2 pounds per day (October 1991).

Under high-flow conditions, the most upstream sampling location in the segment (SF205, east of Larson) had a total zinc loading of less than 1 pound per day (May 1998). From Larson to downstream of Mullan at sampling location SF220, zinc mass loading differences increase. At location SF220, below Mullan, the difference was 80 pounds per day dissolved zinc. Further downstream sampling locations SF227 and SF228, which bracket the Golconda mill and mine site, had differences of 52 and 193 pounds per day (May 1998), respectively. As under low flow conditions, zinc loads increase downstream of the Lucky Friday Mine and tailing ponds and the Gold Hunter No. 6. The total dissolved zinc mass load downstream of the Golconda was 343 pounds per day (May 1998).

4.2.2.3 Groundwater Mass Loading

Information on subsurface conditions in this segment was not sufficient to evaluate mass loading in groundwater. However, based on the results of the seepage study conducted near Osburn (USGS 2000), areas where there is a widening of the floodplain are likely to be losing some surface water to groundwater. Some of the surface water loading in losing reaches of the stream may enter the groundwater system. In this segment, reaches where some floodplain development is evident start above Mullan and continue downstream.

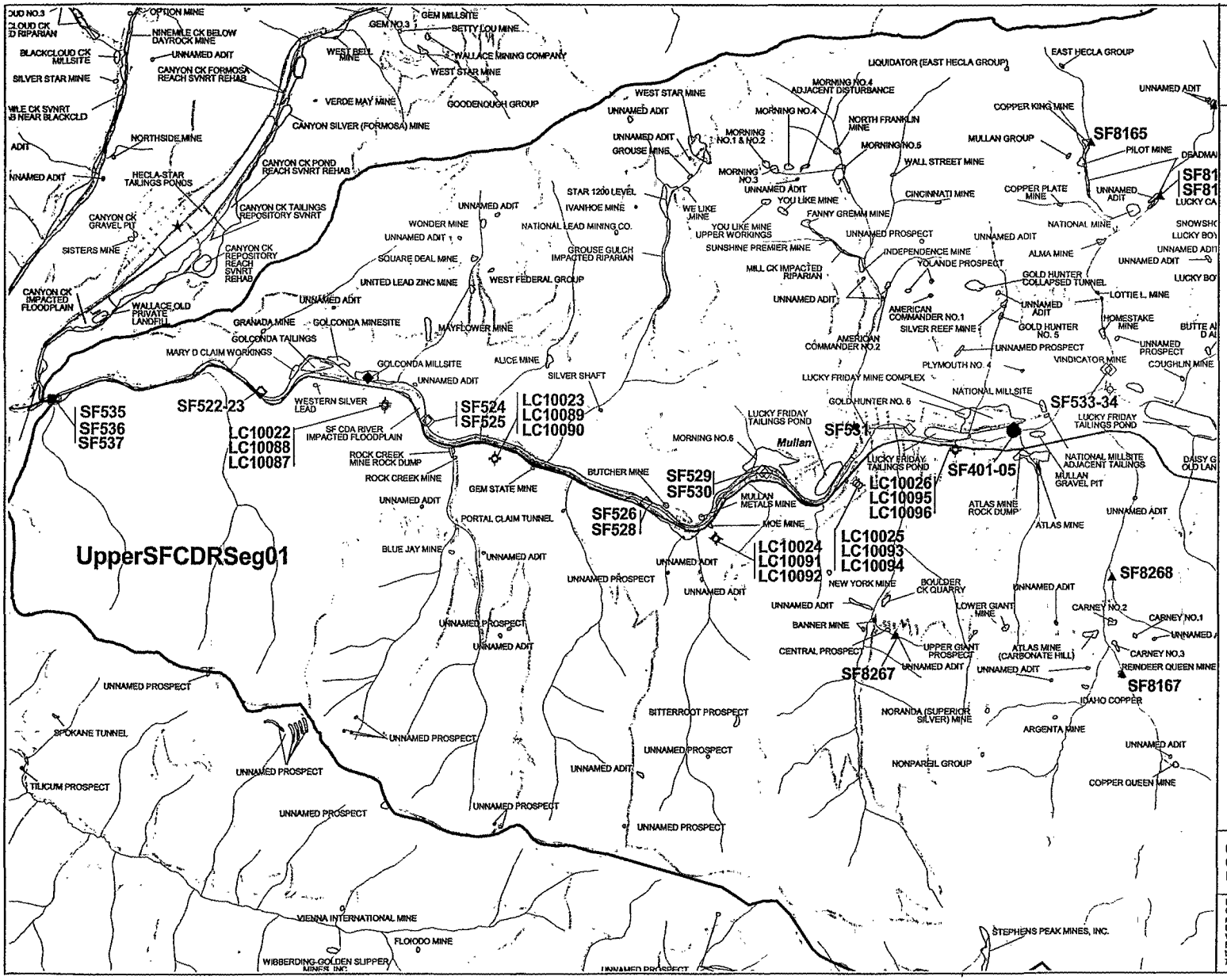

Figure 4.1-1
Upper South Fork Coeur d'Alene River Segment UpperSFCDRSeg01
East Half Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Ground Sampling Location
- Hand Auger Sampling Location
- Tailings Sampling Location
- Test Pit Sampling Location
- River Sampling Location
- Stream
- Road
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

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027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI/FS REPORT

EPA REGION 10

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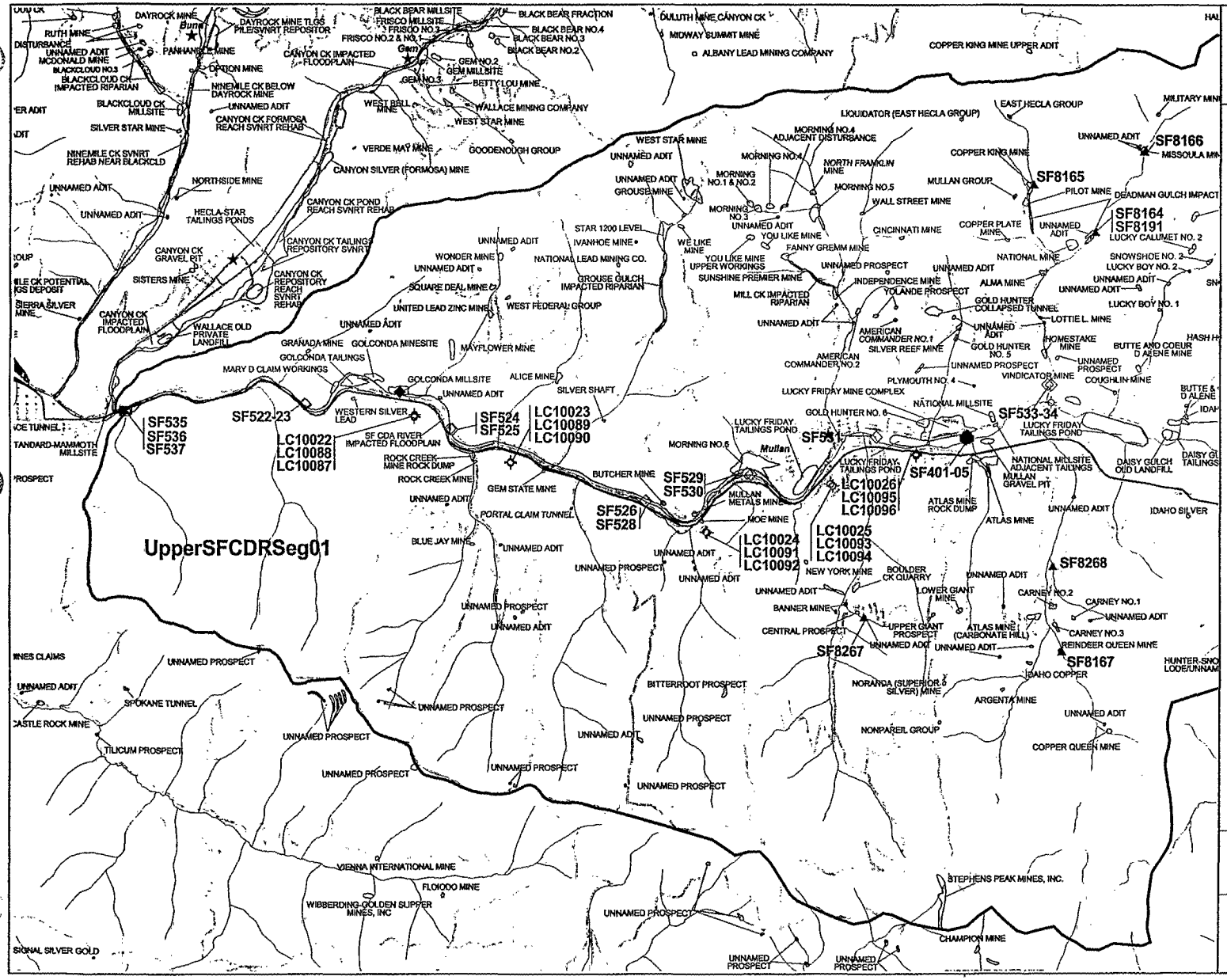

Figure 4.1-2
Upper South Fork Coeur d'Alene River Segment UpperSFCDRSeg01 West Half Source Areas and Soil/Sediment Sampling Locations

LEGEND

- Bore Hole Sampling Location
- Ground Sampling Location
- Hand Auger Sampling Location
- Tailings Sampling Location
- Test Pit Sampling Location
- River Sampling Location
- Stream
- Road
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc.Technical Data Management database as of 3/29/00.

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Coeur d'Alene Basin RI/FS
RI/FS REPORT

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Date of Plot: July 24, 2001

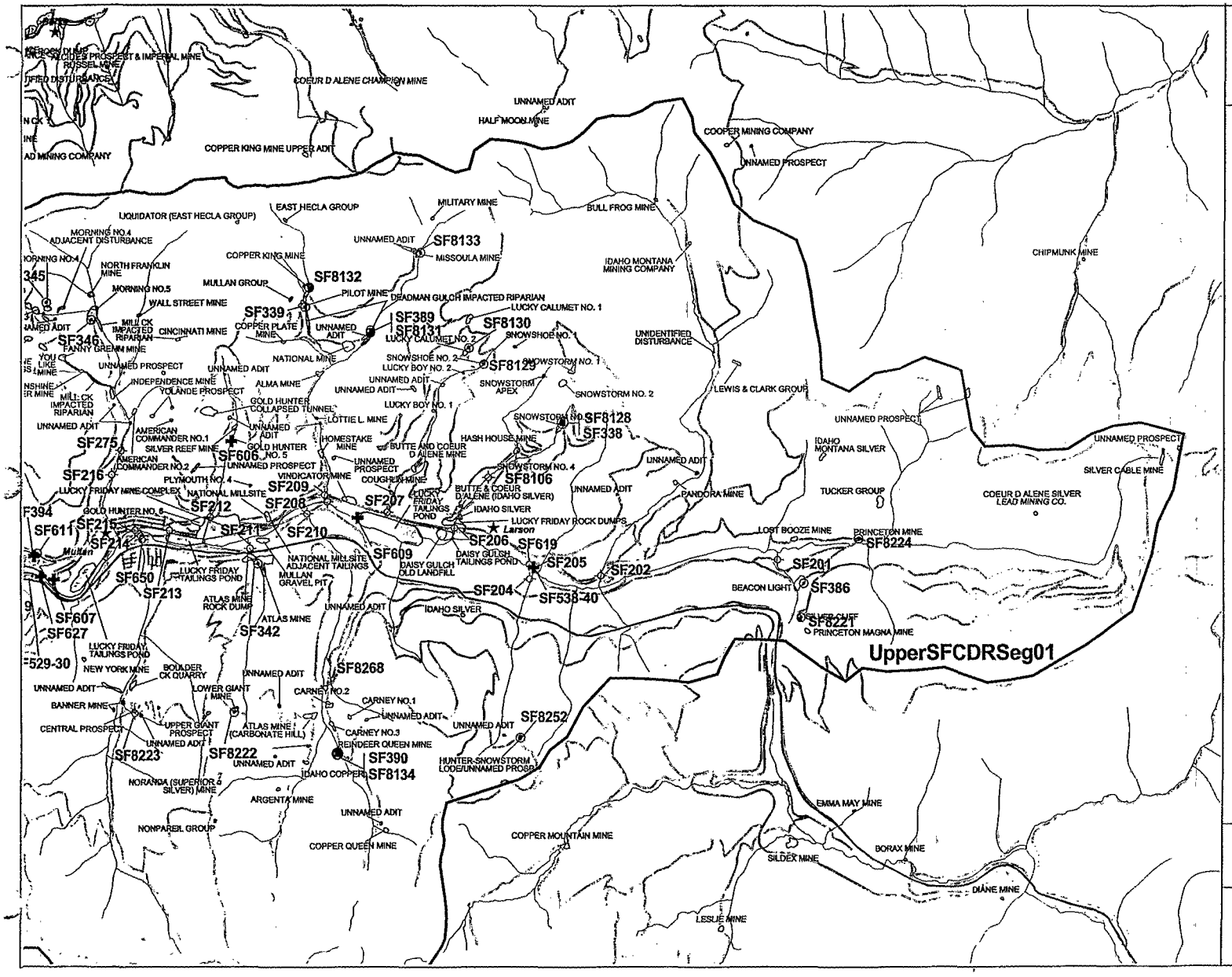
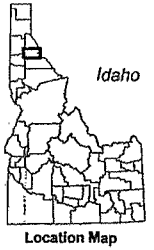


Figure 4.1-3
Upper South Fork Coeur d'Alene River Segment UpperSFCDRSeg01 East Half Source Areas and Surface Water Sampling Locations

LEGEND

- Seep Sampling Location
- Adit Sampling Location
- Outfall Sampling Location
- Wetlands/Marsh Sampling Location
- River Sampling Location
- Stream
- Road
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Segment 1
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

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Coeur d'Alene Basin RI/FS
RI REPORT

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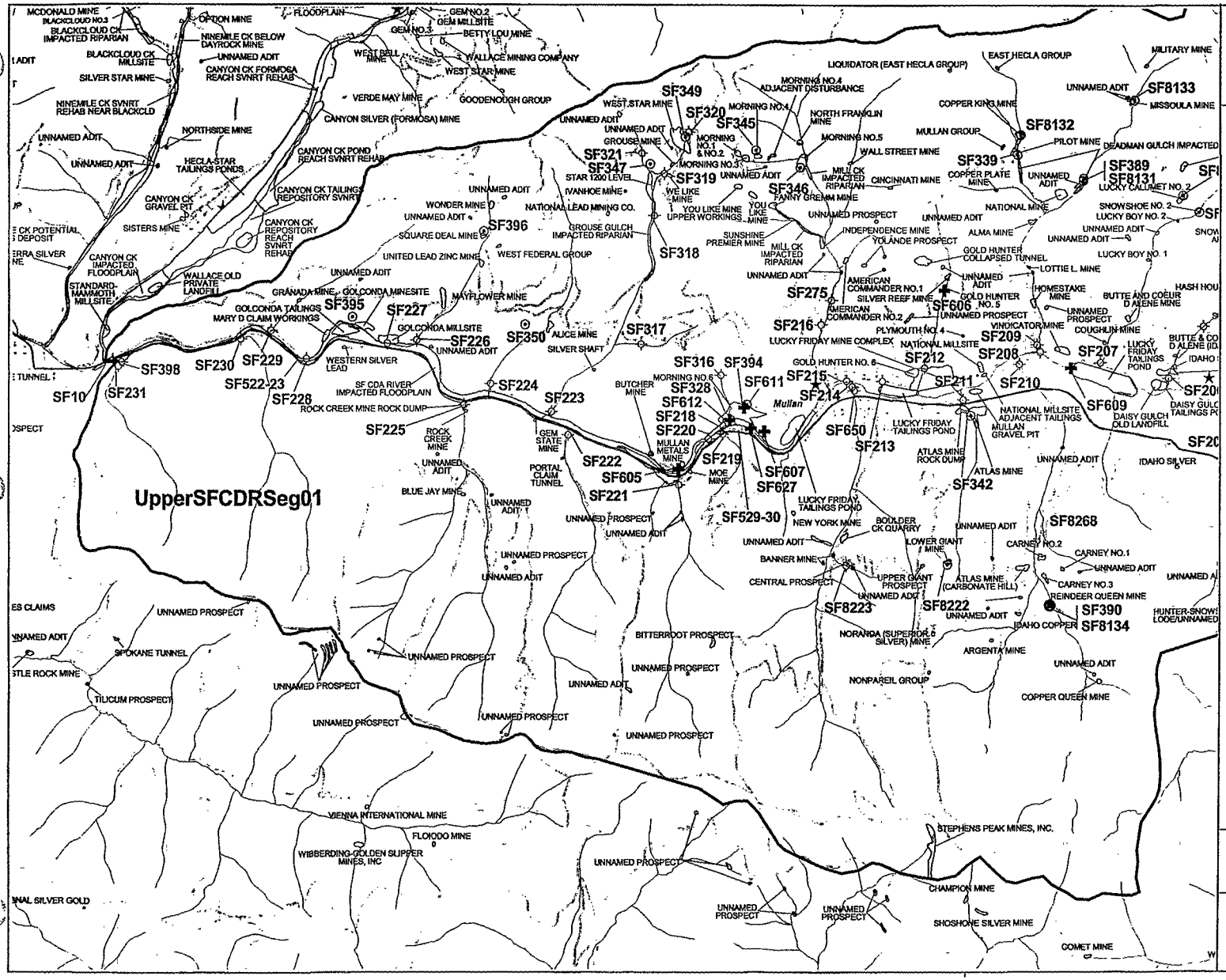

Figure 4.1-4
Upper South Fork Coeur d'Alene River Segment UpperSFCDRSeg01 West Half Source Areas and Surface Water Sampling Locations

LEGEND

- Seep Sampling Location
- Adit Sampling Location
- Outfall Sampling Location
- Wetlands/Marsh Sampling Location
- River Sampling Location
- Stream
- Road
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Segment 1
- Source Area and Name

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner Inc. Technical Data Management database as of 3/29/00.

SCALE 1:44,000

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7/24/2001

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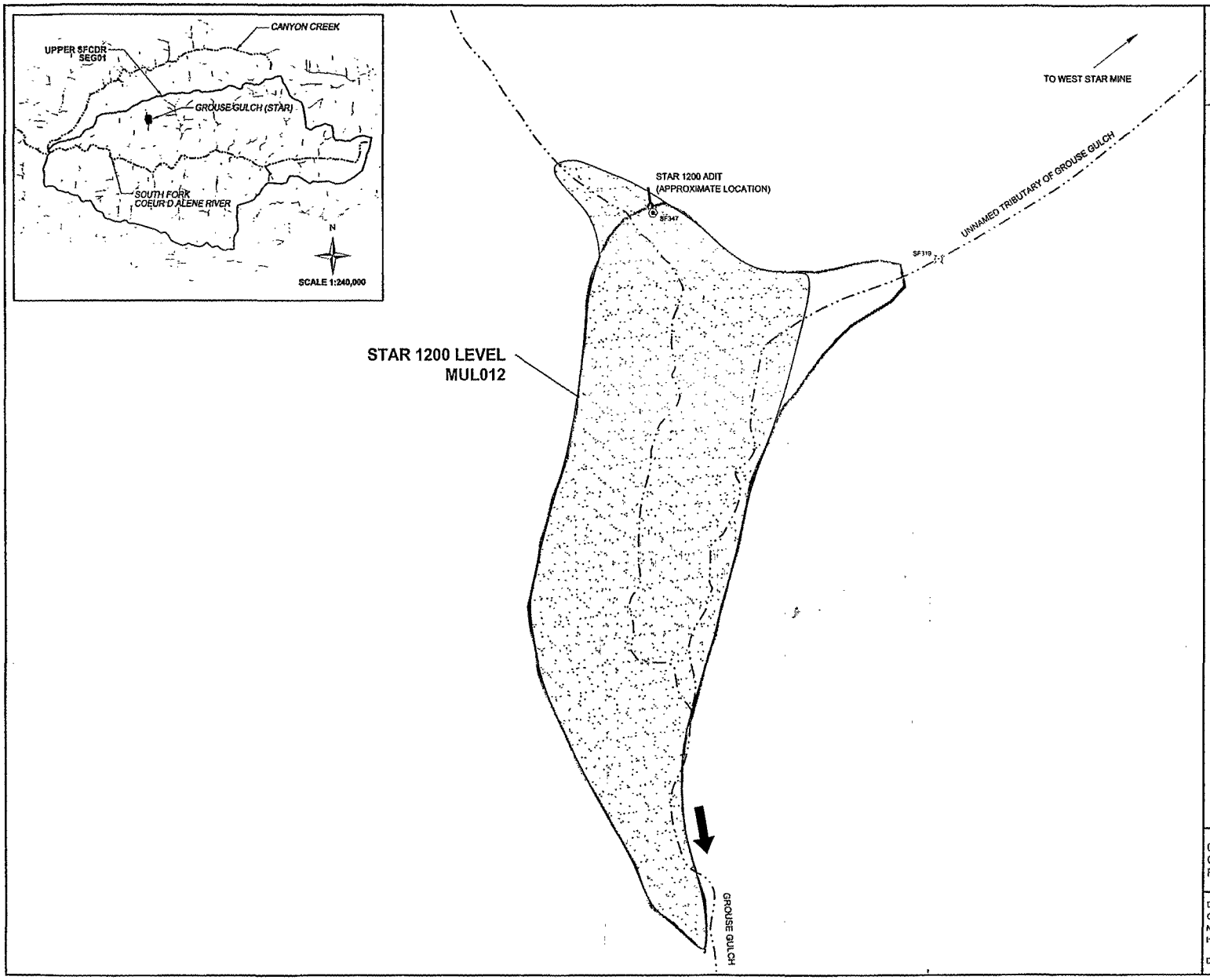

Figure 4.1-5
Grouse Gulch Mines (Star 1200 Level) BLM Source Areas and Sampling Locations

LEGEND

- Stream and Flow
- Adit
- Waste Rock
- Adit Surface Water Sample
- River Surface Water Sample
- BLM Source Area

Location Map

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Coeur d'Alene Basin RI/FS
RI REPORT

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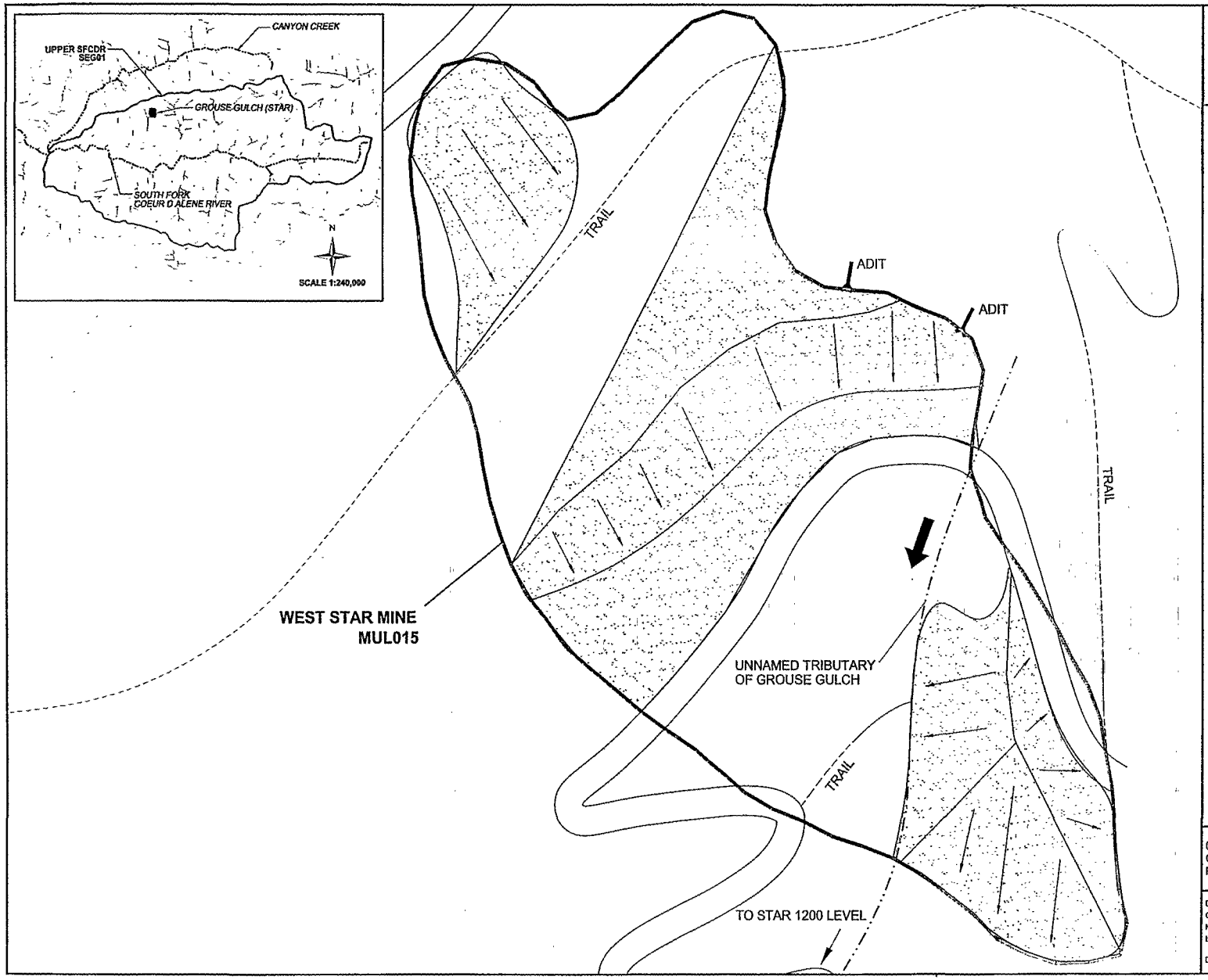

Figure 4.1-6
Grouse Gulch Mines (West Star Mine)
BLM Source Areas and Sampling Locations

LEGEND

- Road
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Adit Surface Water Sample
- River Surface Water Sample
- BLM Source Area

Location Map

SCALE 1:1,200
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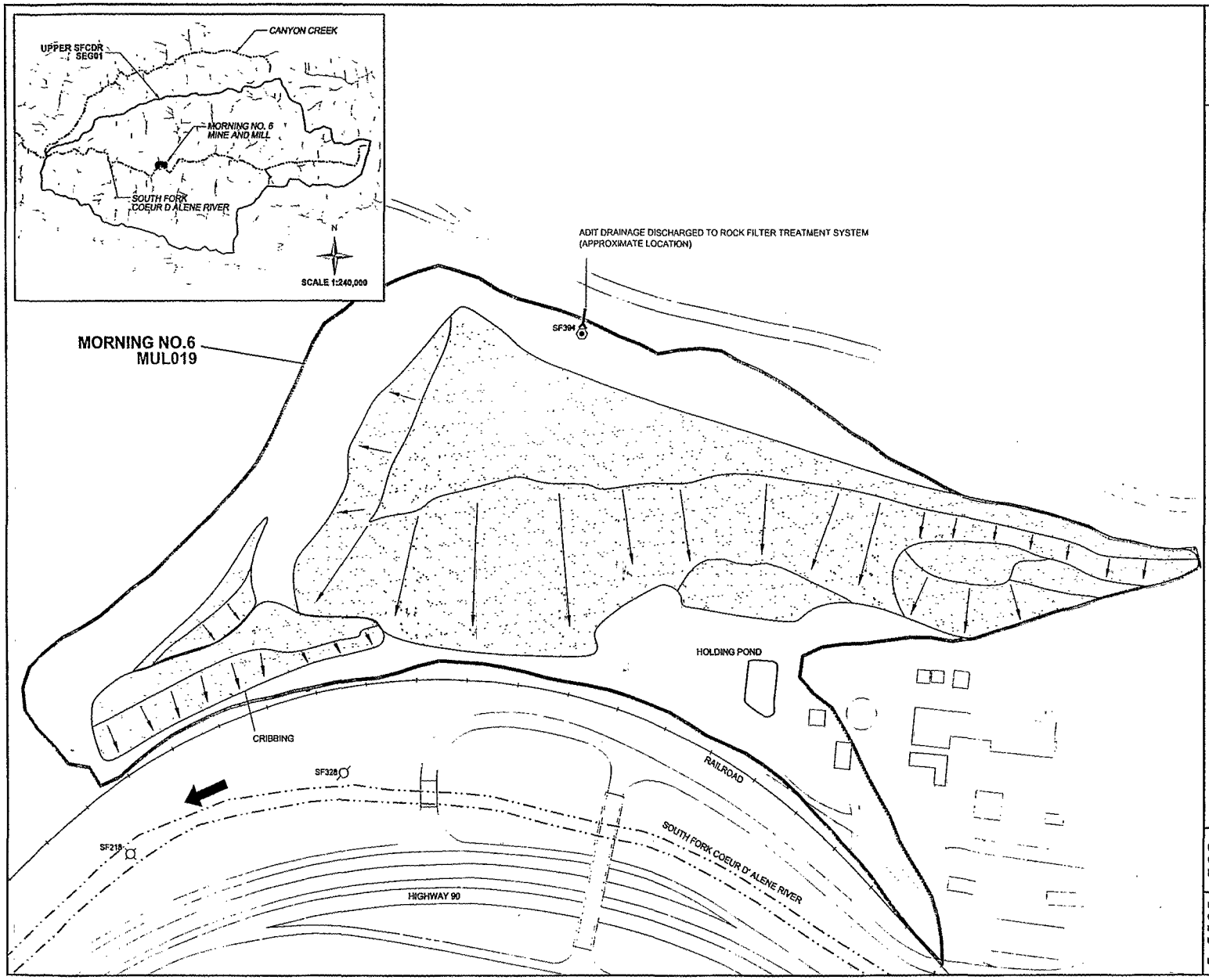
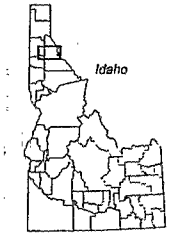


Figure 4.1-7
Morning No. 6 Mine and Millsite Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Adit Surface Water Sample
- River Surface Water Sample
- Seep Water Sample
- BLM Source Area



Location Map

SCALE 1:1,800
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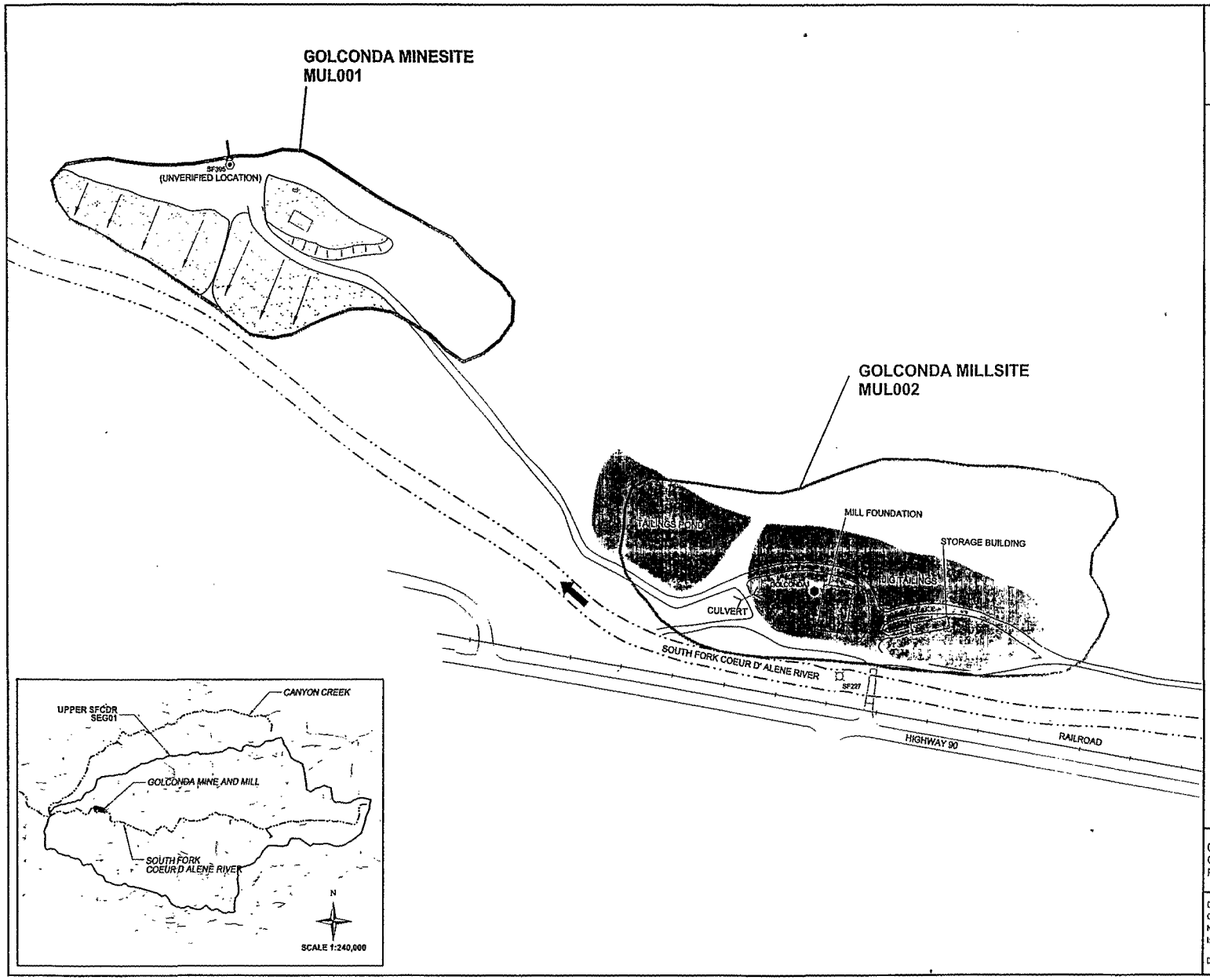

Figure 4.1-8
Golconda Mine and Millsite Map, BLM Source Areas and Sampling Locations

LEGEND

- Road
- Building
- Stream and Flow
- Contour Slope
- Adit
- Waste Rock
- Tailings
- Adit Surface Water Sample
- River Surface Water Sample
- Surface/Near Surface Soil Sample
- BLM Source Area

Location Map

SCALE 1:1,800
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Coeur d'Alene Basin RI/FS
RI REPORT

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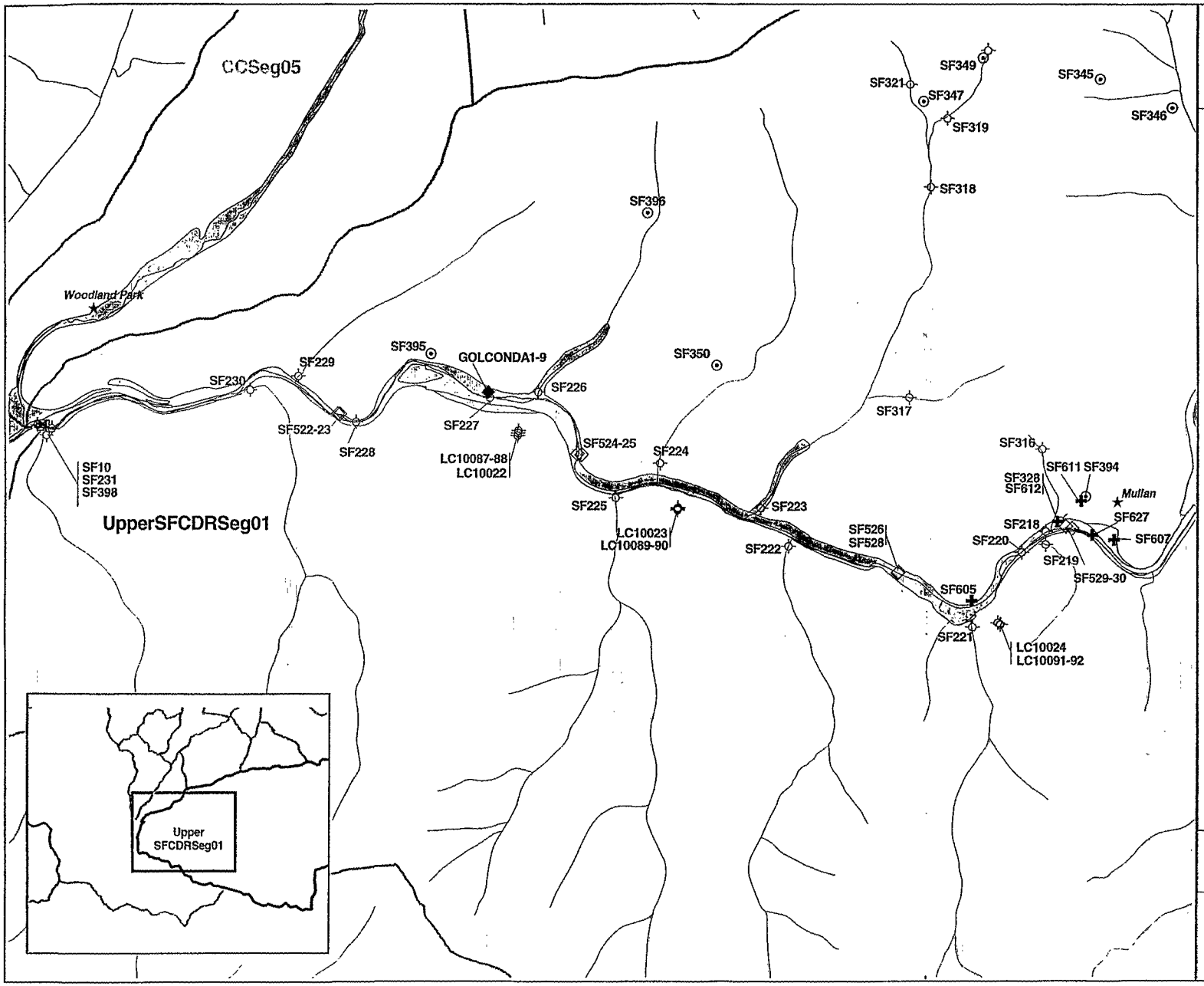
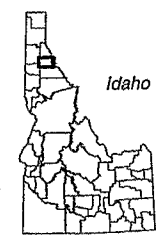


Figure 4.1-9
Upper SFCDR Impacted Floodplain
BLM Source Areas and Sampling Locations

LEGEND

- Adit Sampling Location
- Bore Hole Sampling Location
- Floodplain Sampling Location
- Ground Sampling Location
- Hand Auger Sampling Location
- Lake Sampling Location
- Outfall Sampling Location
- River Sampling Location
- Seep Sampling Location
- Tailings Sampling Location
- Test Pit Sampling Location
- City
- Stream
- River
- River Segment Boundary
- BLM Source Area
- Floodplain



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

N

SCALE 1:26,000

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

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7/24/2001

This Map is based on Idaho State Plane Coordinates West Zone North American Datum 1983

Date of Plot: July 24, 2001

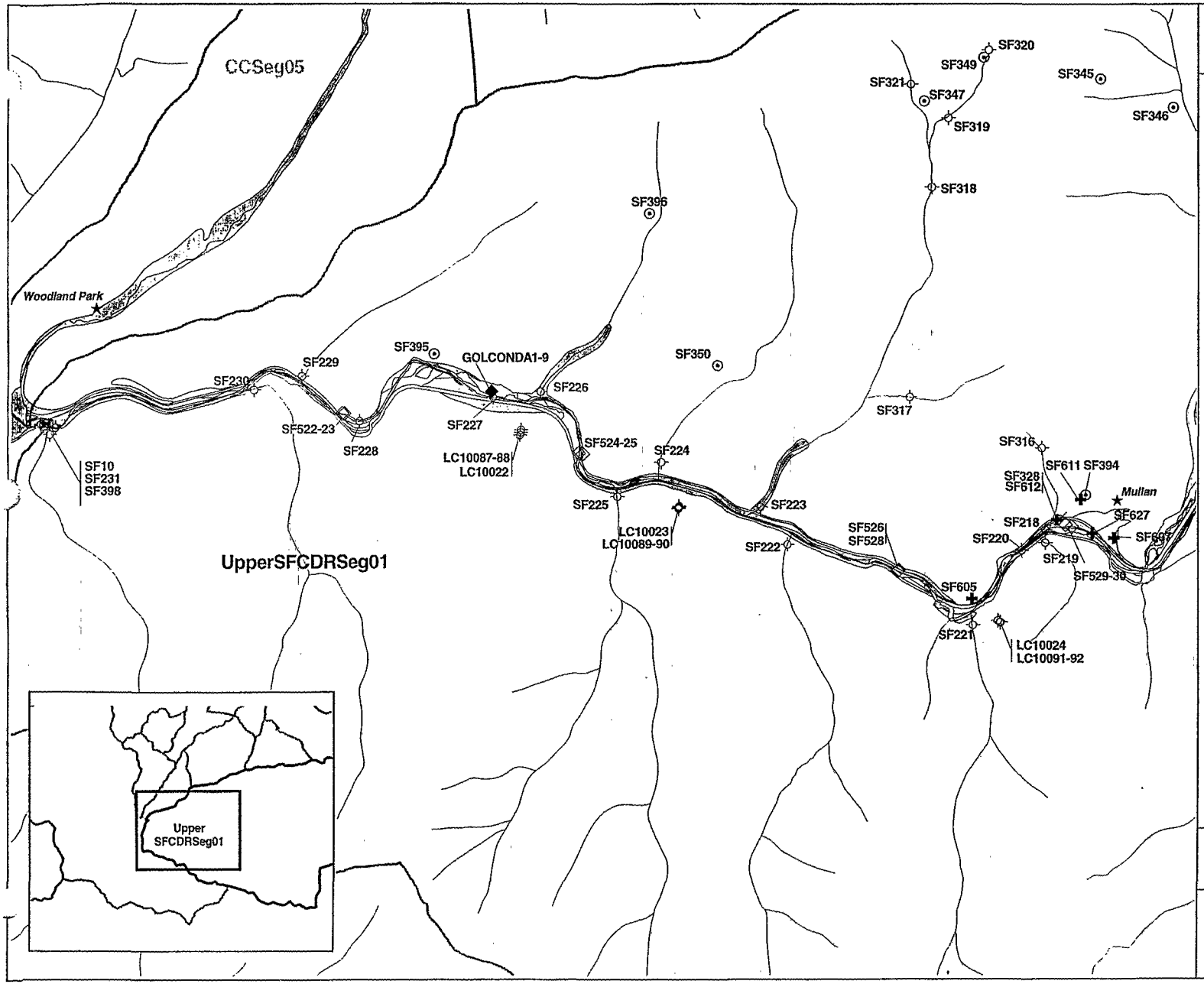

Figure 4.1-10
Upper SFCDR Impacted Floodplain Geologic Units and Sampling Locations

LEGEND

- Adit Sampling Location
- Bore Hole Sampling Location
- Floodplain Sampling Location
- Ground Sampling Location
- Hand Auger Sampling Location
- Lake Sampling Location
- Outfall Sampling Location
- River Sampling Location
- Seep Sampling Location
- Tailings Sampling Location
- Test Pit Sampling Location
- City
- Stream
- River
- River Segment Boundary
- Geologic Units *
- Floodplain

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

*Box,S.E., A.A. Bookstrom, and W.N Kelly. 1999. Surficial geology of the valley of the South Fork of the Coeur d'Alene River, Idaho. U.S. Geological Survey Open File Report 99-XXX. Draft version, October 1999; and ArcView GIS Coverage, January 2000.

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Coeur d' Alene Basin RI/FS
RI REPORT

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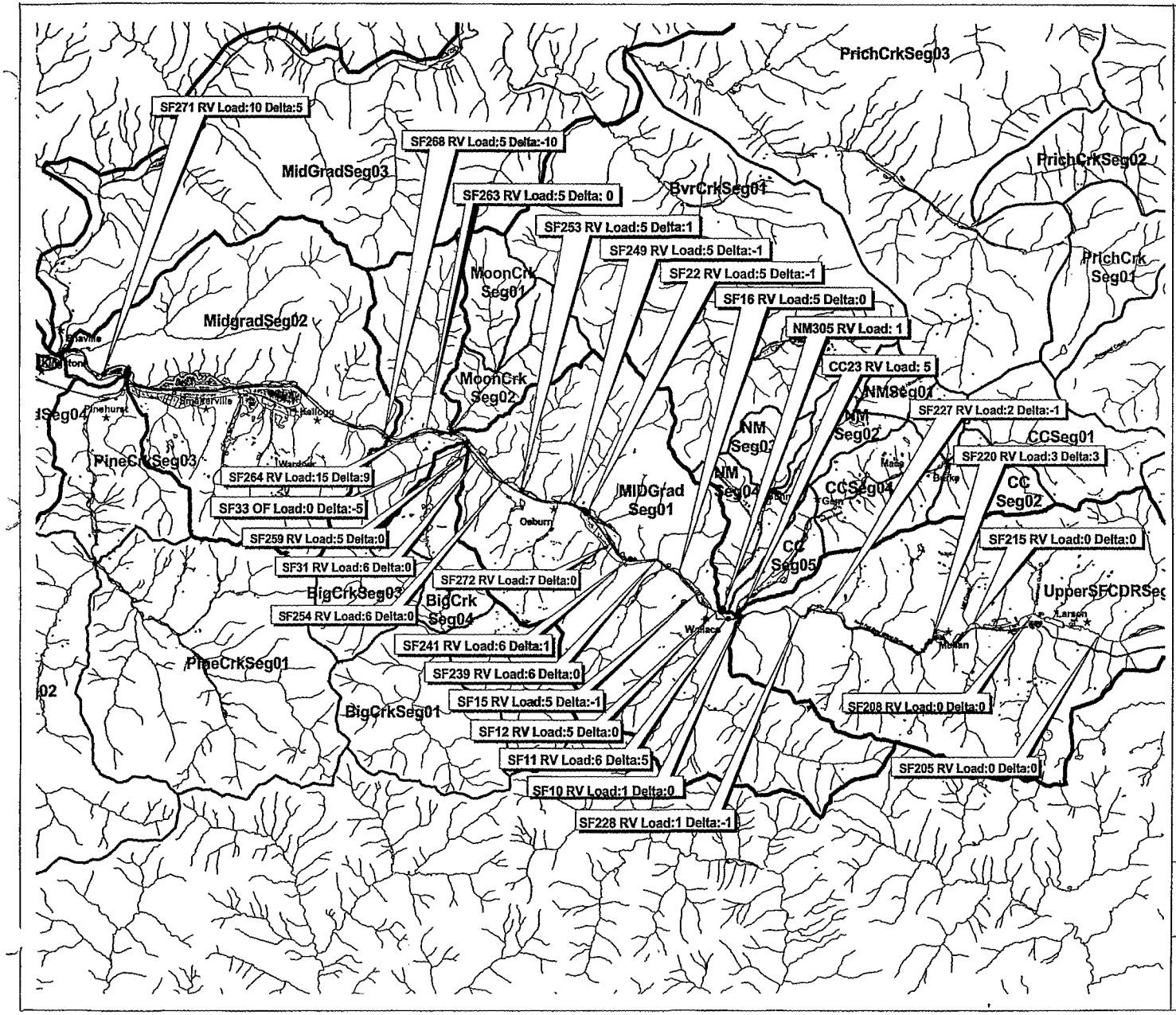


Figure 4.2-1
Upper South Fork Coeur d' Alene River Watershed
Total Lead Mass Loading
Sampling Results Oct. 1991

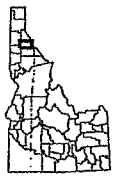
LEGEND

Sampling Location — SF271 RV Load: 10 Delta: 5 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M Hill, and the Bureau of Land Management.

SCALE 1: 160,000
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027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

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Date of Plot: July 24, 2001

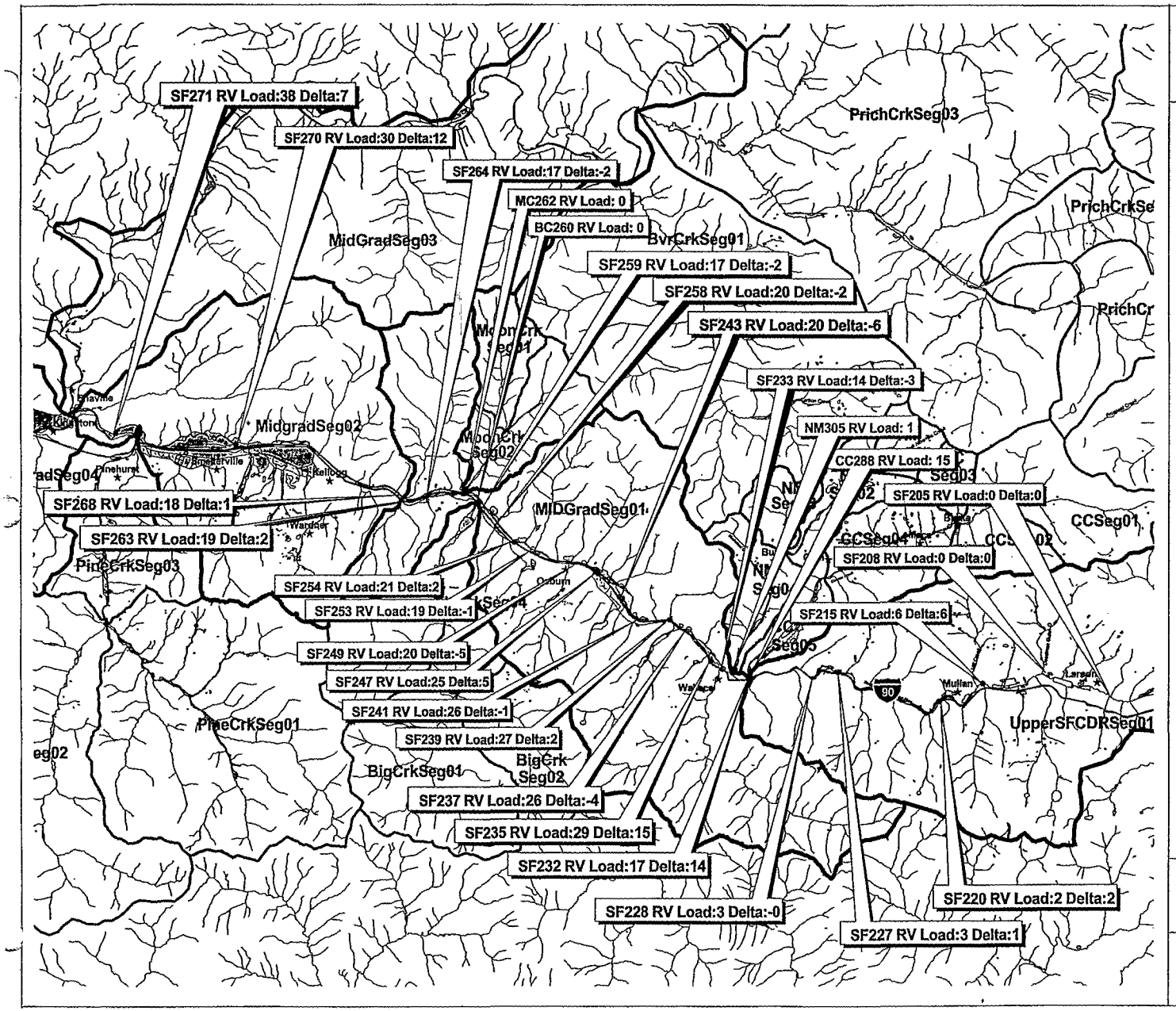


Figure 4.2-2
Upper South Fork Coeur d' Alene River Watershed
Total Lead Mass Loading
Sampling Results Nov. 1997

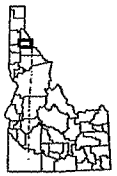
LEGEND

Sampling Location — SF271 RV Load: 88 Delta: 8 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 160,000

0 3 Miles

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

Document Control 4162500.8615.05a
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V: SF-nov97-lead
L: Final RI SF-nov97-lead
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

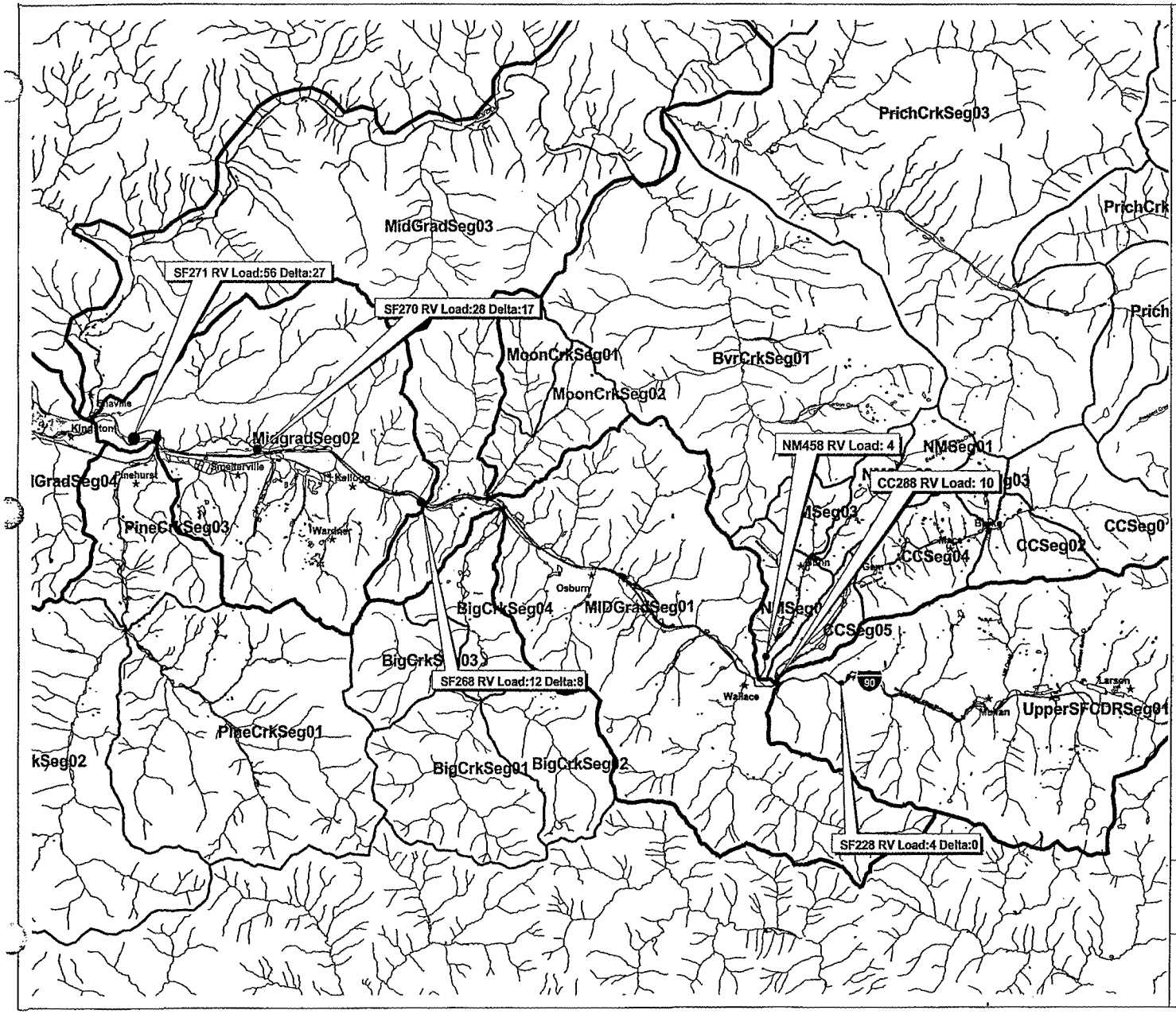


Figure 4.2-3
Upper South Fork Coeur d' Alene River Watershed
Total Lead Mass Loading
Sampling Results Nov. 1998

LEGEND

Sampling Location — Values are lbs/day

SF 268 RV Load: 2055 Delta: 76

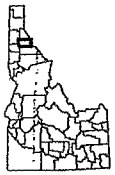
Location Type:

RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

N

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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V: SF-nov98-lead
L: Final RI SF-nov98-lead
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

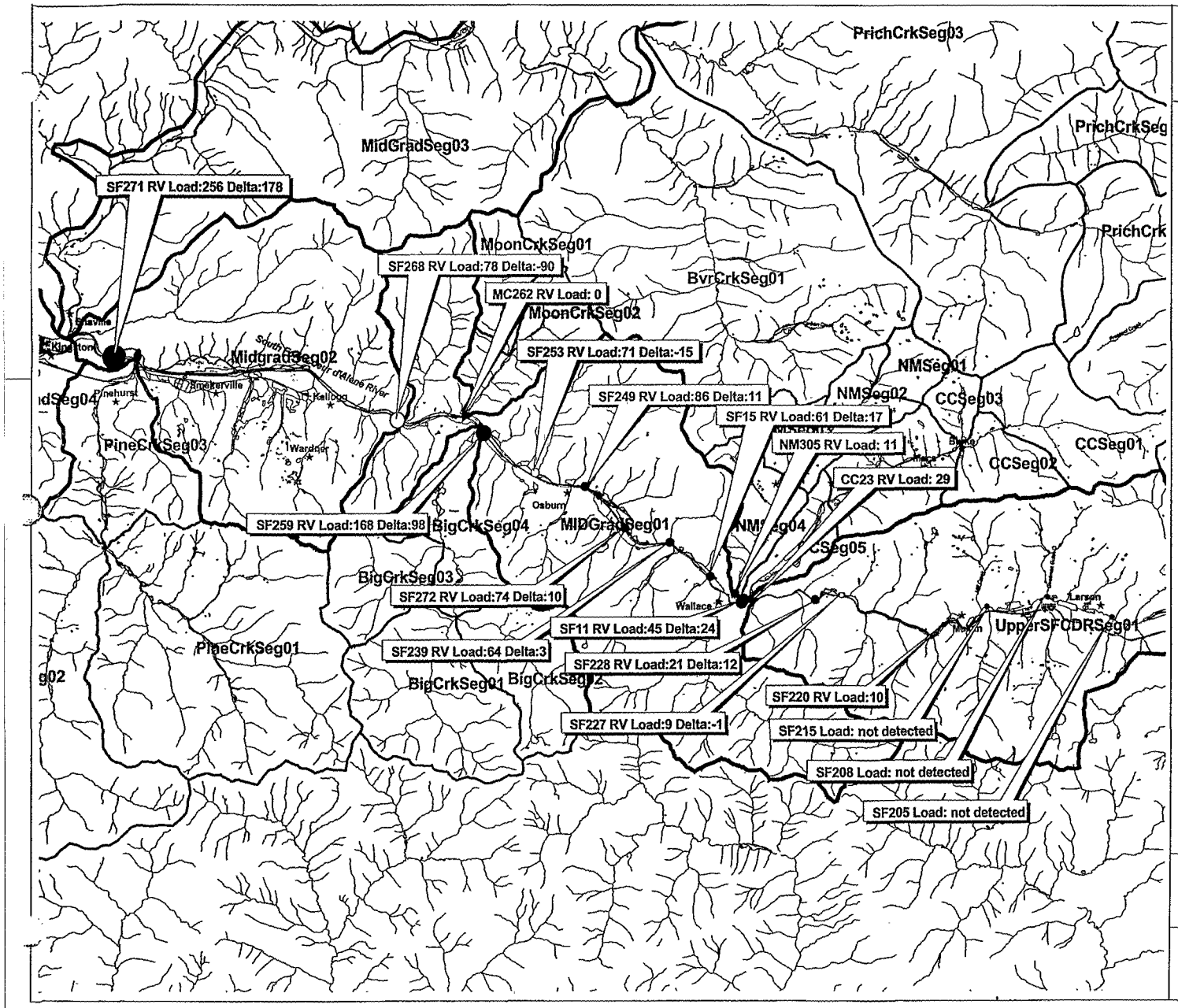

Figure 4.2-4
Upper South Fork Coeur d' Alene River Watershed
Total Lead Mass Loading
Sampling Results May 1991

LEGEND

Sampling Location — SF271 RV Load: 256 Delta: 178 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 160,000

0 3 Miles

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

Document Control 4162500.6615.05a
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7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 24, 2001

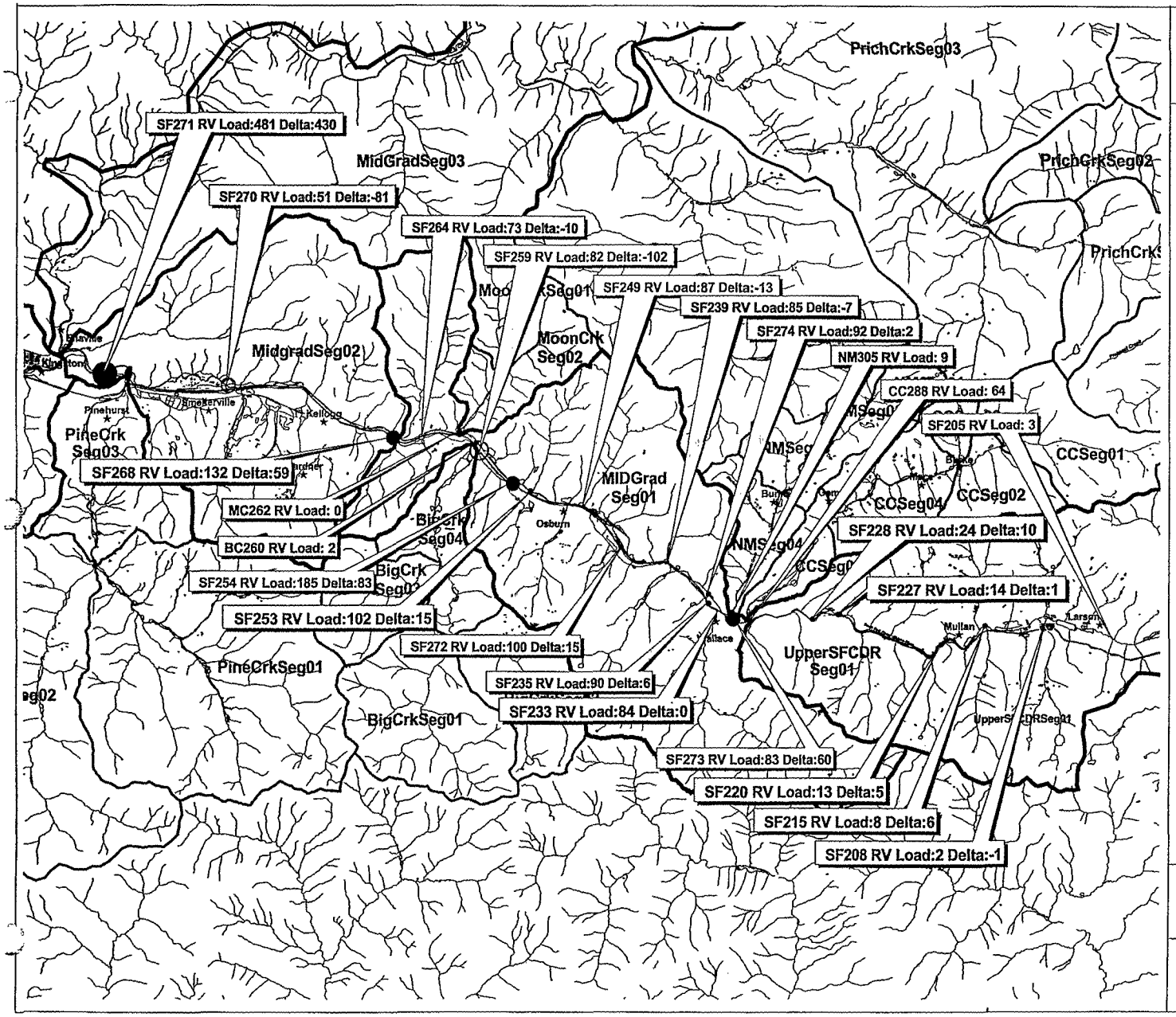


Figure 4.2-5
Upper South Fork Coeur d' Alene River Watershed
Total Lead Mass Loading
Sampling Results May 1998

LEGEND

Sampling Location — Values are lbs/day

SF270 RV Load: 51 Delta: -81

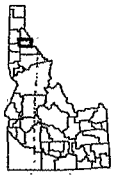
Location Type:

RV: River/Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 160,000

0 — 4 Miles

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

EPA REGION 10

Document Control 4162500.0815.05e
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7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 24, 2001

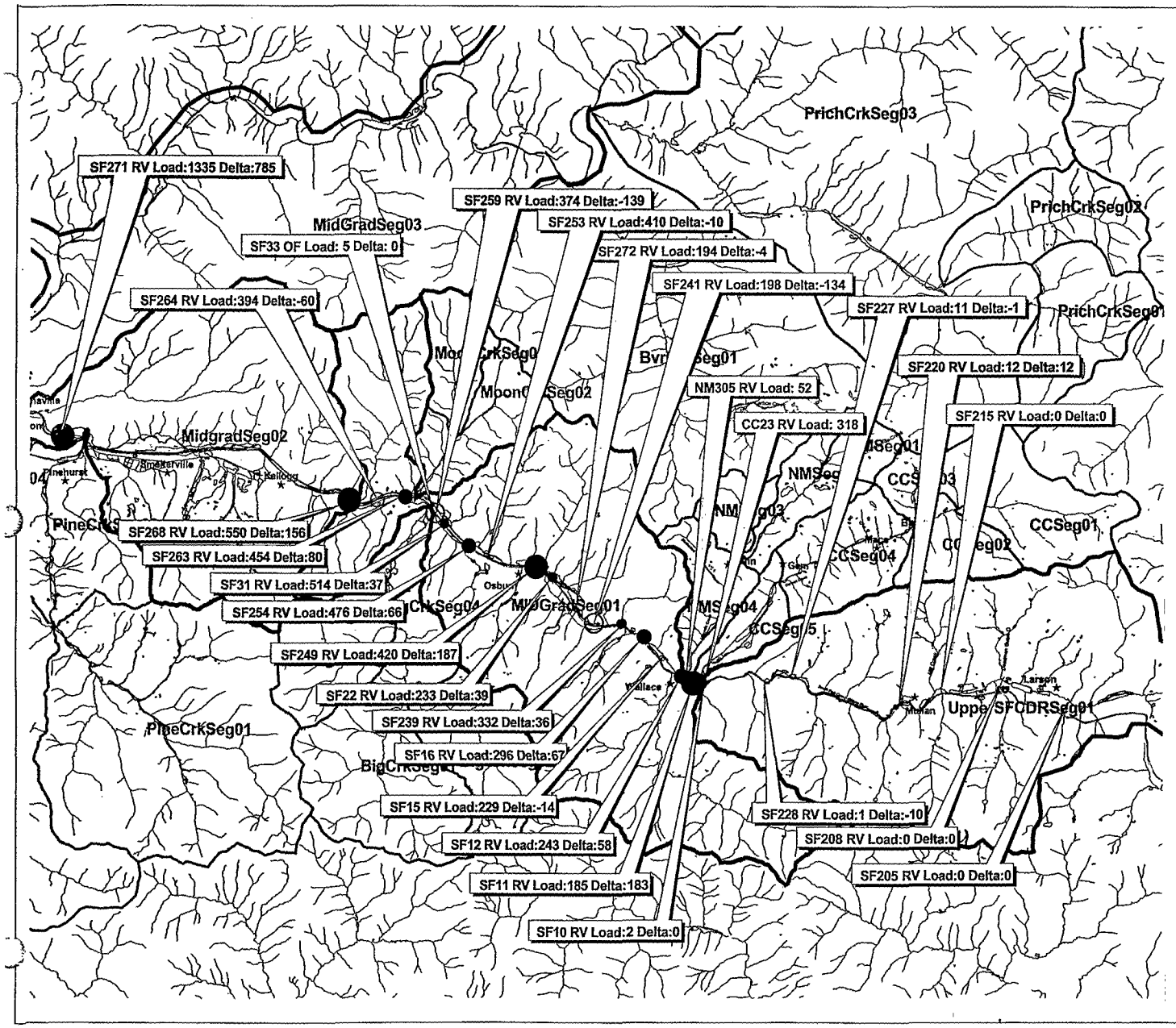


Figure 4.2-6
Upper South Fork Coeur d' Alene River Watershed
Dissolved Zinc Mass Loading
Sampling Results Oct. 1991

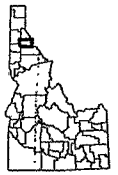
LEGEND

Sampling Location — SF271 RV Load: 5256 Delta: 2919 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location
OF: Outfall Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

EPA REGION 10

Document Control 4162500.6815.05a
Generation 1
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7/24/2001

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Date of Plot: July 24, 2001

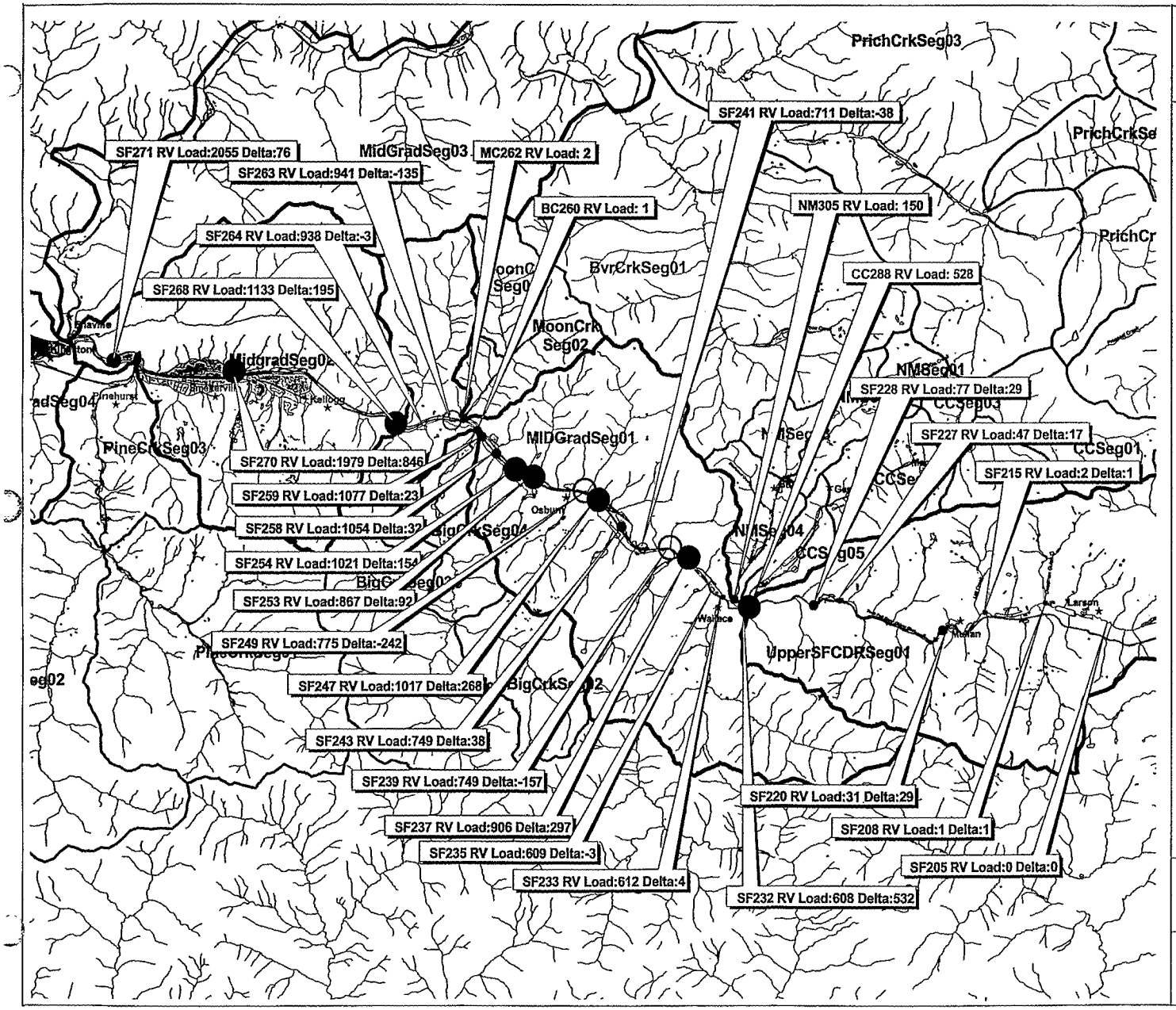


Figure 4.2-7
Upper South Fork Coeur d' Alene River Watershed
Dissolved Zinc Mass Loading
Sampling Results Nov. 1997

LEGEND

Sampling Location — Values are lbs/day

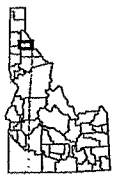
SF271 RV Load: 256 Delta: 178

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

N

027-RI-C0-102Q
Coeur d' Alene RI/FS
RI Report

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Document Control 4162500.8615.05a
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L: Final RI SF-nov97-zinc
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 24, 2001

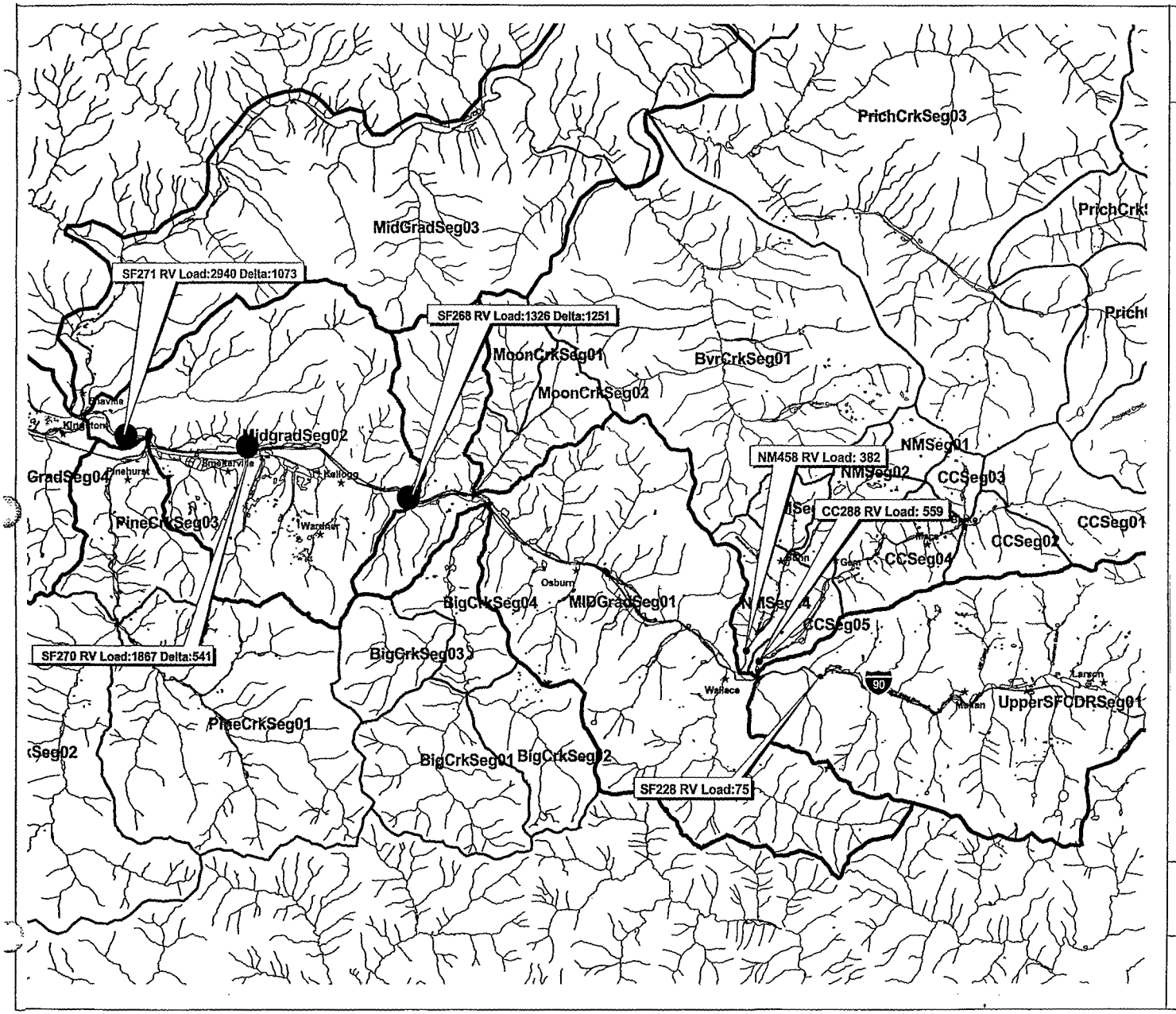


Figure 4.2-8
Upper South Fork Coeur d' Alene River Watershed
Dissolved Zinc Mass Loading
Sampling Results Nov. 1998

LEGEND

Sampling Location — Values are lbs/day

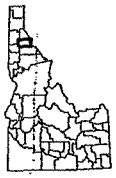
SF 368 RV Load: 1133 Delta: 195

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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L: Final RI SF-nov98-zinc
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 24, 2001

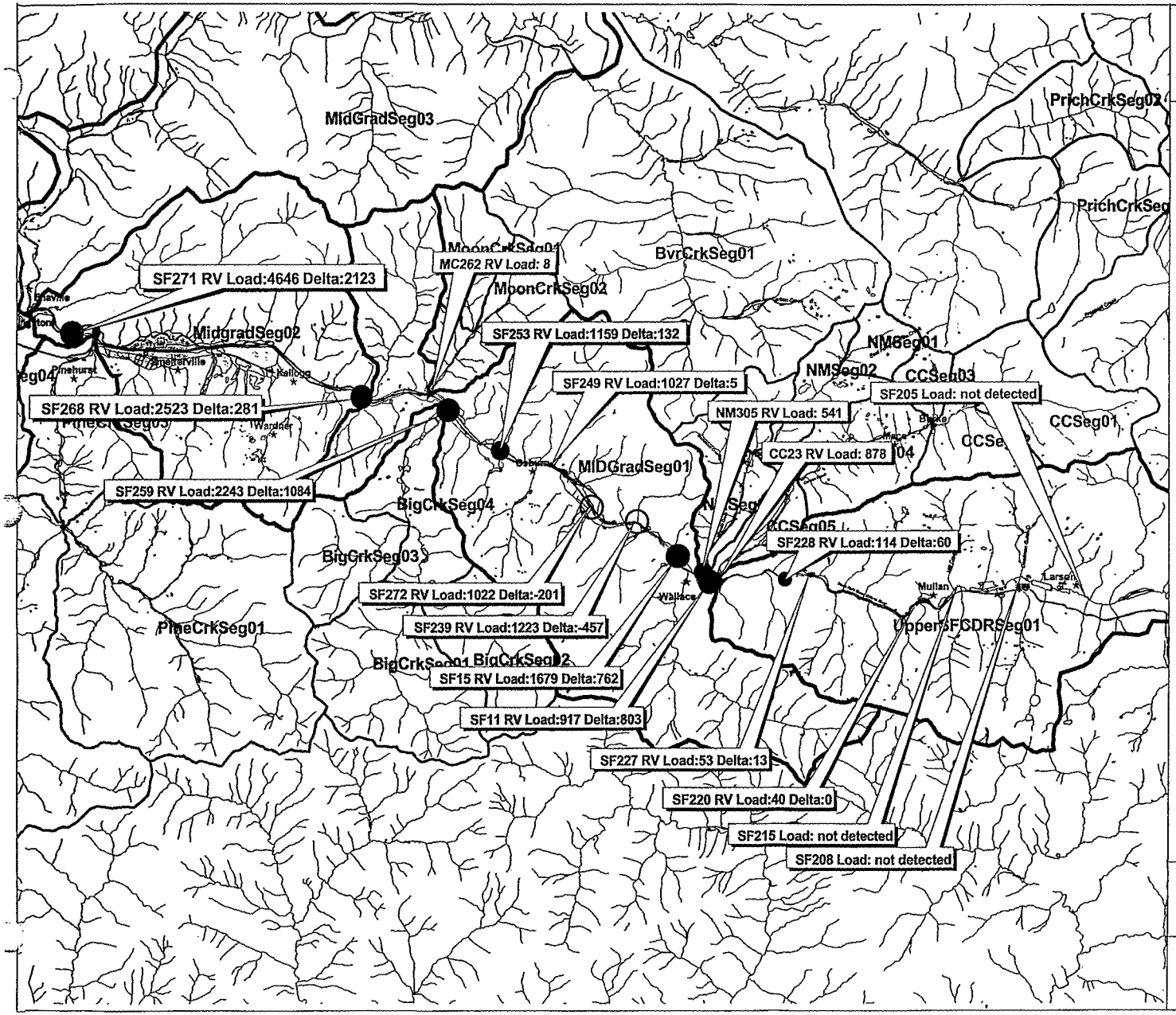


Figure 4.2-9
Upper South Fork Coeur d' Alene River Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1991

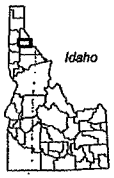
LEGEND

Sampling Location — SF271 RV Load: 4646 Delta: 2123 — Values are lbs/day

Location Type:
RV: River/Stream Sampling Location

(-) Neg. (+) Pos. — Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 0.9
- Delta Range: 1 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150
- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

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REGION 10

Document Control 4162500.8515.05e
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L: Final RI SF-may91-zinc
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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

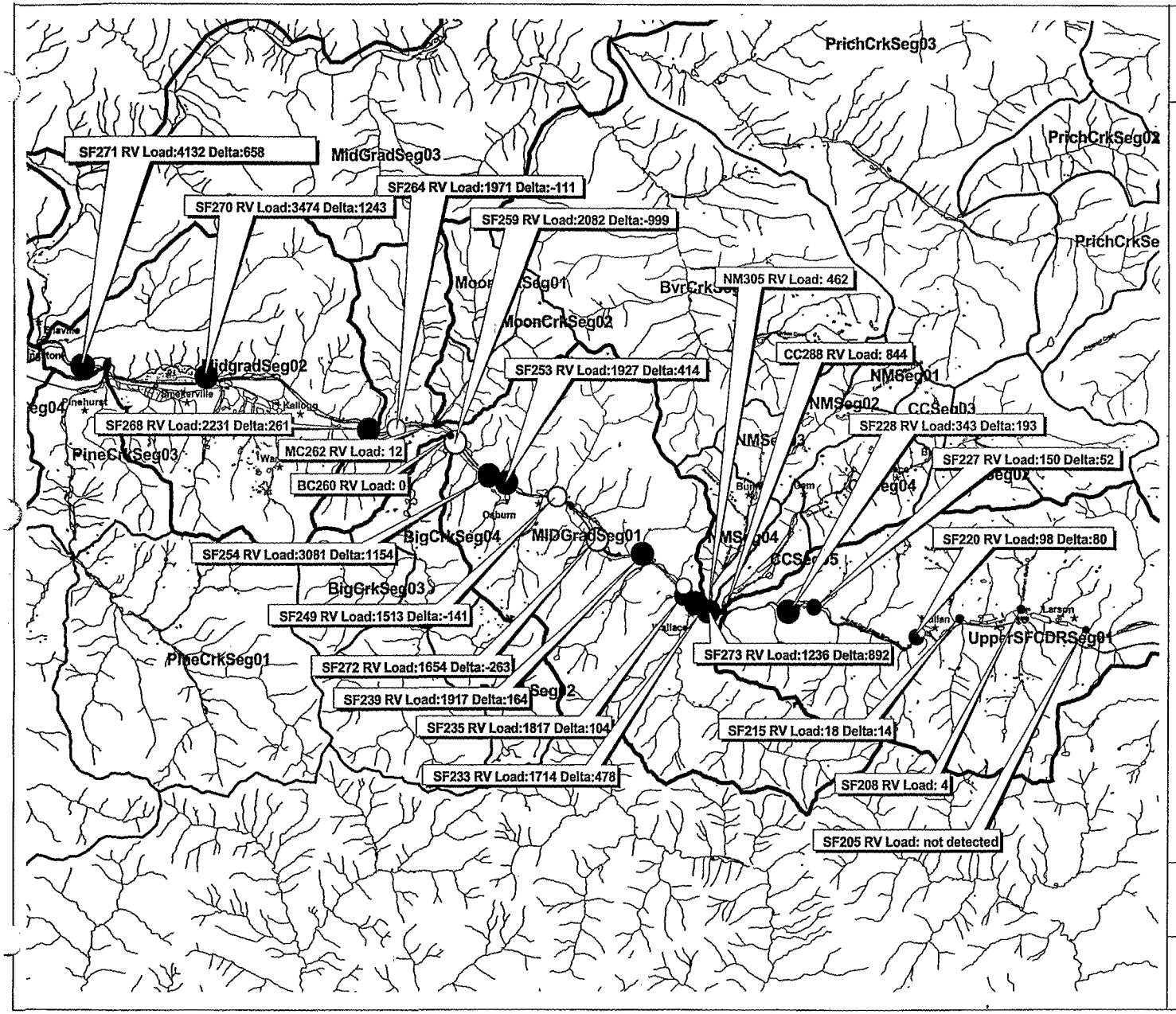


Figure 4.2-10
Upper South Fork Coeur d' Alene River Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1998

LEGEND

Sampling Location — Values are lbs/day

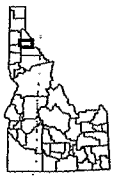
SF271 RV Load: 4182 Delta: 968

Location Type:

RV: River/Stream Sampling Location

(-) Neg.	(+) Pos.	Delta of Mass Load Compared to Preceeding Upstream Sampling Location
		Delta Range: 0 - 0.9
○	•	Delta Range: 1 - 20
○	●	Delta Range: 20 - 40
○	●	Delta Range: 40 - 100
○	●	Delta Range: 100 - 150
○	●	Delta Range: > 150

- Stream
- Interstate 90
- City
- River/Lake
- Midgrad/USFCDR Watershed
- River Segment
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Burueau of Land Management.

SCALE 1: 160,000

0 — 3 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RI Report

EPA REGION 10

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V: SF-may98-zinc
L: Final RI SF-may98-zinc
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone. North American Datum 1983.

Date of Plot: July 24, 2001

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
ALICE MINE	MUL008	1.34	Floodplain waste rock	SW 1	SWD: Sb-1 SWT: Fe-1, Mn-1, Sb-1		
ALMA MINE	MUL048	0.89	Floodplain waste rock				
AMERICAN COMMANDER NO. 1	CH1615	0.28	Upland waste rock				
AMERICAN COMMANDER NO. 2	CH1616	0.66	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
AMERICAN COMMANDER NO.1	MUL036	0.28	Upland waste rock				
AMERICAN COMMANDER NO.2	MUL033	0.66	Floodplain waste rock				
ARGENTA MINE	CH1535	0.30	Upland waste rock				
ARGENTA MINE	MUL075	0.30	Upland waste rock				
ATLAS MINE	CH1580	8.14	Mine Workings/Water, Seeps, Springs and Leachate				
ATLAS MINE	MUL071	8.14	Adit drainage Floodplain waste rock	SW 1	SWD: Cd-1, Pb-1, Zn-1 SWT: Cd-1, Zn-1		
ATLAS MINE (CARBONATE HILL)	CH1541	2.06	Upland waste rock				
ATLAS MINE (CARBONATE HILL)	MUL073	2.06	Upland waste rock				
ATLAS MINE ROCK DUMP	MUL129	1.11	Floodplain waste rock				
BANNER MINE NO. 01	MUL069	0.22	Upland waste rock				
BANNER MINE NO. 02	MUL120	0.34	Floodplain waste rock				
BANNER MINE: NO. 01	CH1531	0.22	Mine Workings/Water, Seeps, Springs and Leachate				
BANNER MINE: NO. 02	CH1530	0.34	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
BEACON LIGHT	CH1661	3.63	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
BEACON LIGHT	LOK017	3.63	Adit drainage Floodplain waste rock				
BITTERROOT PROSPECT	CH1525	0.94	Mine Workings/Water, Seeps, Springs and Leachate				
BITTERROOT PROSPECT	MUL066	0.94	Upland waste rock				
BLUE JAY MINE	CH1527	0.35	Upland waste rock				
BLUE JAY MINE	MUL061	0.35	Upland waste rock				
BORAX MINE	LOK033	0.21					
BOULDER CK QUARRY	CH1669	1.34	Upland waste rock				
BOULDER CK QUARRY	MUL067	1.34	Upland waste rock				
BUILLION MINE	LOK038	0.31					

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BULL FROG MINE	CH1656	0.29	Mine Workings/Water, Seeps, Springs and Leachate				
BULL FROG MINE	THO020	0.29	Floodplain waste rock				
BUTCHER MINE	MUL017	0.54	Upland waste rock				
BUTTE & COEUR D ALENE (IDAHO SILVER)	CH1581	0.27	Upland waste rock				
BUTTE & COEUR D ALENE (IDAHO SILVER)	LOK007	0.27	Upland waste rock (erosion potential)				
BUTTE AND COEUR D ALENE MINE	CH1644	0.79	Mine Workings/Water, Seeps, Springs and Leachate				
BUTTE AND COEUR D ALENE MINE	MUL057	0.79	Upland waste rock (erosion potential)				
CARNEY NO. 1	CH1540	0.34	Mine Workings/Water, Seeps, Springs and Leachate				
CARNEY NO. 2	CH1539	1.14	Mine Workings/Water, Seeps, Springs and Leachate				
CARNEY NO. 3	CH1538	0.89	Upland waste rock				
CARNEY NO.1	MUL080	0.34	Upland waste rock				
CARNEY NO.2	MUL078	1.14	Upland waste rock				
CARNEY NO.3	MUL079	0.89	Upland waste rock				
CENTRAL PROSPECT	CH1529	0.36	Mine Workings/Water, Seeps, Springs and Leachate				
CENTRAL PROSPECT	MUL068	0.36	Upland waste rock				
CHAMPION MINE	MUL096	0.66					
CINCINNATI MINE	CH1617	0.34	Mine Workings/Water, Seeps, Springs and Leachate				
CINCINNATI MINE	MUL031	0.34	Upland waste rock (erosion potential)				
COEUR D ALENE SILVER LEAD MINING CO.	LOK045	0.37	Upland waste rock				
COMET MINE	MUL100	0.69					
COPPER CHIEF MINE	LOK043	0.27					
COPPER KING MINE	CH1632	1.33	Floodplain Waste Rock (Above Cataldo No.& So Fork)				
COPPER KING MINE	MUL052	1.33	Adit drainage Floodplain waste rock	SL 1 SW 2	SST: Pb-1, Zn-1 SWD: Cu-1, Pb-1 SWT: Cd-1, Fe-1, Mn-1, Zn-1	SST: Cu-1 SWT: Cu-1, Pb-1	
COPPER MOUNTAIN MINE	LOK029	0.76					
COPPER PLATE MINE	MUL049	0.30	Upland waste rock (erosion potential)				
COPPER PLATE MINE: ADIT NO. 01	CH1666	0.30	Mine Workings/Water, Seeps, Springs and Leachate				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
COPPER PLATE MINE: ADIT NO. 02	CH1667	0.30	Mine Workings/Water, Seeps, Springs and Leachate				
COPPER PLATE MINE: ADIT NO. 03	CH1633	0.30	Mine Workings/Water, Seeps, Springs and Leachate				
COPPER QUEEN MINE	CH1537	0.64	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
COPPER QUEEN MINE	MUL083	0.64	Floodplain waste rock				
COUGHLIN MINE	CH1650	0.35	Mine Workings/Water, Seeps, Springs and Leachate				
COUGHLIN MINE	MUL056	0.35	Upland waste rock (erosion potential)				
DAISY GULCH OLD LANDFILL	LOK051	1.91	Floodplain artificial fill				
DAISY GULCH TAILINGS POND	CH1583	2.73	Upland tailings				
DAISY GULCH TAILINGS POND	LOK050	2.73	Upland tailings				
DEADMAN GULCH IMPACTED RIPARIAN	MUL150	3.02	Floodplain sediments				
DEADMAN GULCH IMPACTED RIPARIAN	MUL153	1.52	Floodplain sediments	SL 1	SST: Pb-1, Zn-1		
DIANE MINE	LOK034	0.20					
EAST HECLA GROUP	BUR137	0.32	Upland waste rock				
EAST HECLA GROUP	CH1634	0.32	Upland waste rock				
EMMA MAY MINE	LOK032	0.22					
FANNY GREMM MINE	CH1618	1.30	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
FANNY GREMM MINE	MUL023	1.30	Adit drainage Floodplain waste rock				
FOURTH OF JULY MINE	LOK039	2.82					
GEM STATE MINE	CH1584	0.21	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
GEM STATE MINE	MUL063	0.21	Floodplain waste rock				
GOLCONDA MILLSITE	MUL002	5.04	Upland tailings				
GOLCONDA MINESITE	CH1585	3.14	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
GOLCONDA MINESITE	MUL001	3.14	Adit drainage Floodplain waste rock	SW 2	SWT: Cu-1, Fe-2, Pb-2	SWD: Mn-2 SWT: Mn-2	
GOLCONDA TAILINGS	WAL077	6.71	Floodplain sediments Floodplain tailings Groundwater				
GOLD HUNTER COLLAPSED TUNNEL	CH1627	3.72	Upland waste rock				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
GOLD HUNTER COLLAPSED TUNNEL	MUL041	3.72	Upland waste rock				
GOLD HUNTER NO. 5	CH1628	0.58	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
GOLD HUNTER NO. 5	MUL042	0.58	Floodplain waste rock				
GOLD HUNTER NO. 6	CH1586	2.77	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
GOLD HUNTER NO. 6	MUL038	2.77	Floodplain tailings Floodplain waste rock				
GRANADA MINE	CH1596	0.34	Mine Workings/Water, Seeps, Springs and Leachate				
GRANADA MINE	WAL013	0.34	Floodplain waste rock				
GROUSE GULCH IMPACTED RIPARIAN	MUL142	6.86	Floodplain sediments	SW 1	SWD: Mn-1 SWT: Cd-1, Mn-1, Pb-1	SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-1	
GROUSE MINE	CH1609	0.33	Mine Workings/Water, Seeps, Springs and Leachate				
GROUSE MINE	MUL014	0.33	Adit drainage Upland waste rock (erosion potential)	SW 1	SWD: Cd-1, Zn-1 SWT: Pb-1, Zn-1	SWD: Pb-1	
HASH HOUSE MINE	CH1587	0.14	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
HASH HOUSE MINE	LOK010	0.14	Floodplain waste rock				
HOMESTAKE MINE	CH1635	1.15	Mine Workings/Water, Seeps, Springs and Leachate				
HOMESTAKE MINE	MUL045	1.15	Floodplain waste rock				
HORST-POWELL MINE	MUL102	0.40					
HUNTER-SNOWSTORM LODE/UNNAMED PROSP	CH1588	0.46	Upland waste rock				
HUNTER-SNOWSTORM LODE/UNNAMED PROSP	LOK028	0.46	Adit drainage Upland waste rock	SW 1		SWD: Cd-1	
IDAHO COPPER	CH1534	0.46	Upland waste rock				
IDAHO COPPER	MUL074	0.46	Upland waste rock				
IDAHO MONTANA MINING COMPANY	THO021	0.30	Upland waste rock				
IDAHO MONTANA SILVER	LOK041	0.94	Upland waste rock				
IDAHO SILVER NO. 2	LOK008	0.38	Floodplain waste rock				
IDAHO SILVER NO.1	LOK026	0.34	Upland waste rock				
IDAHO SILVER: NO. 02	CH1590	0.34	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
INDEPENDENCE MINE	CH1619	1.21	Floodplain Waste Rock (Above Cataldo No.& So Fork)				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
INDEPENDENCE MINE	MUL021	1.21	Floodplain waste rock				
IRON SPAR MINE	LOK046	0.34					
IVANHOE MINE	CH1610	0.15	Upland waste rock				
IVANHOE MINE	MUL011	0.15	Upland waste rock				
LESLIE MINE	LOK030	0.80					
LEWIS & CLARK GROUP	CH1659	0.76	Upland waste rock				
LEWIS & CLARK GROUP	LOK044	0.76	Upland waste rock				
LIQUIDATOR (EAST HECLA GROUP)	BUR136	0.30	Upland waste rock				
LOST BOOZE MINE	CH1664	0.82	Upland waste rock				
LOST BOOZE MINE	LOK016	0.82	Upland waste rock				
LOTTIE L. MINE	CH1637	0.23	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
LOTTIE L. MINE	MUL047	0.23	Floodplain waste rock				
LOWER GIANT MINE	CH1591	0.77	Upland waste rock				
LOWER GIANT MINE	MUL072	0.77	Adit drainage Upland waste rock	SW 1	SWD: Cu-1 SWT: Cd-1, Mn-1	SWD: Mn-1	
LUCKY BOY NO. 1	CH1668	0.26	Mine Workings/Water, Seeps, Springs and Leachate				
LUCKY BOY NO. 1	LOK006	0.26	Floodplain waste rock				
LUCKY BOY NO. 2	CH1651	0.18	Mine Workings/Water, Seeps, Springs and Leachate				
LUCKY BOY NO. 2	LOK005	0.18	Upland waste rock (erosion potential)				
LUCKY CALUMET NO. 1	CH1652	1.29	Upland waste rock				
LUCKY CALUMET NO. 1	LOK001	1.29	Upland waste rock (erosion potential)				
LUCKY CALUMET NO. 2	CH1653	1.27	Mine Workings/Water, Seeps, Springs and Leachate				
LUCKY CALUMET NO. 2	LOK002	1.27	Upland waste rock (erosion potential)	SW 1			
LUCKY FRIDAY MINE COMPLEX	CH1524	29.00	Mine Workings/Water, Seeps, Springs and Leachate				
LUCKY FRIDAY MINE COMPLEX	CH1670	29.00	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
LUCKY FRIDAY MINE COMPLEX	MUL039	29.00	Upland tailings				
LUCKY FRIDAY ROCK DUMPS	LOK049	3.20	Floodplain waste rock				
LUCKY FRIDAY TAILINGS POND No. 2	MUL037	10.05	Floodplain sediments Floodplain sediments (underlying tailings pond) Floodplain tailings Groundwater				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
LUCKY FRIDAY TAILINGS POND No. 3	MUL020	11.03	Floodplain sediments (underlying tailings pond) Floodplain tailings Groundwater				
LUCKY FRIDAY TAILINGS POND No.1	MUL058	34.72	Floodplain sediments Floodplain sediments (underlying tailings pond) Floodplain tailings Groundwater				
LUCKY SWEDE MINE	LOK040	0.73					
MARY D CLAIM WORKINGS	WAL076	1.70	Floodplain waste rock				
MAYFLOWER MINE	CH1597	2.74	Mine Workings/Water, Seeps, Springs and Leachate				
MAYFLOWER MINE	MUL003	2.74	Upland waste rock				
MILITARY MINE	THO019	0.34	Upland waste rock				
MILL CK IMPACTED RIPARIAN No. 1	MUL149	1.13	Floodplain sediments				
MILL CK IMPACTED RIPARIAN No. 2	MUL145	0.84	Floodplain sediments				
MILL CK IMPACTED RIPARIAN No. 3	MUL141	1.93	Floodplain sediments				
MISSOULA MINE	CH1639	0.94	Mine Workings/Water, Seeps, Springs and Leachate				
MISSOULA MINE	MUL103	0.94	Floodplain waste rock	SL 1 SW 1	SST: Cu-1 SWD: Cd-1, Cu-1 SWT: Cd-1	SWT: Cu-1	
MOE MINE	MUL065	0.31	Floodplain waste rock				
MORNING NO. 1 & NO. 2	CH1646	1.02	Upland waste rock				
MORNING NO. 3	CH1647	1.31	Upland waste rock				
MORNING NO. 4	CH1648	0.99	Upland waste rock				
MORNING NO. 5	CH1649	4.25	Floodplain Waste Rock (Above Cataldo No.& So.Fork)				
MORNING NO.1 & NO.2	MUL026	1.02	Upland waste rock				
MORNING NO 3	MUL146	1.31	Upland waste rock (erosion potential)				
MORNING NO.4	MUL027	0.99	Adit drainage Upland waste rock	SW 1	SWD: Ag-1, Cu-1 SWT: Cd-1, Cu-1, Pb-1	SWD: Cd-1, Mn-1, Pb-1, Zn-1 SWT: Mn-1, Zn-1	
MORNING NO.4 ADJACENT DISTURBANCE	MUL148	0.67	Upland waste rock				
MORNING NO 5	MUL028	4.25	Adit drainage Floodplain waste rock	SW 1	SWT. Cd-1, Mn-1	SWD: Cd-1, Mn-1, Zn-1 SWT: Zn-1	

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
MORNING NO.6	MUL019	17.65	Adit drainage Buildings & structures Floodplain tailings Floodplain waste rock Seep	SW	113	SWD: Cd-5, Pb-2, Zn-3 SWT: Cd-48, Fe-1, Pb-101, Zn-97	SWD: Mn-1 SWT: Mn-4, Pb-2, Zn-11	SWD: Mn-1
MULLAN GRAVEL PIT	MUL130	1.77	Upland waste rock					
MULLAN GROUP	CH1640	0.37	Upland waste rock					
MULLAN GROUP	MUL050	0.37	Upland waste rock					
MULLAN METALS MINE	MUL018	0.60	Floodplain waste rock					
NATIONAL LEAD MINING CO.	MUL010	0.32	Upland waste rock					
NATIONAL MILLSITE	MUL131	1.40	Upland tailings					
NATIONAL MILLSITE ADJACENT TAILINGS	MUL132	0.37	Upland tailings					
NATIONAL MINE	CH1641	3.16	Upland waste rock					
NATIONAL MINE	MUL053	3.16	Adit drainage Upland waste rock (erosion potential)					
NEW YORK MINE	CH1592	0.38	Upland waste rock					
NEW YORK MINE	MUL155	0.38	Upland waste rock					
NONPAREIL GROUP	CH1533	0.24	Upland waste rock					
NONPAREIL GROUP	MUL077	0.24	Upland waste rock					
NORANDA (SUPERIOR SILVER) MINE	MUL076	0.35	Upland waste rock					
NORTH FRANKLIN MINE	CH1620	0.85	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
NORTH FRANKLIN MINE	MUL029	0.85	Floodplain waste rock					
PANDORA MINE	CH1660	0.48	Mine Workings/Water, Seeps, Springs and Leachate					
PANDORA MINE	LOK014	0.48	Upland waste rock					
PEACOCK COPPER MINE	LOK037	0.93						
PILOT MINE	CH1642	1.20	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
PILOT MINE	MUL051	1.20	Floodplain waste rock					
PLYMOUTH NO. 4	MUL040	0.19	Upland waste rock					
PORTAL CLAIM TUNNEL	CH1526	0.17	Mine Workings/Water, Seeps, Springs and Leachate					
PORTAL CLAIM TUNNEL	MUL156	0.17	Upland waste rock					
PRINCETON MAGNA MINE	CH1665	0.66	Upland waste rock					

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
PRINCETON MAGNA MINE	LOK019	0.66	Adit drainage Upland waste rock	SW	1	SWT: Cu-1, Fe-1		
PRINCETON MINE	CH1546	0.54	Mine Workings/Water, Seeps, Springs and Leachate					
PRINCETON MINE	LOK020	0.54	Upland waste rock	SW	1	SWD: Cu-1 SWT: Cd-1		
REINDEER QUEEN MINE	CH1536	0.76	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
REINDEER QUEEN MINE	MUL081	0.76	Adit drainage Floodplain waste rock	SL SW	1 2	SST: As-1, Fe-1, Mn-1 SWD: Cu-1 SWT: Cd-1	SST: Cu-1	
ROCK CREEK MINE	CH1545	0.21	Mine Workings/Water, Seeps, Springs and Leachate					
ROCK CREEK MINE	MUL060	0.21	Floodplain waste rock					
ROCK CREEK MINE ROCK DUMP	MUL059	0.94	Floodplain waste rock	SW	2			
SCENIC SILVER GROUP	MUL101	0.30						
SF CDA RIVER IMPACTED FLOODPLAIN: NO. 1	WAL038	149.00	Floodplain sediments Groundwater	SD SW	7 50	SDT: Ag-2, As-3, Cd-6, Cu-7, Fe-2, Hg-3, Mn-5, Sb-1, Zn-6 SWD: Cd-35, Mn-3, Pb-28, Zn-41 SWT: Cd-2, Cu-5, Fe-1, Mn-5, Pb-9, Sb-1, Zn-48	SDT: Cd-1, Hg-1, Mn-1, Pb-6, Zn-1 SWD: Cd-2, Pb-1, Zn-1 SWT: Zn-2	SDT: Pb-1
SHAMROCK MINE	LOK035	0.22						
SHOSHONE SILVER MINE	MUL097	1.01						
SILDEX MINE	LOK031	2.55						
SILVER CABLE MINE	CH1544	1.32	Mine Workings/Water, Seeps, Springs and Leachate					
SILVER CABLE MINE	LOK024	1.32	Adit drainage Upland waste rock					
SILVER CLIFF	CH1543	0.56	Upland waste rock					
SILVER CLIFF	LOK018	0.56	Upland waste rock	SW	1	SWD: Cd-1, Cu-1 SWT: Cd-1		
SILVER REEF MINE	CH1630	0.73	Mine Workings/Water, Seeps, Springs and Leachate					
SILVER REEF MINE	MUL043	0.73	Floodplain waste rock					
SILVER SHADOW GROUP	MUL099	2.11						
SILVER SHAFT	MUL009	0.25	Upland waste rock (erosion potential)					
SNOWSHOE NO. 1	CH1654	0.24	Upland waste rock					
SNOWSHOE NO 1	LOK003	0.24	Upland waste rock					

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
SNOWSHOE NO. 2	CH1655	0.71	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
SNOWSHOE NO. 2	LOK004	0.71	Adit drainage Floodplain waste rock	SW	1	SWD: Cd-1 SWT: Cd-1		
SNOWSTORM APEX	LOK048	0.27	Floodplain waste rock					
SNOWSTORM NO. 1	CH1593	1.28	Mine Workings/Water, Seeps, Springs and Leachate					
SNOWSTORM NO. 1	LOK013	1.28	Upland waste rock					
SNOWSTORM NO. 2	LOK012	1.45	Upland waste rock					
SNOWSTORM NO. 3	CH1577	1.81	Mine Workings/Water, Seeps, Springs and Leachate					
SNOWSTORM NO. 3	LOK011	1.81	Adit drainage Floodplain waste rock	SW	2	SWD: Mn-1, Sb-1 SWT: Sb-1	SWD: Cu-1	SWD: Cu-1 SWT: Cu-2
SNOWSTORM NO. 4	CH1579	0.92	Mine Workings/Water, Seeps, Springs and Leachate					
SNOWSTORM NO. 4	LOK009	0.92	Floodplain waste rock					
SQUARE DEAL MINE	CH1598	0.73	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
SQUARE DEAL MINE	MUL006	0.73	Floodplain waste rock	SW	2			
STAR 1200 LEVEL	CH1613	6.75	Floodplain Waste Rock (Above Cataldo No.& So.Fork)					
STAR 1200 LEVEL	MUL012	6.75	Adit drainage Floodplain waste rock	SW	2	SWT: Cu-1	SWD: Mn-1 SWT: Cd-1, Mn-1, Pb-1	SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-1
STEPHENS PEAK MINES, INC.	MUL092	7.53						
SUMNER MINE	MUL098	0.41						
SUNSHINE PREMIER MINE	CH1621	0.36	Mine Workings/Water, Seeps, Springs and Leachate					
SUNSHINE PREMIER MINE	MUL022	0.36	Upland waste rock (erosion potential)					
TUCKER GROUP	CH1542	2.26	Upland waste rock					
TUCKER GROUP	LOK047	2.26	Upland waste rock					
UNIDENTIFIED DISTURBANCE	LOK015	0.12	Upland waste rock					
UNITED LEAD ZINC MINE	CH1599	0.82	Mine Workings/Water, Seeps, Springs and Leachate					
UNITED LEAD ZINC MINE	MUL004	0.82	Floodplain waste rock					
UNNAMED ADIT	LOK027	0.19	Upland waste rock					
UNNAMED ADIT	LOK052	0.31	Upland waste rock					
UNNAMED ADIT	LOK053	0.31	Upland waste rock (erosion potential)					
UNNAMED ADIT	LOK054	0.13	Upland waste rock					

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
UNNAMED ADIT	MUL016	0.55	Upland waste rock				
UNNAMED ADIT	MUL054	0.94	Adit drainage Upland waste rock (erosion potential)	SW 1	SWD: Cu-1 SWT: Cd-1		
UNNAMED ADIT	MUL062	0.25	Upland waste rock				
UNNAMED ADIT	MUL064	0.56	Upland waste rock				
UNNAMED ADIT	MUL082	0.25	Upland waste rock				
UNNAMED ADIT	MUL104	0.20					
UNNAMED ADIT	MUL114	0.22	Upland waste rock				
UNNAMED ADIT	MUL115	0.24	Upland waste rock				
UNNAMED ADIT	MUL116	0.18	Upland waste rock				
UNNAMED ADIT	MUL117	0.28	Upland waste rock				
UNNAMED ADIT	MUL119	0.28	Upland waste rock (erosion potential)	SL 1	SST: As-1, Fe-1, Mn-1		SST: Pb-1
UNNAMED ADIT	MUL121	0.16	Upland waste rock				
UNNAMED ADIT	MUL122	0.21	Upland waste rock				
UNNAMED ADIT	MUL124	0.18	Upland waste rock				
UNNAMED ADIT	MUL126	0.22	Upland waste rock				
UNNAMED ADIT	MUL127	0.23	Upland waste rock				
UNNAMED ADIT	MUL128	0.19	Upland waste rock				
UNNAMED ADIT	MUL133	0.25	Upland waste rock				
UNNAMED ADIT	MUL134	0.58	Upland waste rock				
UNNAMED ADIT	MUL135	0.18	Upland waste rock (erosion potential)				
UNNAMED ADIT	MUL136	0.12	Upland waste rock (erosion potential)				
UNNAMED ADIT	MUL137	0.36	Upland waste rock				
UNNAMED ADIT	MUL139	0.24	Upland waste rock (erosion potential)				
UNNAMED ADIT	MUL140	0.17	Upland waste rock				
UNNAMED ADIT	MUL143	0.36	Upland waste rock				
UNNAMED ADIT	MUL144	0.24	Upland waste rock				
UNNAMED ADIT	MUL147	0.19	Upland waste rock				
UNNAMED ADIT	MUL151	0.25	Upland waste rock				
UNNAMED ADIT	MUL152	0.17	Upland waste rock				
UNNAMED ADIT	MUL154	1.74	Upland waste rock				
UNNAMED ADIT	MUL157	0.11	Upland waste rock				
UNNAMED PROSPECT	CH1643	0.35	Mine Workings/Water, Seeps, Springs and Leachate				
UNNAMED PROSPECT	LOK021	1.14	Upland waste rock				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
UNNAMED PROSPECT	LOK022	1.47	Upland waste rock				
UNNAMED PROSPECT	LOK025	0.38	Upland waste rock				
UNNAMED PROSPECT	MUL032	0.34	Upland waste rock				
UNNAMED PROSPECT	MUL046	0.35	Upland waste rock				
UNNAMED PROSPECT	MUL084	1.13	Upland waste rock				
UNNAMED PROSPECT	MUL089	0.70					
UNNAMED PROSPECT	MUL090	0.28					
UNNAMED PROSPECT	MUL091	0.42					
UNNAMED PROSPECT	MUL093	0.48					
UNNAMED PROSPECT	MUL094	0.38					
UNNAMED PROSPECT	MUL095	0.54					
UNNAMED PROSPECT	MUL105	0.21					
UNNAMED PROSPECT	MUL106	0.32					
UNNAMED PROSPECT	MUL107	0.13	Upland waste rock				
UNNAMED PROSPECT	MUL108	0.14	Upland waste rock				
UNNAMED PROSPECT	MUL109	0.17	Upland waste rock				
UNNAMED PROSPECT	MUL110	0.14	Upland waste rock				
UNNAMED PROSPECT	MUL111	0.19	Upland waste rock				
UNNAMED PROSPECT	MUL112	0.18	Upland waste rock				
UNNAMED PROSPECT	MUL113	0.21	Upland waste rock				
UNNAMED PROSPECT	MUL123	0.15	Upland waste rock				
UNNAMED PROSPECT	MUL125	0.25	Upland waste rock				
UNNAMED PROSPECT	MUL138	0.81	Upland waste rock				
UPPER GIANT PROSPECT	CH1528	0.32	Upland waste rock				
UPPER GIANT PROSPECT	MUL118	0.32	Upland waste rock				
VINDICATOR MINE	CH1594	2.61	Mine Workings/Water, Seeps, Springs and Leachate				
VINDICATOR MINE	MUL055	2.61	Upland waste rock				
WALL STREET MINE	CH1622	0.36	Mine Workings/Water, Seeps, Springs and Leachate				
WALL STREET MINE	MUL030	0.36	Floodplain waste rock				
WE LIKE MINE	CH1614	0.53	Upland waste rock				
WE LIKE MINE	MUL013	0.53	Upland waste rock (erosion potential)				
WEST FEDERAL GROUP	CH1600	0.34	Upland waste rock				
WEST FEDERAL GROUP	MUL005	0.34	Upland waste rock				

Table 4.1-1
Potential Source Areas Within Upper South Fork - segment UpperSFCDRSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
WEST STAR MINE	CH1400	9.34	Upland waste rock				
WEST STAR MINE	MUL015	9.34	Upland waste rock (erosion potential)				
WEST STAR MINE: ADIT NO. 01	CH1645	9.34	Mine Workings/Water, Seeps, Springs and Leachate				
WEST STAR MINE: ADIT NO. 02	CH1399	9.34	Mine Workings/Water, Seeps, Springs and Leachate				
WESTERN SILVER LEAD	CH1595	0.29	Upland waste rock				
WESTERN SILVER LEAD	WAL068	0.29	Upland waste rock				
WONDER MINE	MUL007	0.95	Upland waste rock (erosion potential)				
WONDERFUL MINE	LOK036	0.32					
YOLANDE PROSPECT No. 1	MUL035	0.30	Upland waste rock				
YOLANDE PROSPECT No. 2	MUL034	0.44	Upland waste rock				
YOLANDE PROSPECT: NO. 01	CH1623	0.30	Upland waste rock				
YOLANDE PROSPECT: NO. 02	CH1624	0.44	Mine Workings/Water, Seeps, Springs and Leachate				
YOU LIKE MINE	CH1625	1.12	Upland waste rock				
YOU LIKE MINE	MUL024	1.12	Adit drainage Upland waste rock				
YOU LIKE MINE UPPER WORKINGS	CH1626	1.01	Upland waste rock				
YOU LIKE MINE UPPER WORKINGS	MUL025	1.01	Upland waste rock				

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.1.2-1
Adit and Seep Data Summary

BLM ID	Source Name	Average Discharge (cfs)	Maximum Discharge (cfs)	Average Total Zinc Concentration (µg/l)	Average Total Zinc Load (lbs/day)
Adits					
MUL012	Star 1200 Level	0.43	0.70	7,010	16
MUL019	Morning No. 6	1.18	1.85	167	1.1
MUL014	Grouse Mine	1.82	1.82	84	0.82
MUL028	Morning No. 5	0.0547	0.088	1,616	0.48
LOK011	Snowstrom No. 3	5.74	12	12	0.37
MUL027	Morning No. 4	0.0152	0.0152	950	0.078
MUL053	National Mine	0.174	0.174	35	0.033
MUL052	Copper King	0.084	0.112	40	0.018
MUL001	Golconda	0.0304	0.0388	18	0.0029
MUL054	Unnamed adit	0.007	0.007	51	0.0019
LOK004	Snowshoe No. 2	0.112	0.112	3	0.0018
MUL072	Lower Giant	0.0223	0.0223	3	0.00036
MUL081	Reindeer Queen	0.0075	0.011	8	0.00032
LOK017	Beacon Light	0.0045	0.0045	3	0.000073
LOK019	Princeton Magna	0.0003	0.0003	21	0.000034
LOK024	Silver Cable	No data	No data	1,100	No discharge data
LOK028	Hunter-Snowstorm Lode	No data	No data	10	No discharge data
MUL023	Fanny Gremm	No data	No data	40	No discharge data
MUL024	You Like	No data	No data	2,310	No discharge data
MUL071	Atlas	No data	No data	201	No discharge data
LOK002	Lucky Calumet No. 2	No data	No data	No data	No data
LOK008	Idaho Silver No. 2	No data	No data	No data	No data
LOK014	Pandora	No data	No data	No data	No data
MUL006	Square Deal	No data	No data	No data	No data
MUL008	Alice	No data	No data	No data	No data
MUL013	We Like	No data	No data	No data	No data
MUL103	Missoula	No data	No data	No data	No data
Seeps					
MUL019	Morning No. 6 waste rock	1.71	2.37	116	1.1

Notes:
Data compiled from the Restorations Alternative Plan (Gearheart et al. 1999). See Appendix J.
cfs - cubic feet per second
µg/l - micrograms per liter
lbs/day - pounds per day

Table 4.2-1
Mass Loading Upper South Fork

Location	Sample No.	Upper SFCDR Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead Conc. (µg/l)	Total Lead Load (lbs/day)	Total Lead Delta[a] (lbs/day)	Dissolved Zinc Conc. (µg/l)	Dissolved Zinc Load (lbs/day)	Dissolved Zinc Delta[a] (lbs/day)
SF220	172048	1	RV	15-May-91	276.3	0.0	7	10.4	0	27	40.1	0
SF227	172049	1	RV	15-May-91	241.6	-34.7	7	9.1	-1	41	53.3	13
SF228	172050	1	RV	16-May-91	391.6	150.0	10	21.1	12	54	113.8	60
SF11	172051	*	RV	15-May-91	518.2	126.6	16	44.6	24	329	917.2	803
SF15	172054	*	RV	15-May-91	761.3	243.1	15	61.4	17	410	1679.3	762
SF239	172056	*	RV	15-May-91	626	-135.3	19	64.0	3	363	1222.5	-457
SF272	172058	*	RV	14-May-91	532.1	-93.9	26	74.4	10	357	1022.0	-201
SF249	172062	*	RV	14-May-91	513.3	-18.8	31	85.6	11	372	1027.3	5
SF253	172065	*	RV	14-May-91	624.5	111.2	21	70.6	-15	345	1159.1	132
SF259	172066	*	RV	14-May-91	920.2	295.7	34	168.3	98	453	2242.7	1084
SF268	172005	*	RV	15-May-91	1040	119.8	14	78.3	-90	451	2523.4	281
SF271	172000	*	RV	15-May-91	1700	660.0	28	256.1	178	508	4646.2	2123
SF205	172071	1	RV	04-Oct-91	6.47	0.0	1	0.0	0	0	0.0	0
SF208	172072	1	RV	04-Oct-91	11.8	5.3	2	0.1	0	0	0.0	0
SF215	172073	1	RV	04-Oct-91	17.8	6.0	2	0.2	0	0	0.0	0
SF220	172075	1	RV	04-Oct-91	21.6	3.8	26	3.0	3	106	12.3	12
SF227	172076	1	RV	04-Oct-91	26.6	5.0	12	1.7	-1	77	11.0	-1
SF228	172077	1	RV	04-Oct-91	25.2	-1.4	11	1.5	0	10	1.4	-10
SF10	172078	*	RV	03-Oct-91	24.1	-1.1	6	0.8	-1	13	1.7	0
SF11	172080	*	RV	03-Oct-91	41.3	17.2	26	5.8	5	831	184.6	183
SF12	172081	*	RV	03-Oct-91	44.3	3.0	23	5.5	0	1020	243.1	58
SF15	172085	*	RV	03-Oct-91	46.2	1.9	20	5.0	-1	923	229.4	-14
SF16	172086	*	RV	03-Oct-91	53.5	7.3	19	5.5	0	1030	296.5	67
SF239	172088	*	RV	03-Oct-91	56.1	2.6	19	5.7	0	1100	332.0	36

Table 4.2-1 (Continued)
Mass Loading Upper South Fork

Location	Sample No.	Upper SFCDR Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead			Dissolved Zinc		
							Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)	Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)
SF241	172089	*	RV	02-Oct-91	56.2	0.1	21	6.3	1	656	198.3	-134
SF272	172091	*	RV	02-Oct-91	55	-1.2	22	6.5	0	656	194.1	-4
SF22	172092	*	RV	02-Oct-91	51.8	-3.2	19	5.3	-1	837	233.3	39
SF249	172096	*	RV	03-Oct-91	51.7	-0.1	17	4.7	-1	1510	420.0	187
SF253	172098	*	RV	02-Oct-91	50.5	-1.2	20	5.4	1	1510	410.3	-10
SF254	172099	*	RV	02-Oct-91	57.5	7.0	18	5.6	0	1540	476.4	66
SF31	172100	*	RV	02-Oct-91	61.2	3.7	18	5.0	0	1560	513.6	37
SF259	172101	*	RV	01-Oct-91	50.8	-10.4	20	5.5	0	1370	374.4	-139
SF263	172105	*	RV	01-Oct-91	72.8	22.0	14	5.5	0	1160	454.3	80
SF264	172106	*	RV	01-Oct-91	66	-6.8	42	14.9	9	1110	394.1	-60
SF268	172107	*	RV	01-Oct-91	67.3	1.3	14	5.1	-10	1520	550.4	156
SF271	172112	*	RV	01-Oct-91	94	26.7	20	10.1	5	2640	1335.1	785
SF33	172102	*	OF	01-Oct-91	4.02	-	2	0.0	-	240	5.2	-
SF205	46540	1	RV	11-May-98	146	0.0	3.6	2.8	0	0	0.0	0
SF208	46533	1	RV	09-May-98	114	-32.0	2.7	1.7	-1	6	3.7	-
SF215	46538	1	RV	10-May-98	428	314.0	3.4	7.8	6	7.6	17.5	14
SF220	46537	1	RV	10-May-98	432	4.0	5.8	13.5	5	42.2	98.1	81
SF227	46536	1	RV	10-May-98	435	3.0	6	14.0	1	64.3	150.5	52
SF228	46534	1	RV	10-May-98	859	424.0	5.1	23.6	10	74.3	343.4	193
SF273	46554	*	RV	13-May-98	776	-83.0	20	83.5	60	296	1235.8	892
SF233	46551	*	RV	13-May-98	719	-57.0	21.7	83.9	0	443	1713.6	478
SF235	46555	*	RV	13-May-98	918	199.0	18.2	89.9	6	368	1817.5	104
SF274	46552	*	RV	13-May-98	883	-35.0	19.3	91.7	2	369	1752.9	-65
SF239	46550	*	RV	13-May-98	865	-18.0	18.2	84.7	-7	412	1917.3	164
SF272	46549	*	RV	12-May-98	899	34.0	20.6	99.6	15	342	1654.1	-263

Table 4.2-1 (Continued)
Mass Loading Upper South Fork

Location	Sample No.	Upper SFCDR Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead			Dissolved Zinc		
							Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)	Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)
SF249	46547	*	RV	12-May-98	758	-141.0	21.4	87.3	-13	371	1513.0	-141
SF253	46545	*	RV	12-May-98	865	107.0	21.9	101.9	15	414	1926.6	414
SF254	46546	*	RV	12-May-98	1390	525.0	24.7	184.7	83	412	3081.0	1154
SF259	46544	*	RV	12-May-98	902	-488.0	17	82.5	-102	429	2081.8	-999
SF264	46579	*	RV	16-May-98	776	-126.0	17.4	72.6	-10	472	1970.5	-111
SF268	46543	*	RV	11-May-98	1280	504.0	19.1	131.5	59	324	2231.2	261
SF270	46542	*	RV	11-May-98	1230	-50.0	7.7	51.0	-81	525	3474.1	1243
SF271	46541	*	RV	11-May-98	1530	300.0	58.4	480.7	430	502	4132.2	658
SF205	168411	1	RV	10-Nov-97	13.5	0.0	0.27	0.0	0	6.78	0.5	0
SF208	168414	1	RV	10-Nov-97	21.5	8.0	2.3	0.3	0	10	1.2	1
SF215	168421	1	RV	09-Nov-97	34.4	12.9	32.8	6.1	6	11.4	2.1	1
SF220	168425	1	RV	08-Nov-97	42.2	7.8	8.4	1.9	-4	135	30.6	29
SF227	168432	1	RV	07-Nov-97	53.7	11.5	11	3.2	1	164	47.4	17
SF228	168433	1	RV	07-Nov-97	73.7	20.0	7.3	2.9	0	193	76.5	29
SF232	168437	*	RV	09-Nov-97	86.3	12.6	36.8	17.1	14	1310	608.2	532
SF233	168438	*	RV	09-Nov-97	85.5	-0.8	30.6	14.1	-3	1330	611.8	4
SF235	168440	*	RV	08-Nov-97	111	25.5	49.1	29.3	15	1020	609.1	-3
SF237	168411	*	RV	08-Nov-97	149	38.0	32.1	25.7	-4	1130	905.8	297
SF239	168414	*	RV	07-Nov-97	118	-31.0	43.3	27.5	2	1180	749.1	-157
SF241	168421	*	RV	07-Nov-97	119	1.0	40.8	26.1	-1	1110	710.6	-38
SF243	168448	*	RV	08-Nov-97	120	1.0	31.6	20.4	-6	1160	748.9	38
SF247	168451	*	RV	07-Nov-97	150	30.0	31.2	25.2	5	1260	1016.8	268
SF249	168453	*	RV	06-Nov-97	121	-29.0	30.8	20.1	-5	1190	774.7	-242
SF253	168456	*	RV	06-Nov-97	131	10.0	26.8	18.9	-1	1230	866.9	92
SF254	168457	*	RV	06-Nov-97	146	15.0	27.1	21.3	2	1300	021.1	154

Table 4.2-1 (Continued)
Mass Loading Upper South Fork

Location	Sample No.	Upper SFCDR Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead			Dissolved Zinc		
							Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)	Conc. (µg/l)	Load (lbs/day)	Delta[a] (lbs/day)
SF258	168461	*	RV	06-Nov-97	144	-2.0	25.4	19.7	-2	1360	1053.6	32
SF259	168462	*	RV	06-Nov-97	145	1.0	22.3	17.4	-2	1380	1076.5	23
SF263	168466	*	RV	05-Nov-97	162	17.0	22	19.2	2	1080	941.3	-135
SF264	168467	*	RV	05-Nov-97	163	1.0	19.9	17.5	-2	1070	938.3	-3
SF268	168471	*	RV	05-Nov-97	177	14.0	19.3	18.4	1	1190	1133.2	195
SF270	168473	*	RV	04-Nov-97	183	6.0	30.6	30.1	12	2010	1978.9	846
SF271	168474	*	RV	04-Nov-97	248	65.0	28.2	37.6	7	1540	2054.7	76
SF228	202431	1	RV	24-Nov-98	49.7	0.0	15	4.0	0	282	75.4	0
SF268	202431	*	RV	24-Nov-98	156	106.3	14	11.7	8	1580	1326.1	1251
SF270	202432	*	RV	24-Nov-98	139.4	-16.6	38	28.5	17	2490	1867.4	541
SF271	202433	*	RV	24-Nov-98	297	157.6	35	55.9	27	1840	2940.1	1073

[a]The Delta value reported at a sample location is the difference between Mass load at that location and the next upstream Sample location, except for side streams and adits which are the mass load at that location.

* : Sample Location in CSM2, Segments MidGradSeg01 and MidGradSeg02

- : Mass Load or Delta not calculated

RV: River Sample

OF: Outfall Sample

CFS: Cubic feet per Second

µg/l: Micrograms per liter

lbs/day: pounds per day

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Upper South Fork Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for this segment, as presented in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in the Upper South Fork Watershed is presented in Section 5.4.

5.1 INTRODUCTION

The Upper South Fork Watershed contributes significant quantities of cadmium, lead, zinc, and other metals to the South Fork. The lowest and highest dissolved cadmium, lead, and zinc and total lead loadings measured during six sampling events (from October 1991 to May 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2. Data and associated calculations are included in Appendix C.

Data were evaluated for two separate sampling locations. Only sampling locations with 10 or more individual data points for each parameter of interest were evaluated. The two sampling locations, in order from upstream to downstream, are SF220 and SF228. Sampling locations are shown on Figure 5.2-1. The first, and most upgradient, sampling location evaluated, SF220, is

immediately downstream of Mullan. The second sampling location, SF228, is situated a couple of river miles upstream of Wallace and immediately downstream of the Golconda tailings.

River stretches bracketed by sampling locations are designated reaches. For example, the portion of the Upper South Fork lying between sampling locations SF220 and SF228 is called a reach. Accordingly, there is one reach encompassed by the two sampling locations.

5.2.1 Estimated Discharge

An example of the lognormal distribution of discharge data at sampling location SF228 at is shown in Figure 5.2-2. Data from sampling location SF228 are used throughout this discussion for consistency of presentation and because more data are available at this location than at other locations. In Figure 5.2-2, discharge (in cfs) is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a variable (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative distribution function is plotted versus the normal standard variate in Figure 5.2-3. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-2, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-3. For example, for a discharge of 100 cfs, the normal standard variate is approximately 0.4 (Figure 5.2-2). Looking on Figure 5.2-3, this value corresponds to a cumulative probability of approximately 0.66; therefore, approximately 66 percent of the time, discharges at this location will be 100 cfs or less.

The probability distribution function (PDF) shown in Figure 5.2-2 is a predictive tool that can be used to estimate the expected discharge and provide a quantitative estimate of the probability that the observed discharge will not exceed a given value. Conversely, one can find the estimated discharge rate having a specified probability of exceedance or non-exceedance by the observed discharge.

As shown in Figure 5.2-2, there is a good fit of the lognormal regression line (solid line in Figure 5.2-2) to the data. This goodness of fit, as evidenced by a high coefficient of determination ($r^2 = 0.92$), supports the assumption that discharges are lognormally distributed. The dotted line represents the true (ideal) lognormal distribution having the same mean (118) and coefficient of variation (1.38) as the actual data. The expected value, or average discharge rate,

for the Upper South Fork at location SF228 is approximately 115 cfs. Expected values for discharge at both sampling locations are summarized in Table 5.2-1.

Estimated gains or losses in discharge (EV) and the coefficients of variation (CV) for the one reach on the Upper South Fork are listed in Table 5.2-2. The reach between SF220 and SF228 gains an estimated 28.8 cfs. Losses tend to occur where the gradient lessens and the valley broadens, while gains generally occur where the valley narrows.

5.2.2 Estimated Zinc, Lead, and Cadmium Concentrations and Mass Loading

Dissolved cadmium and zinc and total lead concentrations and loads were evaluated using the probabilistic model at the two sampling locations (one reach) that contained a minimum of ten data points.

5.2.2.1 Individual Sampling Locations

To illustrate the lognormal distribution of dissolved zinc, total lead, and dissolved cadmium concentrations and dissolved zinc, total lead, and dissolved cadmium loading at sampling location SF228 on the Upper South Fork, Figures 5.2-4 through 5.2-9 are provided. The high r-squared values (r^2) for the dissolved concentrations and total loads when plotted lognormally attest to the fact that the data follow a lognormal distribution. For dissolved concentrations, the r-squared values for zinc and cadmium were 0.79 and 0.90, respectively. The r-squared value for the total lead concentration was 0.87. The corresponding values for dissolved zinc, total lead, and dissolved cadmium loads were 0.83, 0.96, and 0.96, respectively.

To assist in interpreting and placing the results in context, screening levels, and expected values are shown on the figures where applicable. In the Final Technical Support Document of August 2000 (USEPA 2000), no TMDLs were provided for the Upper South Fork and, therefore, no TMDLs are included on the plots.

The screening level for dissolved cadmium in surface waters is 0.38 µg/L. Several cadmium measurements at SF228 were above this screening level. None of the measured cadmium concentrations exceeded 10 times the screening level (Figure 5.2-4). The estimated dissolved cadmium concentration of approximately 1.07 µg/L is greater than the screening level.

The majority of the total lead concentrations are less than the screening level (15 µg/L) (Figure 5.2-5). The estimated expected lead concentration (approximately 9.21 µg/L) is also less than the screening level.

Almost all dissolved zinc concentrations (Figure 5.2-6) measured at sampling location SF228 fall between the screening level and 10 times the screening level of 42 µg/L. The estimated dissolved zinc concentration (188 µg/L) exceeds the screening level for zinc.

Dissolved zinc and cadmium and total lead loads are shown on Figures 5.2-9, 5.2-7, and 5.2-8, respectively. The estimated dissolved zinc load of 89.4 pounds per day at SF228 located above Wallace exceeds the 90th percentile TMDL for the dissolved zinc load (81.7 pounds/day) below Wallace. The estimated total lead load (8.22 pounds/day) at SF228 above Wallace is several-fold greater than the 90th percentile TMDL (1.64 pounds/day) for the total lead load below Wallace. Sampling location SF228 is on the South Fork before Canyon and Ninemile Creeks enter the South Fork, and sampling location SF233 (for which the TMDL was developed) is on the South Fork after Canyon and Ninemile Creeks enter the South Fork. TMDLs for non-point sources are for dissolved loads. However, the TMDL for the dissolved lead load was multiplied by a translator (USEPA 2000) to convert to a total lead load. The translator is the ratio of total lead to dissolved lead. In contrast to the dissolved zinc and total lead loads, the estimated value of the dissolved cadmium load at SF228 above Wallace (0.504 pounds/day) is lower than the 90th percentile TMDL for dissolved cadmium (0.934) established below Wallace at SF233.

Figures similar to Figures 5.2-4 to 5.2-9 were developed for each of the sampling locations. The results of these and additional analyses are presented in Appendix C. Data in Appendix C were used to compute estimated expected values and coefficients of variation for dissolved and total zinc, lead, and cadmium concentrations and loads in the one reach of the Upper South Fork. The resulting computations are presented in Tables 5.2-3 through 5.2-8. The calculations were performed in the same manner as described in the discharge section (Section 5.2.1).

The expected values of dissolved cadmium and zinc and total lead concentrations and loads generally increase, with some exceptions, as one progresses downstream on the Upper South Fork.

The reach in this segment extends from SF220 below Mullan to SF228 below the Golconda Mill site. The estimated values of the dissolved zinc concentrations and loads increase in this reach (Appendix C) by approximately 58 µg/L. Estimated value of dissolved zinc concentration at the downgradient station in this reach (SF228) exceed screening level for dissolved zinc in surface waters by approximately four-fold.

Probabilistic modeling indicated that approximately 93 percent of the cadmium concentration and essentially 100 percent of the zinc concentration would be in the dissolved phase compared to only 13 percent of the lead. Based on evaluation of data at SF228, estimated values of the

total loadings from segment Upper SFCDRSeg01 for zinc, lead, and cadmium are, approximately, 89.4 pounds/day, 8.2 pounds/day, and 0.5 pounds/day, respectively.

5.2.2.2 Concentrations Versus Discharge

The following discussion is based on evaluation of data (Appendix C) at SF228. There is a decrease in dissolved zinc concentrations with increased discharge. Total lead concentrations increased with increasing discharge. Similarly to zinc, estimated values of dissolved cadmium concentrations also exhibited decreased concentrations with increased discharge.

Ion speciation solubility calculations performed with the MINTEQA2 geochemical computer code indicated there were no solid phases controlling zinc concentrations in surface waters in the Coeur d'Alene basin. Decreasing zinc and cadmium concentrations with increased discharge rates support this hypothesis by indicating that no solid has achieved equilibrium with these surface waters. Otherwise, the concentrations would remain relatively constant at different discharge rates. As indicated in the solubility and adsorption modeling, adsorption is the most likely control on zinc and cadmium concentrations. Accordingly, mechanistic modeling supports conclusions inferred from the regression analyses developed here.

5.3 SEDIMENT FATE AND TRANSPORT

Sediment transport processes were discussed in detail in Section 3. Brief summaries of sediment transport processes active in the watershed are presented in this section, followed by descriptions of sediment sources and transport processes observed in each segment.

5.3.1 Sediment Transport Processes

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movement incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing exposes soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling, sliding or hopping on the channel bed (Dunne and Leopold 1978).

Sediment transport (particulate metal loading) occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et al. 1992). High-flow periods usually occur in the spring as a result of precipitation and snowmelt but can occur in midwinter for the same reasons. Physical erosion of riverbanks and channels during high-flow events causes particulate forms of metals to reenter the river and be transported. There is a propensity for increased erosion during high-flow events and following high flow events when river banks are saturated and the river stage decreases and a propensity for sediment deposition as river stage decreases. Upon entering Pine Creek, dissolved and particulate metals are transported downstream. In general, where the creek widens into floodplains there is a tendency for surface water to discharge dissolved metals to groundwater and deposit suspended sediment onto the streambed.

As suspended or bedload particles are transported by the river system, there is a possibility that metals will desorb from the sediments and enter the river in the dissolved phase. Furthermore, metals may enter the river from riverbank porewater. During high flow events, riverbanks and adjacent floodplain areas store water. The stored pore water can increase in concentration as metals desorb from sediments or as precipitated solid phases and minerals dissolve. As the waters subside, these dissolved metals reenter the river system and are transported.

Sediment derived in the Upper South Fork is transported through the system and into the South Fork. Sediment sources in the Upper South Fork are mine waste and tailings, rock debris situated adjacent to channels, mobilization of channel bed sediment, bank erosion, and sediment derived from road drainage. Because no sediment transport data were collected for the Upper South Fork, estimates of sediment transport for water year 1999 were made using the sediment transport analysis from Canyon and Ninemile Creeks. It should be kept in mind that sediment yields in Canyon and Ninemile Creeks may have been impacted by remediation efforts. These analyses produced annual sediment yields for Canyon and Ninemile Creeks for three size classes of particles—fines, sand, and bedload—expressed as tons per square mile of drainage area. As land use in these watersheds is similar to the land use in the Upper South Fork, these sediment yields were used to estimate sediment yield in the Upper South Fork. The sediment yield per

drainage area was averaged for each size class and applied to the Upper South Fork to estimate an annual sediment yield.

With a drainage area of approximately 50 square miles, the total suspended sediment yield for water year 1999 was approximately 42 tons per year per square mile. Of that, approximately 17 tons was sand and 25 tons was fines, for a total of approximately 2,113 tons of suspended sediment transported in water year 1999. Annual bedload sediment yield was approximately 6 tons per year per square mile in water year 1999 for a total of about 300 tons. Summing estimated suspended and bedload sediment yield gives an estimate total sediment yield for water year 1999 for the Upper South Fork Watershed of 2,413 tons per year.

Suspended sediment and bedload samples were not analyzed for total metals; therefore mass loading was estimated from total and dissolved surface water data as described in Section 5.2.

5.3.2 Watershed Description

The Upper South Fork has approximately 70,000 feet, or 13.3 miles, of mapped channel. Channel slope varies from less than 1 percent at the downstream portions to more than 15 percent at the headwaters.

Moving downstream from the headwaters, the channel meanders through a valley typically 700 feet wide. Few anthropogenic constraints such as roads exist in this reach of channel. Likely sediment sources include mine waste and tailings, minor bank erosion, and channel bed remobilization with possible migration of channel location. Channel confinement by road embankments begins at the Lucky Friday Tailings Ponds. Sediment sources in this reach include minor bank erosion and channel bed remobilization. If surface water drainage from the tailings pond is connected to the Upper South Fork, it also may be a sediment source.

From the Lucky Friday Tailings Pond to the town of Mullan, the channel slope varies from 1 to 5 percent. It appears the channel is constrained in location by embankments from secondary roadways and the mill, mine, and tailings dams from the Lucky Friday Mine among others. Likely sediment sources in this area are mine waste and tailings, remobilization of channel bed material, and minor bank erosion. Sediment from the exposed areas around the mines, mills and tailings dams could also enter the Upper South Fork if surface water drainage from these sites flows into the Upper South Fork.

Interstate 90 runs adjacent to the Upper South Fork beginning near the town of Mullan. A high floodplain is situated between the channel and the I-90 embankment. Sediment sources in this

reach are likely channel bed remobilization and minor bank erosion with some potential for erosion into the floodplain deposits between the channel and I-90. From the town of Mullan to the mouth of Canyon Creek, the channel is channelized and constrained. The channel flows adjacent to the Mary D Claim workings, Golconda Tailing and Golconda Mine and Millsite, with exposed sediment surrounding these areas. Likely sediment sources in this reach are remobilization of channel bed material and minor bank erosion. Sediment could be contributed from the mine and mine workings if surface water drainage from these deposits flows into the Upper South Fork.

5.3.3 Summary of Sediment Transport

Approximately 2,413 tons of sediment was transported from the Upper South Fork to the South Fork in water year 1999. Sediment sources include mine waste and tailings, channel bed remobilization, minor bank erosion, lateral migration and rock debris piles adjacent to the stream.

5.4 SUMMARY OF FATE AND TRANSPORT

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading to the Upper South Fork Watershed. Sediment transport was evaluated using USGS suspended and bedload sediment discharge data. Results are summarized in this section.

Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal PDFs at two separate sampling locations in the Upper South Fork Watershed. Only results for cadmium, lead, and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends in concentrations and mass loading with changing discharge rates. The percentages of dissolved and particulate forms of metals were computed from the estimated expected values predicted by the model.

Results of the probabilistic modeling indicate:

- Dissolved cadmium and zinc concentrations exceed their corresponding screening levels. Total lead concentrations remain below the screening level.

- Lead and zinc mass loading exceed the TMDLs established for the portion of the South Fork above Wallace. The estimated total dissolved cadmium load is less than the TMDL.

- In general, concentrations of dissolved cadmium and zinc tend to decrease, and total lead tends to increase, as discharge increases. Mass loading tends to increase as discharge increase.

- Potential major source areas identified in each reach are listed in Table 5.4-1. Identification of major source areas was primarily based on the estimated contributions of sites to dissolved zinc loading in surface water of the Coeur d'Alene River basin. The identification process and backup documentation is presented in Draft Technical Memorandum No. 1: Candidate Alternatives and Typical Conceptual Designs, Coeur d'Alene Basin Feasibility Study (URSG and CH2M Hill 2000).

To illustrate the observed trends of estimated expected values throughout the watershed, estimated expected values for cadmium, lead, and zinc concentrations and mass loading are shown in Figures 5.4-1 through 5.4-6.

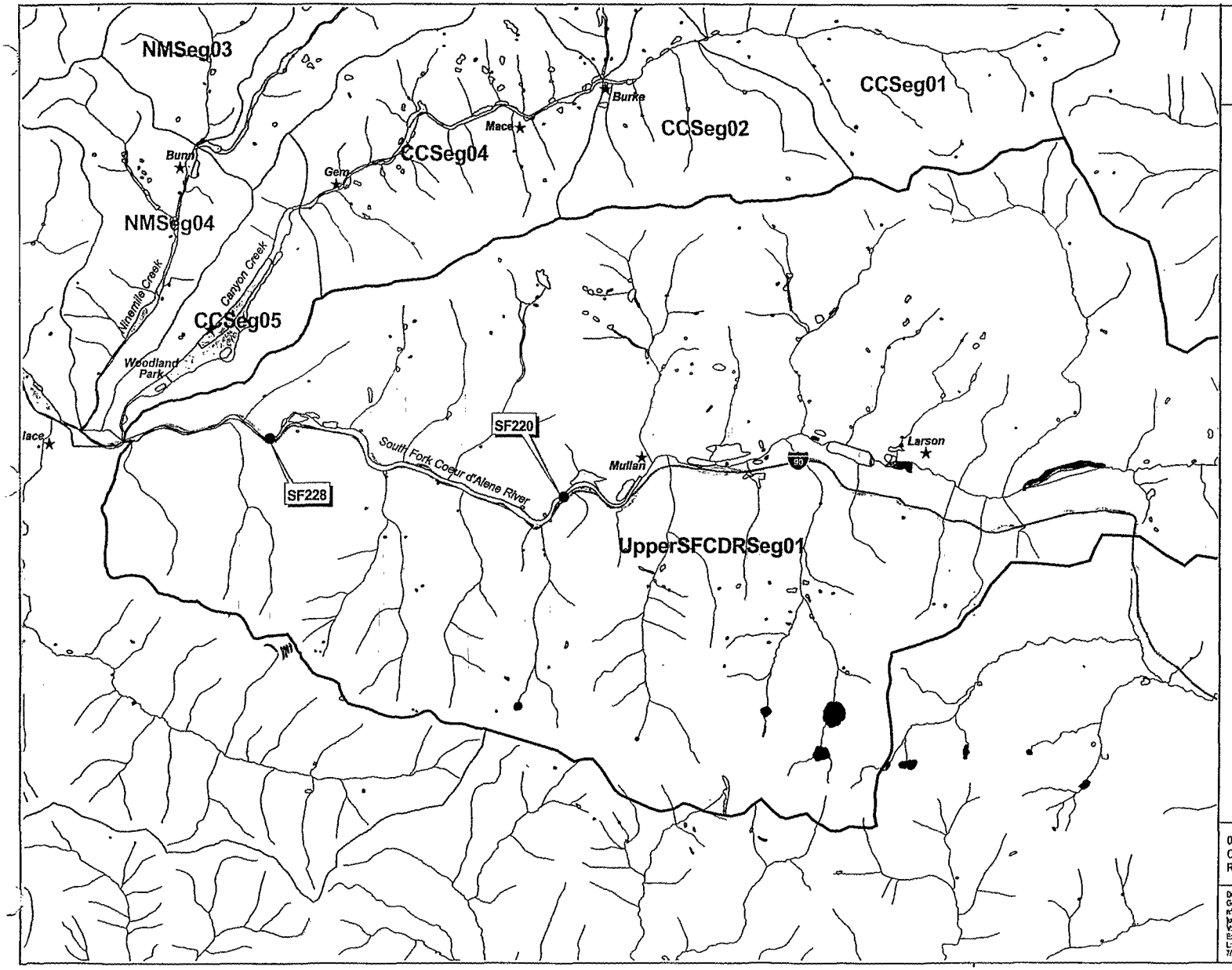


Figure 5.2-1
Upper South Fork Coeur d'Alene River Watershed
Sampling Locations Evaluated in Probabilistic Modeling

LEGEND

- Sampling Location
- Stream
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Watershed
- River Segment
- Lake/River
- Source Area

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

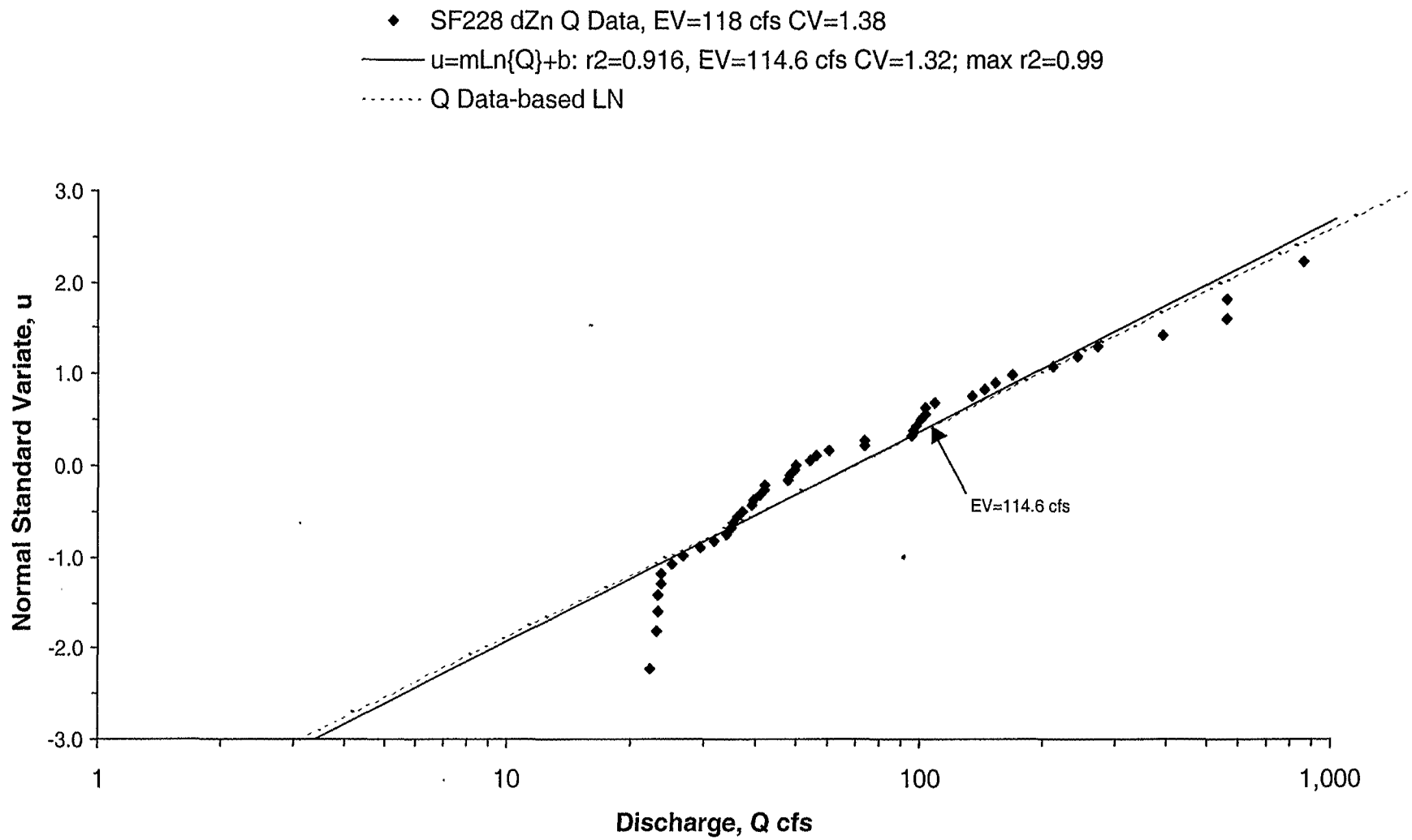
EPA REGION 10

Document Control 4162500.8615.05a
Generation 1
n:\Projects\watersheds\upper_south_fork\
jusfcdr_ev7-18.apt
V:Locate
E:Locate
L: Final RI Locate
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

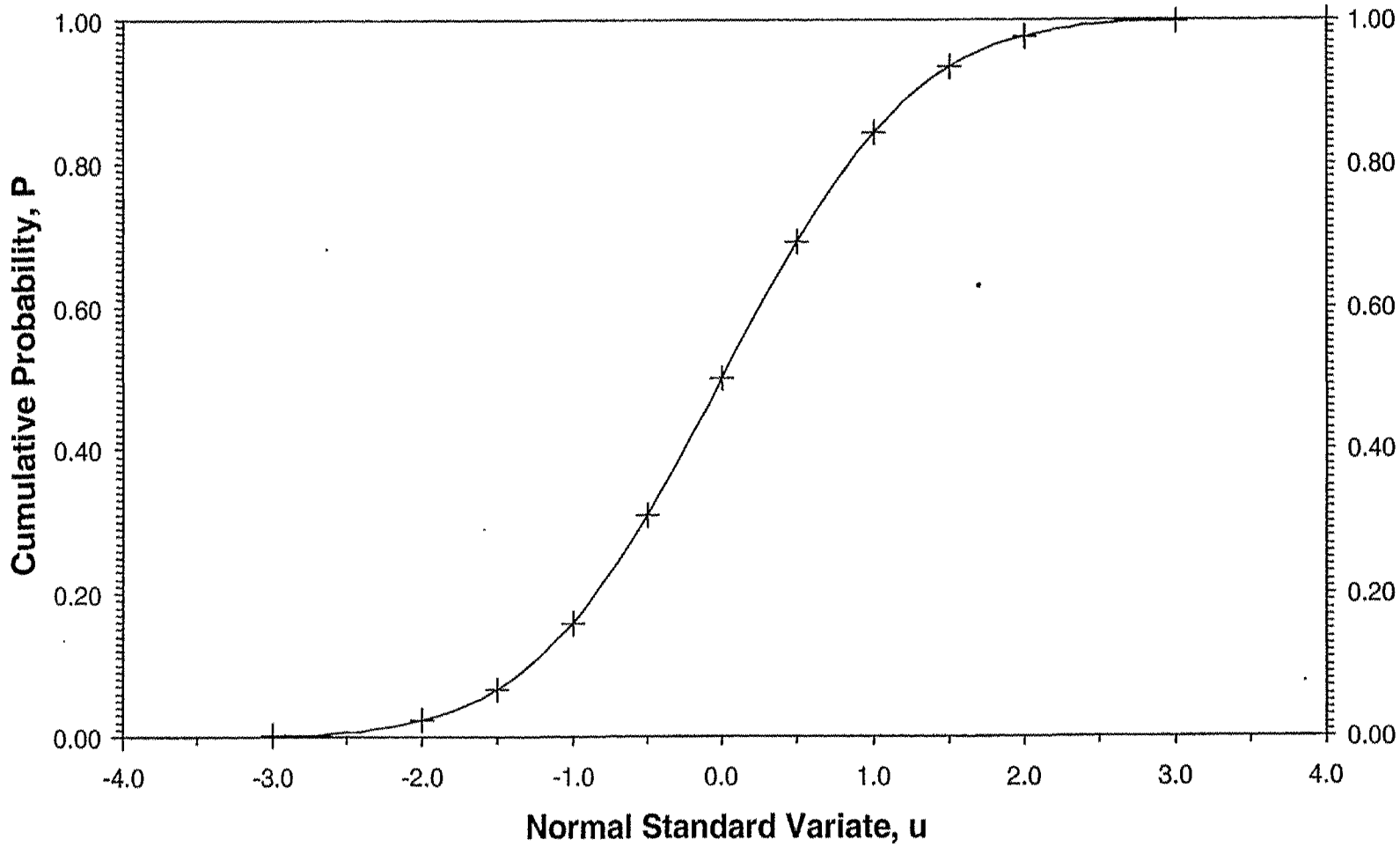
Date of Plot: July 24, 2001

Probabilistic Modeling Results for Discharge at SF228



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-2

Cumulative Probability Values Corresponding to Normal Standard Variate Values



EPA REGION 10

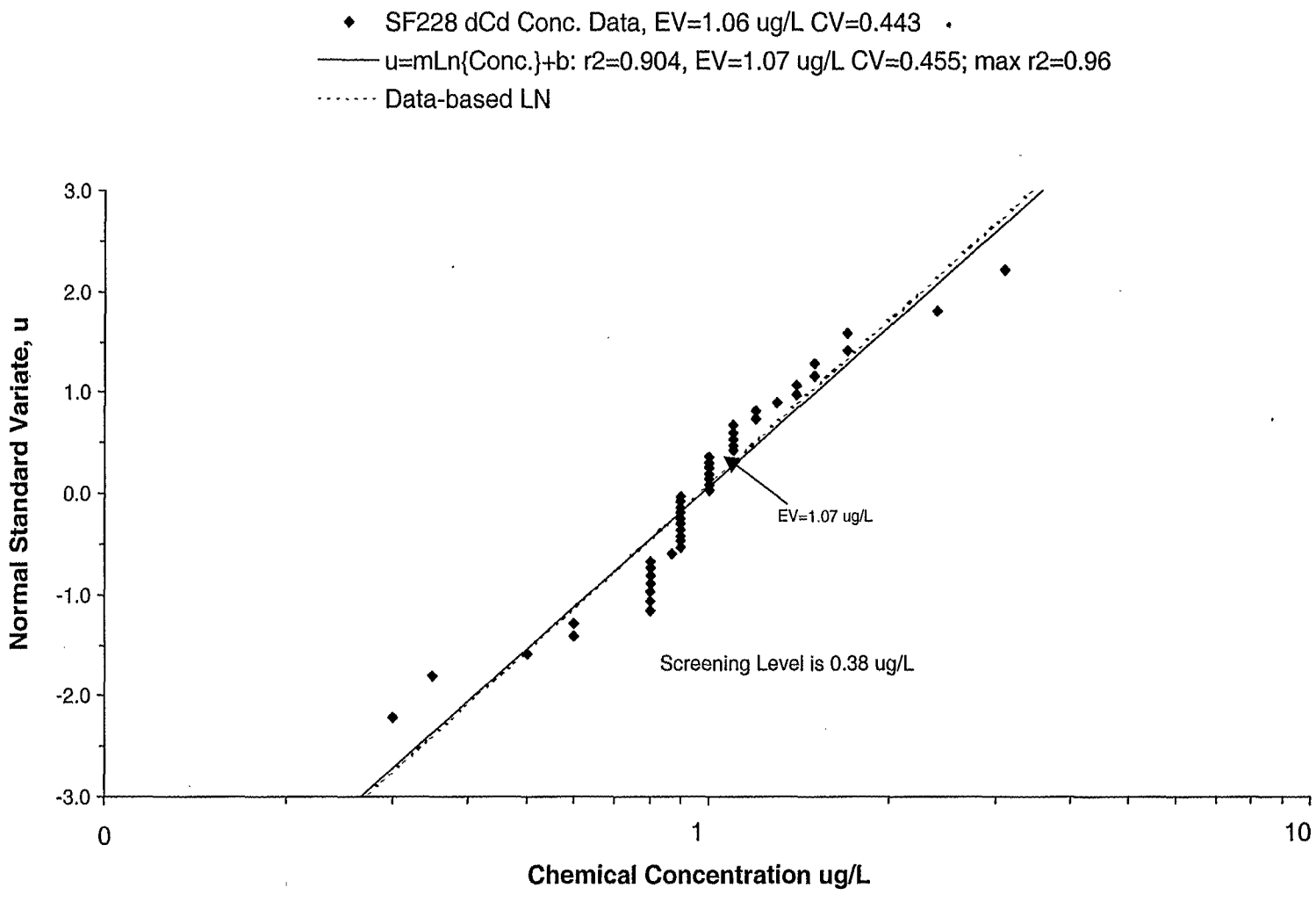
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Upper South Fork Series
7/12/01

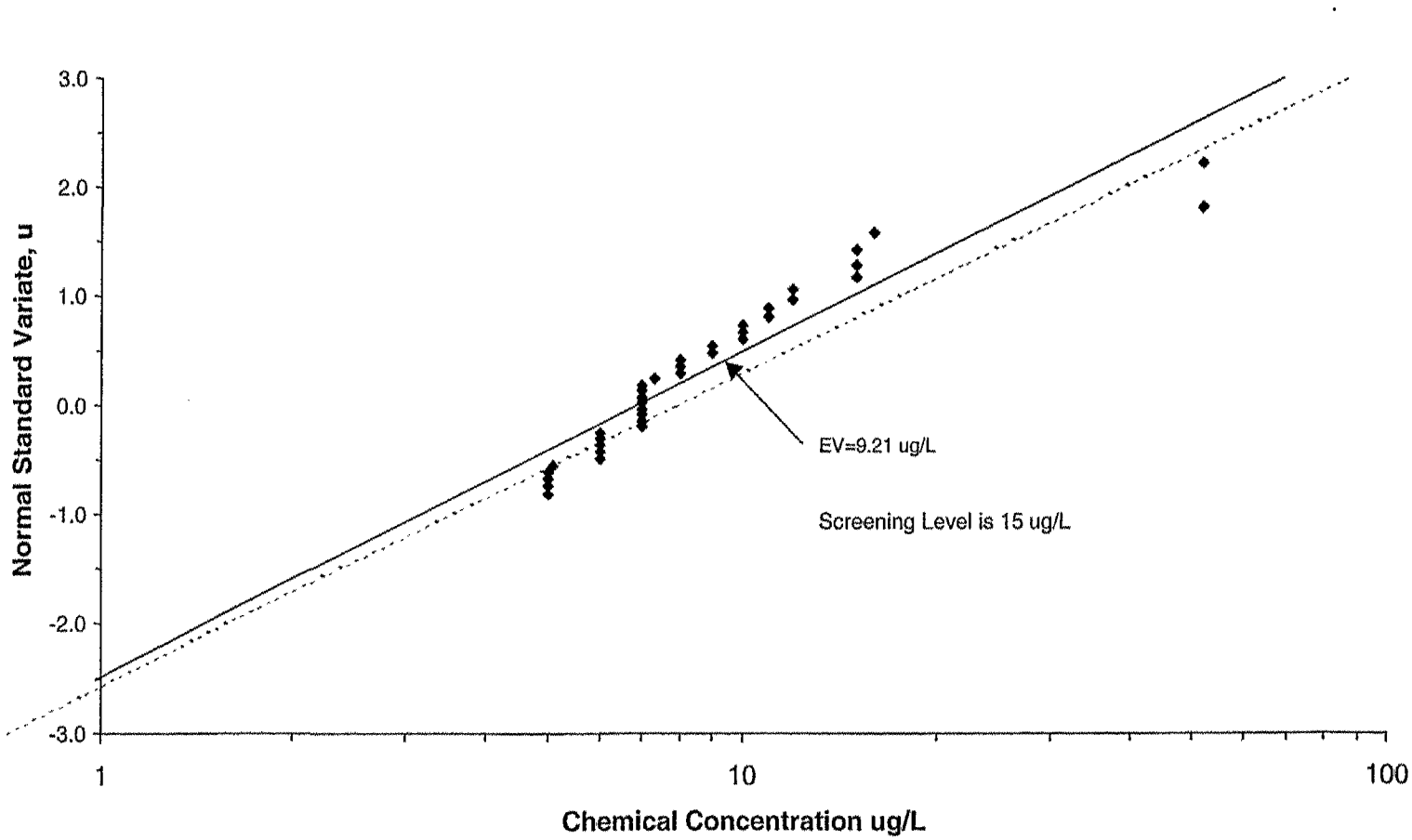
Figure 5.2-3

Probabilistic Modeling Results for Dissolved Cadmium Concentrations at SF228



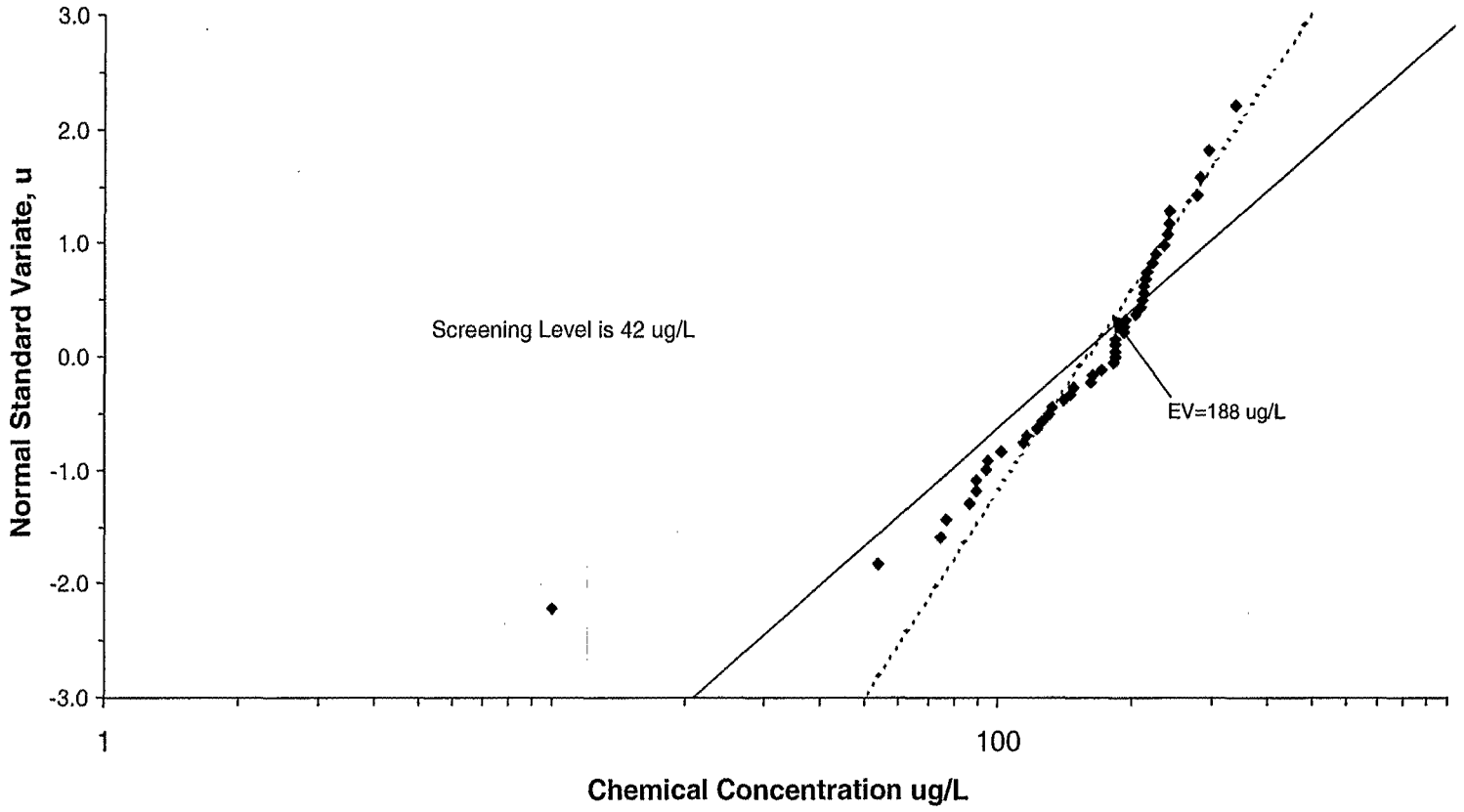
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-4

Probabilistic Modeling Results for Total Lead Concentrations at SF228



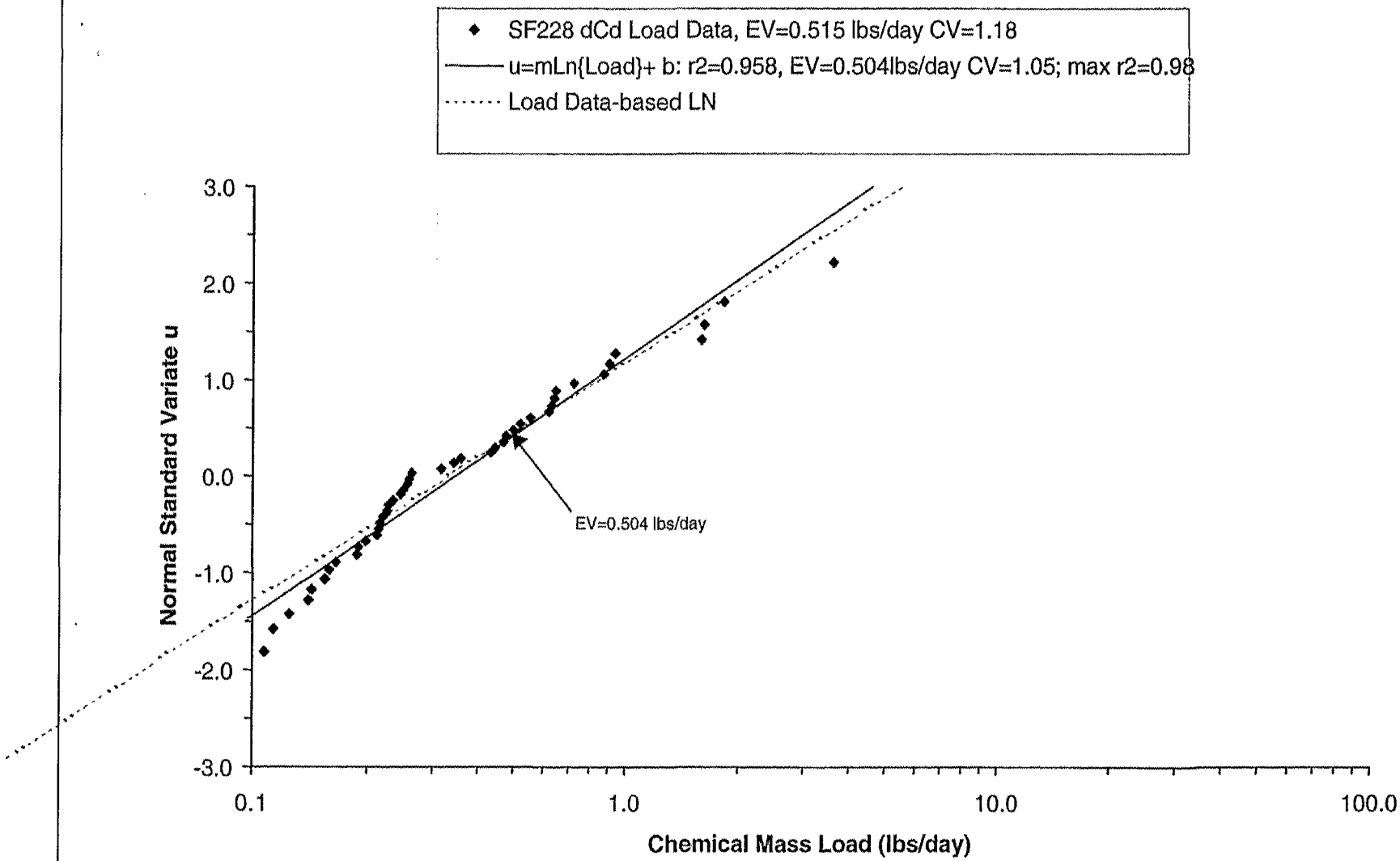
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-5

Probabilistic Modeling Results for Dissolved Zinc Concentrations at SF228



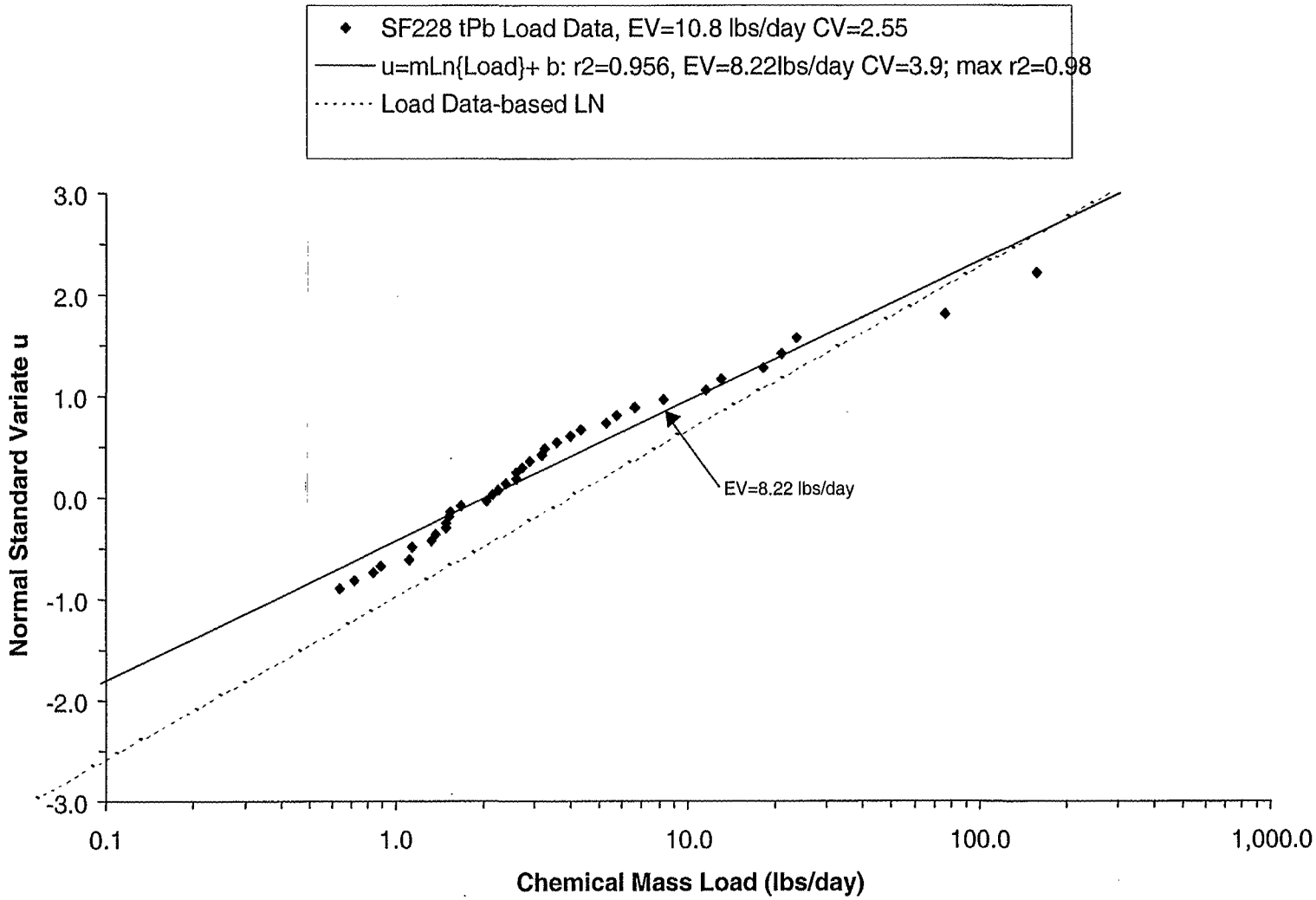
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-6

Probabilistic Modeling Results for Dissolved Cadmium Mass Loading at SF228



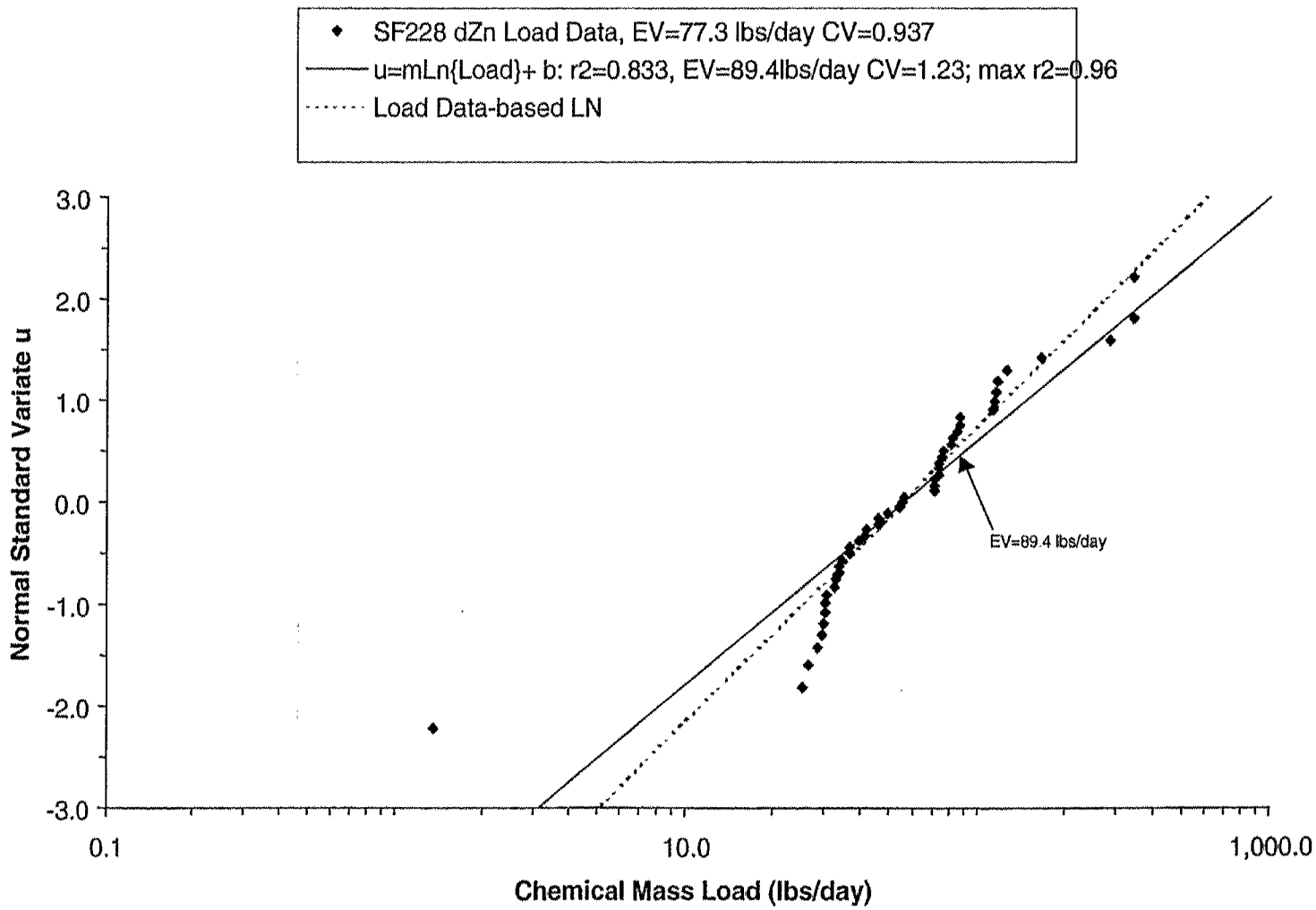
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-7

Probabilistic Modeling Results for Total Lead Mass Loading at SF228



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-8

Probabilistic Modeling Results for Dissolved Zinc Mass Loading at SF228



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Upper South Fork Series 7/12/01	Figure 5.2-9

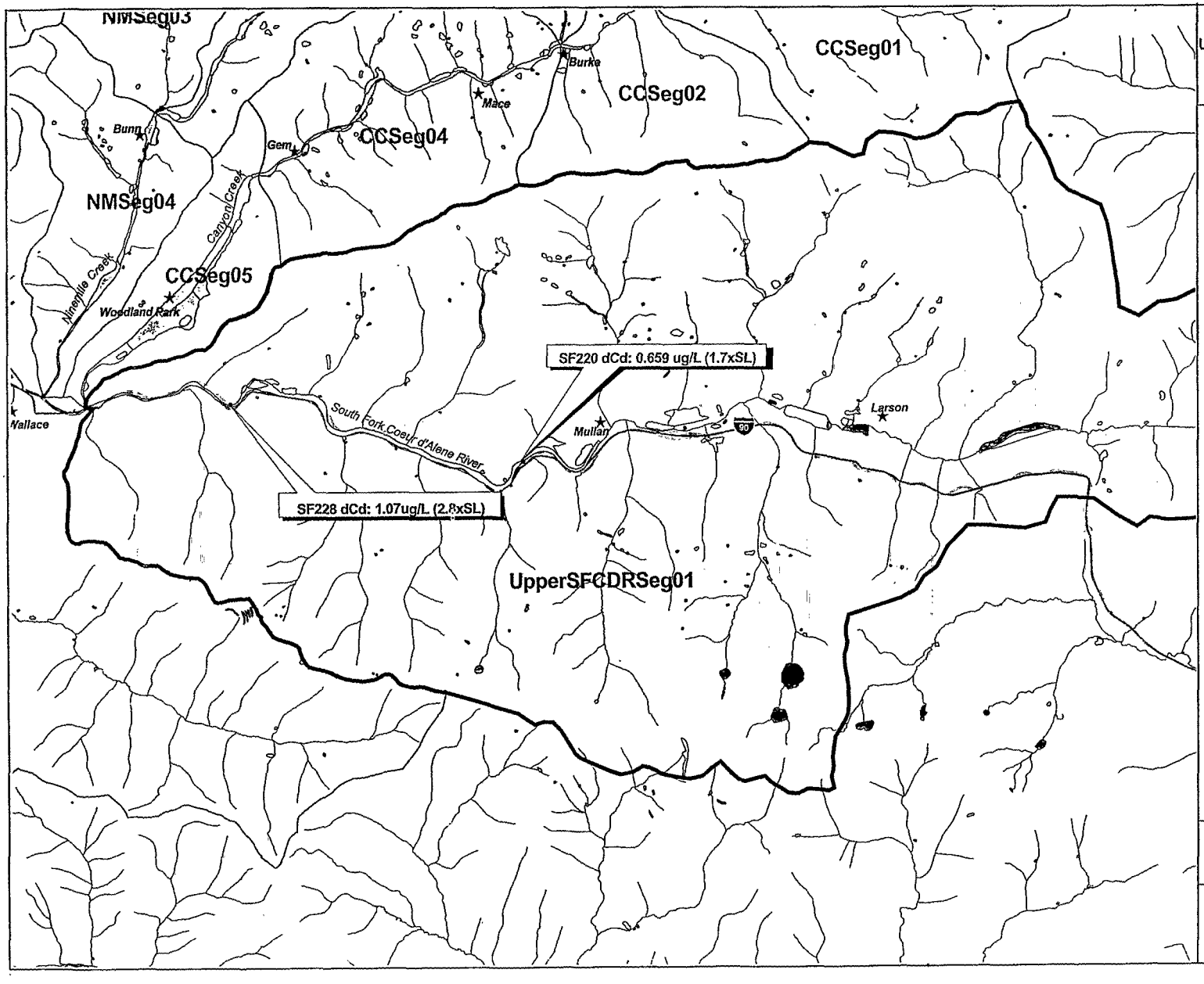


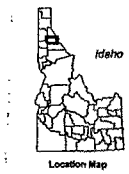
Figure 5.4-1
Upper South Fork Coeur d'Alene River Watershed Estimated Expected Values for Dissolved Cadmium Concentrations

LEGEND

Sampling Location
Concentration
SF220 dCd: 0.66ug/L (1.7xSL)
Analyte
Screening Level is 0.38 ug/L

Range of Dissolved Cadmium Concentrations in ug/L
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

Stream
Interstate 90
City
Upper South Fork Coeur d'Alene River Watershed
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6515.05.a
Generation 1
rs:\Projects\watersheds\USFCDR\
jusfcdr_ev7-13.apr
V:dCd USFCDR concentrations
E:dCd
L: Final RI dCd Concentrations
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

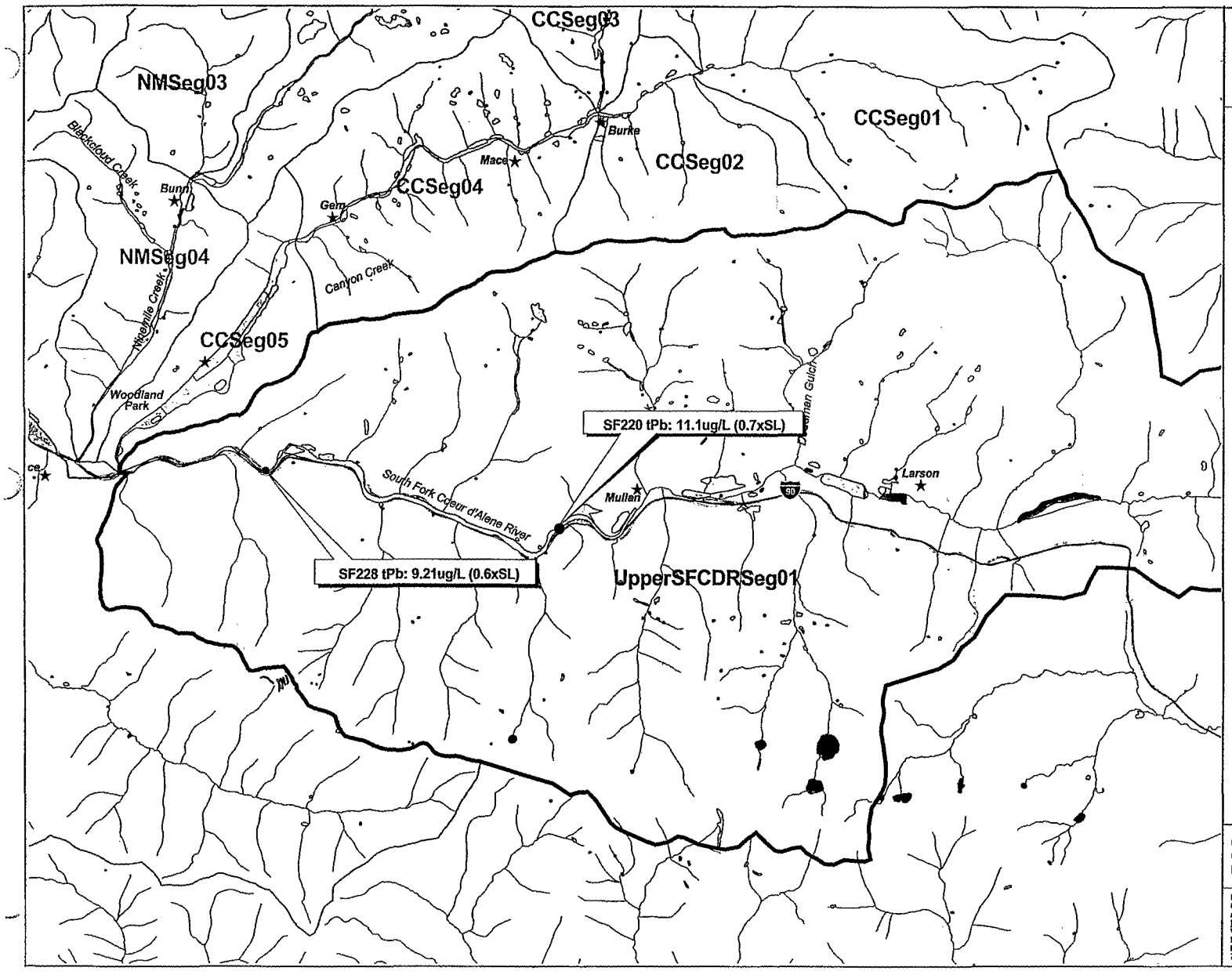


Figure 5.4-2
Upper South Fork Coeur d'Alene River Watershed
Estimated Expected Values for Total Lead Concentrations

LEGEND

Sampling Location — Concentration

SF220 tPb: 11.1ug/L (0.7xSL)

Analyte — Screening Level is 15 ug/L

Range of Total Lead Concentrations in ug/L
- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100

- Stream
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Watershed
- River Segment
- Lake/River
- Source Area

Idaho
Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05e
Generation 1
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\usfcdr_ev_7-18.apr
V:\Pb concentrations
E:\Pb
L: Final RI tPb Concentrations
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24 2001

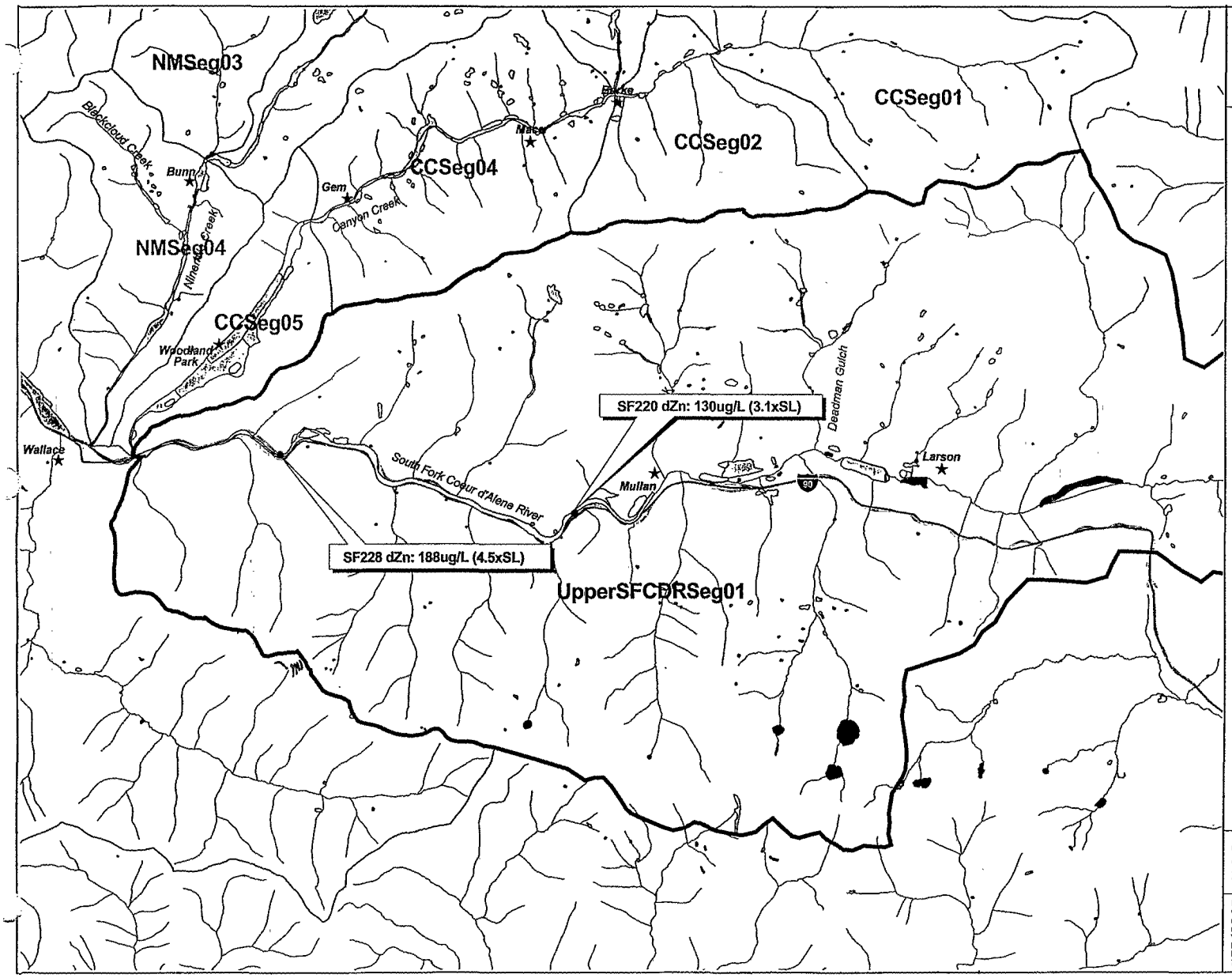


Figure 5.4-3
Upper South Fork Coeur d'Alene River Watershed
Estimated Expected Values for Dissolved Zinc Concentrations

LEGEND

Sampling Location — Concentration

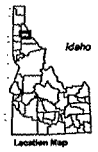
SF220 dZn: 130.2ug/L (3.1xSL)

Analyte — Screening Level is 42 ug/L

Range of Dissolved Zinc Concentrations in ug/L

- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500

- Stream
- Interstate 90
- City
- Upper South Fork Coeur d'Alene River Watershed
- River Segment
- Lake/River
- Source Area



NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.8515.05.a
Generation 1
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V:dZn concentrations
E:dZn
L: Final RI dZn concentrations
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

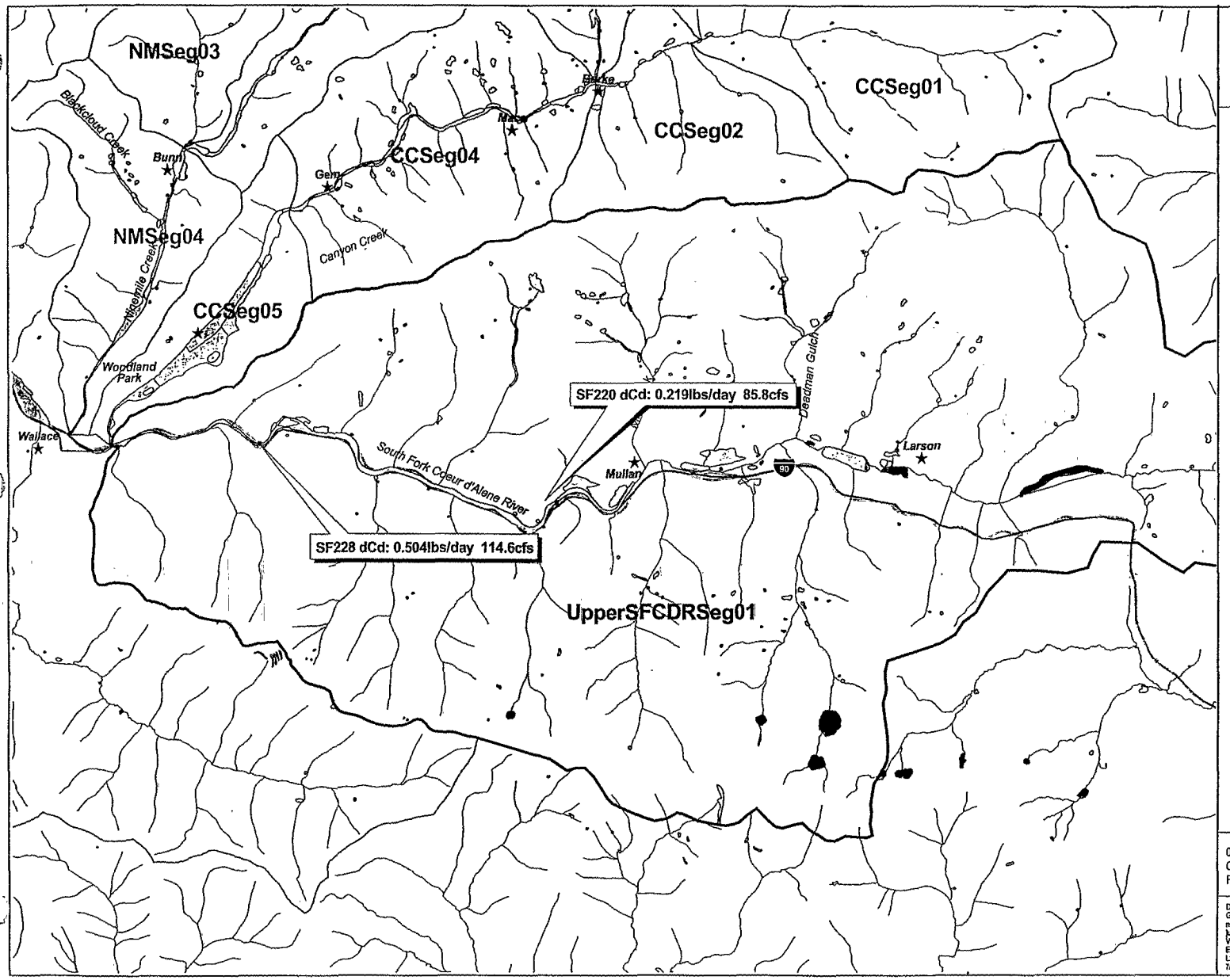

Figure 5.4-4
Upper South Fork Coeur d'Alene River Watershed
Estimated Expected Values for Dissolved Cadmium Mass Loading

LEGEND

Sampling Location — Mass Load

SF228 dCd: 0.5lbs/day 114.6cfs

Analyte — Flow in Cubic Feet per Second

Range of Total Cadmium Mass Loading in lbs/day
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162300.6915.05e
Generation 1
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lusfcdr_ev7-13.apr
VdCd Mass Loading
EcCd
L: Final RI dCd Mass Loading
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 24, 2001

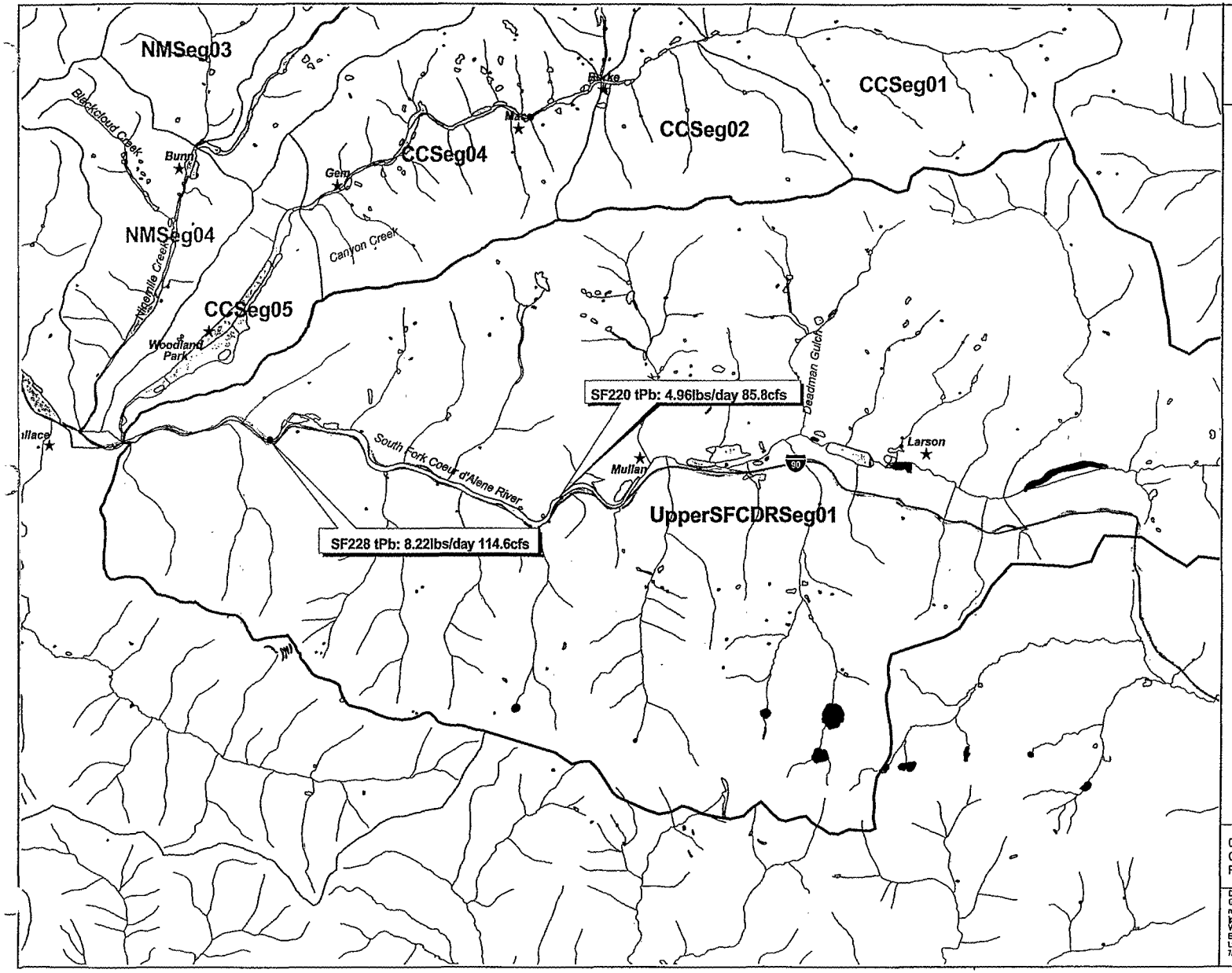

Figure 5.4-5
Upper South Fork Coeur d'Alene River Watershed
Estimated Expected Values for Total Lead Mass Loading

LEGEND

Sampling Location

Mass Load

SF228 tPb: 8.2lbs/day 114.6cfs

Analyte

Flow measured in Cubic Feet per Second

Range of Total Lead Mass Loading in lbs/day

- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100

Stream

Interstate 90

City

Upper south Fork Coeur d'Alene River Watershed

Upper south Fork Coeur d'Alene River Watershed

River Segment

Lake/River

Source Area

Location Map

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI/FS REPORT

EPA REGION 10

Document Control 4152500.8515.05.a
Generation 1
n:\Projects\watersheds\pine_wtrshed\pine_creek\ev_7-18.apr
Y:\Pb mass\loading
E:\Pb
L: Final RI\Pb Mass Loading
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 24, 2001

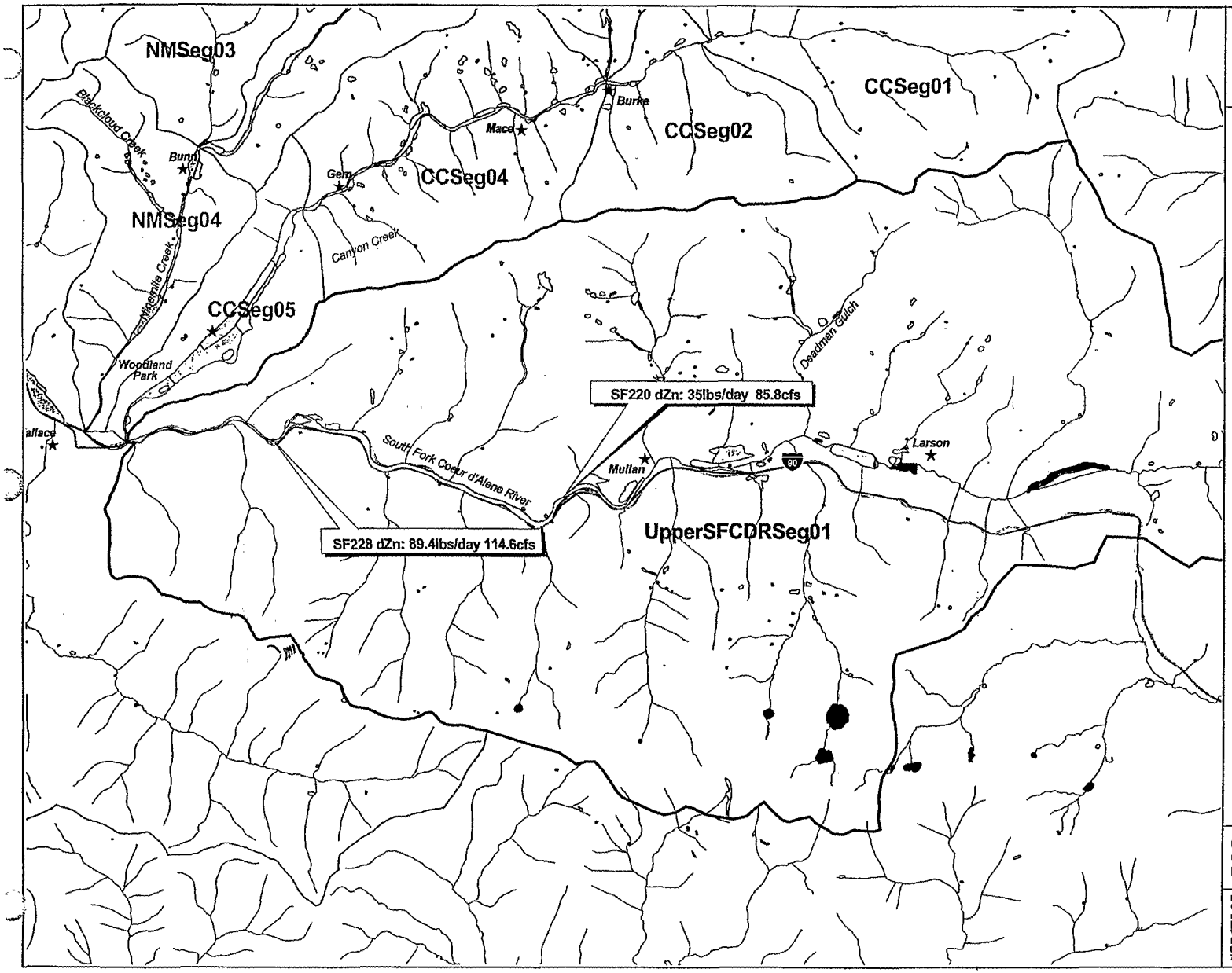

Figure 5.4-6
Upper South Fork Coeur d'Alene River Watershed
Estimated Expected Values for Dissolved Zinc Mass Loading

LEGEND

Sampling Location
Mass Load
SF228 dZn: 89.4lbs/day 114.6cfs
Analyte
Flow measured in Cubic Feet per Second

Range of Dissolved Zinc Mass Loading in lbs/day
- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500

Stream
Interstate 90
City
Upper South Fork Coeur d'Alene River Watershed
Upper South Fork Coeur d'Alene River Segment
River Segment
Lake/River
Source Area

Idaho
Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:60,000
0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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V:dZn Mass Loading
E:dZn
L: Final RI dZn Mass Loading
7/24/2001

This map is based on Idaho State Plane Coordinates West Zone. North American Datum 1983.

Date of Plot: July 24, 2001

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligrams per kilogram

Table 5.1-1
Low and High Instantaneous Metal Loading Values for Six Sampling Events From May 1991 to May 1999

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.07	1.04
Total Lead	0.779	24.9
Dissolved Lead	0.13	0.61
Dissolved Zinc	1.69	6.9

Table 5.2-1
Estimated Expected Values of Concentrations and Loads Compared to Screening Levels and TMDLs for the South Fork Above Wallace

Sampling Location	Concentration (µg/L)			Mass Loading (pounds/day)			Discharge (cfs)
	Dissolved Cadmium	Total Lead	Dissolved Zinc	Dissolved Cadmium	Total Lead	Dissolved Zinc	
Screening Level or TMDL[a]	0.38	15	42	0.934	1.64	81.7	NA
SF220	**0.659** (0.545)	11.1 (0.593)	**130** (0.679)	0.219 (1.11)	**4.96** (1.65)	35.0 (0.666)	85.8 (1.39)
SF228	**1.07** (0.455)	9.21 (0.902)	**188** (0.741)	0.504 (1.05)	**8.22** (3.9)	**89.4** (1.23)	114.6 (1.32)

[a]TMDLs shown are for the South Fork at Wallace.

Notes:
NA - not applicable
Values in parentheses are coefficients of variation
µg/L - micrograms per liter
cfs - cubic feet per second
Bold indicates exceedance of screening level

Table 5.2-2
Estimated Gains or Losses (EV[X]) in Discharge

Reach - between location Xi and Xj (# of samples)	Estimated expected value of gain or loss (EV[X]) in discharge, cfs	Coefficient of variation (CV) for reach (pxi,xj = 0.9)
SF220 (41) to SF228 (47)	28.8	2.4

Note:
cfs - cubic feet per second

Table 5.2-3
Estimated Gains or Losses (EV[X]) for Dissolved Zinc Concentrations and Load

Reach - between location Xi and Xj (no. of samples)	Estimated expected value of increase or decrease in the concentration of dissolved zinc (µg/L)	Estimated coefficient of variation (CV) for the dissolved zinc (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved zinc load (lbs/day)	Estimated coefficient of variation (CV) for the dissolved zinc load (pxi,xj = 0.9)
SF220 (41) to SF228 (47)	58	1.2	54.4	1.6

Notes:
µg/L - micrograms per liter
lbs/day - pounds per day

Table 5.2-4
Estimated Gains or Losses (E[V]) for Total Lead Concentrations and Load

Reach - between location Xi and Xj (no. of samples)	Estimated expected value of increase or decrease in the total concentration of lead (µg/L)	Estimated Coefficient of variation (CV) for total lead concentrations	Estimated expected value of gain or loss in the total lead load (lbs/day)	Estimated coefficient of variation (CV) for the total lead load
SF220 (41) to SF228 (47)	-1.89	2.0	3.26	7.7

Notes:
µg/L - micrograms per liter
lbs/day - pounds per day

Table 5.2-5
Estimated Gains or Losses (E[V]) for Dissolved Cadmium Concentrations and Load

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the concentration of dissolved cadmium (µg/L)	Estimated coefficient of variation (CV) for the dissolved cadmium (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved cadmium load (lbs/day)	Estimated coefficient of variation (CV) for the dissolved cadmium load (pxi,xj = 0.9)
SF220 (41) to SF228 (47)	0.41	0.6	0.285	1.2

Notes:
µg/L - micrograms per liter
lbs/day - pounds per day

Table 5.4-1
Potential Major Source Areas in the Upper South Fork Watershed

Reach	Location Description	Associated Source Areas
Upstream of SF220	Headwaters to just downgradient of Mullan	Morning No. 6 Mine and Mill Gold Hunter No. 6 Lucky Friday Mine and Tailings Pond
SF220 to SF228	Downgradient of Mullan to downgradient of the Golconda Minesite	Grouse Gulch Mines Golconda Mine and Mill (Star 1200 Level and West Star Mine) Upper SFCDAR Impacted Floodplain

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ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
7	IDEQ Historical Data	IDEQ Water Quality Data	Idaho Department of Environmental Quality. 1998. Assortment of files from Glen Pettit for water years 1993 through 1996
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
			Environmental Protection Agency. 1998. E-mail from Ben Cope August 5, 1998. Subject: State of Idaho Lat/Longs File Attached: PAT.DBF
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: PCSDATA.WK4
10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
			US Forest Service. 1995. Pilot Inventory of Inactive and Abandoned Mine Lands, East Fork Pine Creek Watershed, Shoshone County, Idaho
14	Historical Sediment Core Data: University of Idaho (Thesis papers)	Historical Lateral Lakes Sediment Data from F. Rabbi and M.L. Hoffman	Characterization of Heavy Metal Contamination in Two Lateral Lakes of the Lower Coeur d'Alene River Valley, A thesis by M.L. Hoffmann, May 1995
			Trace Element Geochemistry of Bottom Sediments and Waters from the Lateral Lakes of Coeur d'Alene River, A Dissertation by F. Rabbi, May 1994
15	URS FSPA No. 9	Source Area Characterization; Field XRF Data	CH2M Hill and URS Greiner. 1998. Field Sampling Plan Addendum 9 Delineation of Contaminant Source Areas in the Coeur d'Alene Basin using Survey and Hyperspectral Imaging Techniques
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
17	USGS Spokane River Basin Sediment Samples	Surface Sediment Samples Collected by USGS in the Spokane River Basin	Environmental Protection Agency. 1999. Data Validation Memorandum and Attached Table from Laura Castrilli to Mary Jane Nearman dated June 9, 1999. Subject: Coeur d'Alene (Bunker Hill) Spokane River Basin Surface Sample Samples, USGS Metals Analysis, <63 um fraction, Data Validation, Samples SRH7-SRH30
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured on the Ascending and Descending Limbs of the 1999 Snomelt Runoff Hydrograph at Nine Stations, Coeur d'Alene River Basin Idaho
22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.
28	USGS National Water Quality Assessment database	Surface water data for sampling location NF50 at Enaville, Idaho	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur d'Alene River At Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are included in the data summary tables in the "Ref" column.

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
GOLCON	GS	3	05/19/1998	0	88	185	93.3	358	124000	* 33800	15900	26.4	96.5	13400
GOLCON	BH	3	05/19/1998	0	71.2	153	54.9	483	64300	* 26800	5380	3.7	114	12500
GOLCON	BH	3	05/19/1998	0	116	205	225	506	207000	* 37500	27700	37.2	81.1	* 39400
GOLCON	BH	3	05/19/1998	0	14	140	17.7	135	38200	4120	2800	6	11.8	2460
GOLCON	BH	3	05/19/1998	0	226	93.1	56.6	545	41300	* 23900	3420	10	119	10100
GOLCON	BH	3	05/19/1998	0	17.7	418	60.5	974	18100	7970	2050	5.4	31.6	8500
GOLCON	BH	3	05/19/1998	0	* 3150	* 3010	4.5	31.7	29700	541	185	0.2	8.6	80.8
GOLCON	BH	3	05/19/1998	0	155	139	21.2	499	41500	* 65700	1110	14.2	145	2390
LC10022	RV	22	—	0.5						15500				
LC10023	RV	22	—	0.5						12300				
LC10024	RV	22	—	0.5						* 21600				
LC10025	RV	22	—	0.5						* 24100				
LC10026	RV	22	—	0.5						15200				
LC10087	RV	22	—	0.5						6610				
LC10088	RV	22	—	0.5						3840				
LC10089	RV	22	—	0.5						2650				
LC10090	RV	22	—	0.5						1710				
LC10091	RV	22	—	0.5						3700				
LC10092	RV	22	—	0.5						3150				
LC10093	RV	22	—	0.5						9400				
LC10094	RV	22	—	0.5						2700				
LC10095	RV	22	—	0.5						* 33500				
LC10096	RV	22	—	0.5						7840				
SF401	GS	11	12/21/1998	0	19.7 J	42.1	11.9	954	29700	4570		0.9	19.2	1820
SF401	GS	11	12/21/1998	0							2130			
SF402	GS	11	12/21/1998	0	20.3 J	35.4	13.8	210	33200	4080	2100	1.6	15.6	2880
SF403	GS	11	12/21/1998	0	16.5 J	28.2	1.1	3100	22600	245	864	0.13	12.6	324
SF404	GS	11	12/21/1998	0	1.5 J	5.6	0.55 J	12.7	12900	234	2750	0.05 J	0.94 J	97.2
SF405	GS	11	12/21/1998	0	1.2 J	6.7	0.51 J	11	12500	228	2670	0.07 J	0.69 J	89.7
SF8164	TL	13	—			85 U	1.8	52	12000	640	690			620
SF8165	TL	13	—			85 U	6.6	1400	19000	1500	1800			1700
SF8166	TL	13	—			85 U	0.78	130	4400	160	930			15
SF8167	TL	13	—			85	7.7	1900	190000	150	7500			97
SF8267	TL	13	—			92	5.2	70	77000	* 21000	4200			60
SF8268	TL	13	—			160	82	240	65000	* 20000	9500			11000
SF8269	TL	13	—			140	3.3	68	31000	78	840			120

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Subsurface Soil (mg/kg)														
GOLCON	BH	3	05/19/1998	0.5	42.4	127	90.8	360	86500	* 24500	9840	8.9	68.7	16200
GOLCON	BH	3	05/19/1998	1	29.6	152	88.6	467	88200	* 25300	7920	8.8	68.4	15200
GOLCON	BH	3	05/19/1998	0.5	105	184	397	329	210000	* 34800	26500	51.5	72.4	* 58300
GOLCON	BH	3	05/19/1998	1	164	231	543	341	225000	* 52200	27500	35.6	118	* 83900
GOLCON	BH	3	05/19/1998	0.5	15.3	145	26.2	149	43300	7010	3750	6.9	16.2	3560
GOLCON	BH	3	05/19/1998	1	7	124	31.1	136	55100	4590	4130	4.8	13.3	4090
GOLCON	BH	3	05/19/1998	0.5	186	265	132	622	192000	* 46300	23400	37.6	120	21000
GOLCON	BH	3	05/19/1998	1	68.1	311	138	400	205000	* 39800	26500	25.6	75.6	25300
GOLCON	BH	3	05/19/1998	0.5	43.8	485	79.6	613	22400	11600	4670	9.8	51.5	6980
GOLCON	BH	3	05/19/1998	1	44	141	25.6	552	97100	* 17600	15500	16.2	50.6	3660
GOLCON	BH	3	05/19/1998	0.08	885	* 2760	5.1	27.1	23600	729	329	0.26	16.3	140
GOLCON	BH	3	05/19/1998	0.5	1110	* 2560	3.2	25.7	29000	345	139	0.13	3.8	90.6
GOLCON	BH	3	05/19/1998	1	1700	* 2940	3.3	22.2	25500	279	102	0.06 U	2.7	62.6
GOLCON	BH	3	05/19/1998	0.5	52	134	16.1	491	60800	* 23600	3080	14.8	65.9	4030
GOLCON	BH	3	05/19/1998	1	67.3	118	42.1	658	54400	* 26800	2610	18.4	68.8	7680
LC10022	RV	22	—	1						12800				
LC10022	RV	22	—	1.5						4320				
LC10023	RV	22	—	1						9470				
LC10023	RV	22	—	1.5						2620				
LC10024	RV	22	—	1						* 25500				
LC10024	RV	22	—	1.5						6890				
LC10025	RV	22	—	1						* 28100				
LC10025	RV	22	—	1.5						7150				
LC10026	RV	22	—	1						* 22800				
LC10026	RV	22	—	1.5						* 21900				
LC10087	RV	22	—	1						4260				
LC10087	RV	22	—	1.5						2250				
LC10088	RV	22	—	1						8120				
LC10088	RV	22	—	1.5						12200				
LC10089	RV	22	—	1						1750				
LC10089	RV	22	—	1.5						4480				
LC10090	RV	22	—	1						1500				
LC10090	RV	22	—	1.5						1670				
LC10091	RV	22	—	1						4790				
LC10091	RV	22	—	1.5						5260				
LC10092	RV	22	—	1						2750				
LC10092	RV	22	—	1.5						1720				

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Subsurface Soil (mg/kg)														
LC10093	RV	22	---	1						9730				
LC10093	RV	22	---	1.5						8860				
LC10094	RV	22	---	1						2590				
LC10094	RV	22	---	1.5						3580				
LC10095	RV	22	---	1						* 33000				
LC10095	RV	22	---	1.5						* 34500				
LC10096	RV	22	---	1						8560				
LC10096	RV	22	---	1.5						6100				
Sediment (mg/kg)														
GOLCON	GS	3	05/19/1998	0	50	214	112	245	124000	* 21500	13400	* 26	54.3	16300
SF522	HA	2	12/14/1997	0	9.08 UJ	15.1 J	21.8	109	53100	4610	4900 J	0.234 J	9.72	5570 J
SF523	HA	2	12/14/1997	0	4.07 UJ	9.62 J	7.1	98.3	55300	* 5270	6030 J	0.72 J	12	2530 J
SF524	HA	2	12/14/1997	0	3.11 U	11 J	2.58	39.7	18200	726	1310 J	0.31 J	2.96	439 J
SF525	HA	2	12/14/1997	0	2.33 UJ	10.1 J	3.83	92.9	21000	611	1600 J	0.225 J	2.25	1180 J
SF526	HA	2	12/15/1997	0	5.24 UJ	11 J	2.49	124	42500	1850	3880 J	0.199 J	5.81	1890 J
SF526	HA	2	12/15/1997	0.17	0.948 J	9.93 J	4.56	104	33700	1230	3070 J	0.537 J	4.38	1630 J
SF528	HA	2	12/15/1997	0	2.7 UJ	8.95 J	2.89	92.5	33400	861	2700 J	0.146 J	3.42	1510 J
SF529	HA	2	12/15/1997	0	4.54 UJ	18 J	5.92	139	28300	666	1430 J	0.154 J	3.15	1820 J
SF530	HA	2	12/15/1997	0	1.12 U	3.19 J	1.61	61.5	6160	527	391 J	0.0533 J	0.896 J	305 J
SF531	HA	2	12/15/1997	0	1.01 U	15.7 J	0.873 J	165	18800		1420 J		1.85 J	
SF531	HA	2	12/15/1997	0						200 J		0.0794 J		636 J
SF533	HA	2	12/15/1997	0	3.19 U	10.3 J	1.17 J	228 J	12800	114 J	1960	0.0728 J	3.76	428 J
SF534	HA	2	12/15/1997	0	7.51 U	24.4 J	2.66 J	283 J	15000	361 J	3060	0.268	4.62	560 J
SF535	TP	2	12/16/1997	1	1.36 U	18.8 J	4.23 J	34.1 J	23900	1190 J	1730	0.556	2.31 J	1060 J
SF536	TP	2	12/16/1997	0	14.7 J	28.4 J	81 J	91.9 J	121000	* 13800 J	15700	3.55	24.9	13700 J
SF537	TP	2	12/16/1997	1	26.9 J	84.2 J	40.2 J	85.9 J	129000	* 23500 J	13500	3.36	31.3	6240 J
SF538	TP	2	12/16/1997	1.5	1.03 U	4.8 J	0.067 J	12.9 J	11500	36.1 J	501	0.065 J	0.303 J	195 J
SF539	TP	2	12/16/1997	0	0.996 U	4.43 J	0.143 J	16.2 J	10700	31.1 J	628	0.0515 U	0.226 J	471 J
SF540	TP	2	12/16/1997	2	1.01 U	10.3 J	0.0774 J	9.81 J	8880	35.3 J	447	0.0558 J	0.17 J	58.7 J
Surface Water - Total Metals (ug/l)														
SF10	RV	5	10/03/1991				1			6				293
SF201	RV	2	11/11/1997		0.75 U	1.4 J	0.069 U	0.39 J	16.6 U	0.41 J	2 J	0.1 U	0.22 U	26.1 U
SF201	RV	3	05/09/1998		0.72	1 U	0.62	3 U	80	3.7	6.3	0.2 UJ	0.3 U	120
SF202	RV	2	11/11/1997		0.25 U	0.27 UJ	0.069 U		5 U	0.19 J	1 J	0.1 U	0.22 U	

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF202	RV	2	11/11/1997					0.54 J						10.5 U
SF202	RV	18	05/22/1999						20		2			
SF202	RV	3	05/09/1998		0.5 U	1 U	0.1 U	3 U	31.2	0.5 U	5 U	0.2 UJ	0.3 U	5 U
SF204	RV	2	11/10/1997		0.05 U	0.16 U	0.069 U	0.14 U	5 U	0.026 U	1.1 J	0.1 U	0.22 U	12.2 U
SF204	RV	3	05/09/1998		0.5 U	1 U	0.1 U	3 U	141	4.4	42.2	0.2 UJ	0.3 U	9.5
SF205	RV	2	11/10/1997		0.2 U	0.22	0.069 U	0.2 U	52.9 J	0.27 J	12.1	0.1 U	0.22 U	18.4 U
SF205	RV	4	05/16/1991				0.2 U			3 U				20 U
SF205	RV	5	10/04/1991				0.2 U			1				42
SF205	RV	7	10/26/1993				0.25 U			7				16
SF205	RV	7	11/30/1993				0.25 U			6				5.7 J
SF205	RV	7	12/16/1993				0.25 U			2.5 U				59.3
SF205	RV	7	01/19/1994				2.5			2.5 U				28.5
SF205	RV	7	02/15/1994				2.5			2.5 U				11
SF205	RV	7	03/07/1994				0.25 U			2.5 U				25
SF205	RV	7	03/23/1994				0.25 U			2.5 U				5 U
SF205	RV	7	04/06/1994				0.25 U			2.5 U				5 U
SF205	RV	7	04/18/1994				0.25 U			6				12
SF205	RV	7	05/03/1994				0.25 U			6				11
SF205	RV	7	05/20/1994				0.25 U			10				12
SF205	RV	7	06/08/1994				0.25 U			2.5 U				15
SF205	RV	7	06/24/1994				0.25 U			2.5 U				61
SF205	RV	7	07/23/1994				0.25 U			6				14
SF205	RV	7	08/16/1994				0.25 U			2.5 U				17
SF205	RV	7	09/09/1994				0.25 U			2.5 U				15
SF205	RV	7	10/05/1994				0.25 U			2.5 U				39
SF205	RV	7	11/15/1994				0.25 U			2.5 U				5 U
SF205	RV	7	12/14/1994				0.25 U			2.5 U				16
SF205	RV	7	01/11/1995				0.25 U			8				18
SF205	RV	7	02/10/1995				0.25 U			2.5 U				17
SF205	RV	7	03/08/1995				0.25 U			2.5 U				18
SF205	RV	7	03/22/1995				0.25 U			2.5 U				29
SF205	RV	7	04/12/1995				0.25 U			2.5 U				10 J
SF205	RV	7	04/25/1995				0.25 U			2.5 U				11
SF205	RV	7	05/09/1995				0.25 U			2.5 U				24
SF205	RV	7	05/23/1995				0.25 U			2.5 U				10 J
SF205	RV	7	06/13/1995				1			2.5 U				20
SF205	RV	7	06/28/1995				0.25 U			2.5 U				10 J

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF205	RV	7	07/12/1995				0.25 U			2.5 U				13
SF205	RV	7	07/26/1995				0.25 U			2.5 U				10 J
SF205	RV	7	08/15/1995				0.25 U			2.5 U				13
SF205	RV	7	09/14/1995				0.25 U			2.5 U				5 U
SF205	RV	18	05/22/1999							2				10
SF205	RV	18	05/25/1999						920	11	94			30
SF205	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	132	3.6	13	0.2 U	0.2 U	10 U
SF206	RV	2	11/10/1997		2.7	0.6	0.069 U	5.7	5 U	0.13 J	1 U	0.29 U	0.22 U	9.5 U
SF206	RV	3	05/08/1998		4	2 U	0.2 U	11	28	1.3	5 U	0.2 U	0.2 U	10 U
SF207	RV	2	11/10/1997		1.3 U	0.31	0.069 U	2.5 J	5 U	0.097 J	1.2 J	0.1 U	0.22 U	9.8 U
SF207	RV	3	05/08/1998		1	2 U	0.2 U	3	20 U	0.2	5 U	0.2 U	0.2 U	10 U
SF208	RV	2	11/10/1997		1.1 U	0.47	0.069 U	0.93 J	103	2.3	127	0.1 U	0.22 U	24.2 U
SF208	RV	4	05/16/1991				0.2 U			3 U				20 U
SF208	RV	5	10/04/1991				0.2 U			2				12 U
SF208	RV	18	10/22/1998				1 UJ			1 UJ				10
SF208	RV	18	10/22/1998				1 UJ			1 UJ				10
SF208	RV	18	11/16/1998				1			10				60
SF208	RV	18	12/14/1998				1 UJ			7				30
SF208	RV	18	01/20/1999				1			4				20
SF208	RV	18	03/22/1999				1 UJ			24 UJ				50
SF208	RV	18	04/19/1999				1 UJ			5				30
SF208	RV	18	05/05/1999						70	2	56			10
SF208	RV	18	05/22/1999						250	4	73			10
SF208	RV	18	05/25/1999						870	13	170			20
SF208	RV	18	05/27/1999						330	5	62			10
SF208	RV	18	05/31/1999						160	2	39			10
SF208	RV	18	06/16/1999							3				10
SF208	RV	18	07/12/1999				0.1 U			1.8				4.4
SF208	RV	18	08/12/1999				0.1 U			1.4				6.7
SF208	RV	18	08/31/1999				0.1 U			1.3				8.2
SF208	RV	3	05/09/1998		0.5 U	1 U	0.1 U	3 U	75	2.7	27.5	0.2 UJ	0.3 U	7
SF209	RV	2	11/10/1997		3	0.91	0.069 U	1.1 J	5 U	1.2	1.3 J	0.1 U	0.22 U	13.3 U
SF209	RV	3	05/08/1998		1	2 U	0.2 U	3	32	3.1	5 U	0.2 U	0.2 U	10 U
SF209	RV	3	05/19/1998		0.43 U	0.27 J	0.041 U	0.56 J	85.3 J	0.66 J	38.5 J	0.16 U	0.042 U	4.7 J
SF210	RV	2	11/10/1997		0.27 U	0.22 J	0.069 U	0.56 U	5 U	0.24 J	1 U	0.1 U	7.2	11.1 U
SF210	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2	44	0.5	5 U	0.2 U	0.2 U	10 U
SF211	RV	2	11/09/1997				0.29 U	0.37 U	5 U	0.38 J	1.4 J	0.1 U	0.22 U	

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF211	RV	2	11/09/1997		0.46 U	0.63 U								31.8 U
SF211	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	30	1.5	5 U	0.2 U	0.2 U	10 U
SF212	RV	2	11/09/1997		3.5 J	0.43 U	2.9	0.81 J	6.1 U	12.6	1.8 J	0.1 U	0.22 U	13.9 U
SF212	RV	3	05/08/1998		2.5	2 U	0.2 U	8	20 U	2.7	5 U	0.2 U	0.2 U	10 U
SF213	RV	2	11/10/1997		0.29 U	0.16 U	0.069 U	0.15 U	10 J	0.19 J	3.4 J	0.1 U	7.7	13.4 U
SF213	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	38	0.9	7	0.2 U	0.2 U	10 U
SF214	RV	2	11/09/1997		0.17 U	0.16 U	0.069 U	0.36 U	9.9 U	0.33 J	2.6 J	0.1 U	0.22 U	29.5 U
SF214	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	28	0.7	5 U	0.2 U	0.2 U	10 U
SF215	RV	2	11/09/1997		4 J	0.32 U	4.4	1.6 J	48.7 U	32.8	60.2	0.1 U	0.22 U	28.2 U
SF215	RV	4	05/15/1991				0.2 U			3 U				20 U
SF215	RV	5	10/04/1991				0.2 U			2				16
SF215	RV	3	05/10/1998		0.032 U	0.31 J	0.042 U	1 J	94.5 J	3.4	18.9	0.16 U	0.042 U	9.1 J
SF216	RV	2	11/09/1997		0.67 U	0.2 U	0.16 U	0.5 U	23.1 U	1.3	5.8 J	0.1 U	0.22 U	47.5
SF218	RV	2	11/09/1997		19	1.8 J	0.92	0.46 J	5 UJ	7	17.8	0.1 U	0.22 UJ	202
SF218	RV	3	05/08/1998		0.9	2 U	0.9	3	23	5	6	0.2 U	0.2 U	156
SF219	RV	2	11/08/1997		0.05 U	0.34 J	0.069 U	0.06 U	5 UJ	0.17 J	1 U	0.1 U	0.22 UJ	14.4 U
SF219	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	81.8 U	0.85	11.5	0.32	0.3 U	5 U
SF220	RV	2	11/08/1997		2.1 J	0.5 J	0.56	1.4 J	39.4 UJ	8.4	81.6	0.1 U	0.22 UJ	146
SF220	RV	4	05/15/1991				0.2			7				51
SF220	RV	5	10/04/1991				0.6			26				207
SF220	RV	7	10/26/1993				0.8			8				176
SF220	RV	7	11/30/1993				0.7			18				174
SF220	RV	7	12/20/1993				0.8			9				207
SF220	RV	7	01/19/1994				0.6			11				172
SF220	RV	7	02/15/1994				0.7			13				187
SF220	RV	7	03/07/1994				0.5 J			9				118
SF220	RV	7	03/23/1994				0.6			9				135
SF220	RV	7	04/06/1994				0.5 J			10				81
SF220	RV	7	04/18/1994				0.25 U			21				46
SF220	RV	7	05/03/1994				0.5 J			5 J				58
SF220	RV	7	05/20/1994				0.7			63				57
SF220	RV	7	06/08/1994				0.25 U			9				66
SF220	RV	7	06/24/1994				0.6			7				94
SF220	RV	7	07/23/1994				0.7			11				146
SF220	RV	7	08/16/1994				2.2			14				175
SF220	RV	7	09/09/1994				0.6			6				158
SF220	RV	7	10/05/1994				1			6				201

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF220	RV	7	11/15/1994				1			7				192
SF220	RV	7	12/14/1994				1.1			7				218
SF220	RV	7	01/11/1995				0.7			12				122
SF220	RV	7	02/10/1995				0.6			7				114
SF220	RV	7	03/08/1995				0.6			6				118
SF220	RV	7	03/22/1995				1			5 J				214
SF220	RV	7	04/12/1995				1.2			7				113
SF220	RV	7	04/25/1995				0.5 J			7				80
SF220	RV	7	05/08/1995				1.1			18				85
SF220	RV	7	05/23/1995				0.9			10				67
SF220	RV	7	06/13/1995				0.6			6				70
SF220	RV	7	06/28/1995				0.25 U			6				72
SF220	RV	7	07/12/1995				0.5 J			8				93
SF220	RV	7	07/26/1995				1			6				115
SF220	RV	7	08/15/1995				0.6			16				138
SF220	RV	7	09/14/1995				0.7			8				164
SF220	RV	3	05/10/1998		0.43 J	0.41 J	0.17 J	1 J	92.3 J	5.8 J	23.5 U	0.16 U	0.042 U	38.8
SF221	RV	2	11/08/1997				0.069 U				1 U	0.1 U	0.22 UJ	
SF221	RV	2	11/08/1997		0.05 U	0.2 J		0.16 J	5 UJ	0.12 J				8.1 U
SF221	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	30.5 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF222	RV	2	11/08/1997		0.05 U	0.16 U	0.069 U	0.06 U	5 UJ	0.15 J	1 U	0.1 U	0.22 UJ	7.4 U
SF222	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF223	RV	2	11/08/1997		3.1 J	0.41 J	7.3	0.24 J	5 UJ	9.5	3.1 U	0.1 U	0.22 UJ	1440
SF223	RV	7	04/24/1998				7			460				805
SF223	RV	7	05/28/1998				3.9			38				587
SF223	RV	7	06/25/1998				4.9			22				727
SF223	RV	7	07/27/1998				6.4			25				623
SF223	RV	7	08/25/1998				7.6			23				958
SF223	RV	7	09/23/1998				8			27				1080
SF223	RV	7	10/27/1998				11			24				1540
SF223	RV	7	11/24/1998				16			32				2340
SF223	RV	7	12/31/1998				12			32				1590
SF223	RV	7	01/14/1999				10			34				1470
SF223	RV	7	02/22/1999				10			19				1360
SF223	RV	7	03/09/1999				14			23				1400
SF223	RV	3	05/06/1998		0.5 U	1 U	8.8	3 U	20 U	12.2	7.5	0.2 U	0.3 U	1370
SF224	RV	2	11/08/1997		0.92 U	0.32 J	0.069 U	0.73 J	5 UJ	10.5	1.2 U	0.1 U	0.22 UJ	10.3 U

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF224	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	38 U	24.7	6	0.2 U	0.3 U	5 U
SF225	RV	2	11/07/1997		0.42 U	0.16 U	0.069 U	0.47 J	76.4 UJ	0.1 J	1 U	0.1 U	0.22 UJ	9.6 U
SF225	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U	51	0.2 U	5 U	0.2 U	0.2 U	10 U
SF226	RV	2	11/07/1997		0.18 U	0.16 U	0.069 U	0.19 J	10 U	1.7	4.6 J	0.1 UJ	0.22 U	14.7 J
SF226	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U	65	1.8	5 U	0.2 U	0.2 U	10 U
SF227	RV	2	11/07/1997		1.8 U	0.28	0.79	1.2	51 J	11	50.6	0.1 U	0.22 U	168
SF227	RV	4	05/15/1991				0.4			7				86
SF227	RV	5	10/04/1991				0.9			12				249
SF227	RV	18	05/24/1999				1		1000	85	340			130
SF227	RV	3	05/10/1998		0.24 J	0.57 J	0.36 J	1.1 J	93.5 J	6	21.7	0.16 U	0.042 U	66.9
SF228	RV	2	11/07/1997		1.9 U	0.37	0.88	1.2	193	7.3	60.9	0.1 U	0.22 U	225
SF228	RV	4	05/16/1991				0.4			10				95
SF228	RV	5	10/04/1991				0.7			11				291
SF228	RV	7	10/26/1993				1.1			5 J				228
SF228	RV	7	11/30/1993				1.2			11				245
SF228	RV	7	12/20/1993				2.5			1 U				251
SF228	RV	7	01/19/1994				1			2.5 U				193
SF228	RV	7	02/15/1994				0.9			7				217
SF228	RV	7	03/07/1994				0.9			8				192
SF228	RV	7	03/23/1994				1			6				218
SF228	RV	7	04/06/1994				0.8			12				156
SF228	RV	7	04/18/1994				1.2			52				162
SF228	RV	7	05/03/1994				0.6			7				93
SF228	RV	7	05/20/1994				0.9			15				110
SF228	RV	7	06/08/1994				0.7			6				132
SF228	RV	7	06/24/1994				0.8			7				124
SF228	RV	7	07/23/1994				1			2.5 U				164
SF228	RV	7	08/16/1994				1.6			7				232
SF228	RV	7	09/09/1994				0.9			6				201
SF228	RV	7	11/15/1994				1.2			2.5 U				284
SF228	RV	7	12/14/1994				1.7			8				326
SF228	RV	7	01/11/1995				1.1			15				233
SF228	RV	7	02/10/1995				0.9			6				218
SF228	RV	7	03/22/1995				1			2.5 U				194
SF228	RV	7	04/12/1995				1.4			7				163
SF228	RV	7	04/25/1995				0.8			9				143
SF228	RV	7	05/08/1995				1.9			16				109

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF228	RV	7	05/23/1995				1.2			10				105
SF228	RV	7	06/13/1995				0.9			6				108
SF228	RV	7	06/28/1995				0.7			2.5 U				117
SF228	RV	7	07/12/1995				0.9			7				131
SF228	RV	7	07/26/1995				1			2.5 U				177
SF228	RV	7	08/15/1995				1			5 J				217
SF228	RV	7	09/14/1995				1.1			5 J				212
SF228	RV	7	10/18/1995				0.9			14				181
SF228	RV	7	11/22/1995				0.9			7				142
SF228	RV	7	12/27/1995				1.3			7				243
SF228	RV	7	01/17/1996				1.1			8				223
SF228	RV	7	02/29/1996				0.9			8				219
SF228	RV	7	03/27/1996				0.8			5 J				193
SF228	RV	7	04/17/1996				0.6			12				166
SF228	RV	7	05/08/1996				0.8			11				160
SF228	RV	7	06/19/1996				1			13				144
SF228	RV	7	07/23/1996				1.1			11				145
SF228	RV	7	08/21/1996				1			14				210
SF228	RV	7	09/26/1996				1.2			8				235
SF228	RV	7	10/29/1996				1.1			8				219
SF228	RV	7	11/26/1996				1.2			8				277
SF228	RV	7	12/17/1996				1.3			6				330
SF228	RV	7	01/29/1997				1.1			10				227
SF228	RV	7	03/27/1997				1.5							256
SF228	RV	7	04/17/1997				1.8			12				214
SF228	RV	7	05/15/1997				3.3			588				485
SF228	RV	7	06/25/1997				0.25			9				101
SF228	RV	7	07/24/1997				0.7			8				139
SF228	RV	7	08/13/1997				0.9			10				174
SF228	RV	7	09/04/1997				1.4			11				223
SF228	RV	7	10/17/1997				1.5			11				262
SF228	RV	7	11/25/1997				1			8				207
SF228	RV	7	12/18/1997				1.2			13				225
SF228	RV	7	01/22/1998				1.2			9				243
SF228	RV	7	02/26/1998				1.2			11				254
SF228	RV	7	03/19/1998				1			14				224
SF228	RV	7	04/24/1998				1.4			52				150

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF228	RV	7	04/24/1998				1.2			52				127
SF228	RV	7	05/28/1998				0.6			8				98
SF228	RV	7	06/25/1998				0.9			5				154
SF228	RV	7	07/27/1998				1			10				148
SF228	RV	7	08/25/1998				1			7				175
SF228	RV	7	09/23/1998				1.2			12				203
SF228	RV	7	10/27/1998				1.1			8				260
SF228	RV	7	11/24/1998				2.1			15				282
SF228	RV	7	12/31/1998				2.2			27				274
SF228	RV	7	02/22/1999				1.3			9				193
SF228	RV	7	03/09/1999				3.2			9				242
SF228	RV	3	05/10/1998					0.98 J				0.16 U	0.042 U	67.5
SF228	RV	3	05/10/1998		0.3 J	0.34 J	0.32 J		84.3 J	5.1	19.1			
SF229	RV	2	11/07/1997		0.3 U	0.16 U	0.069 U	0.37 U	5 U	0.58	1 U	0.1 U	0.22 U	29.6
SF229	RV	3	05/05/1998		0.3	2 U	0.2 U	2 U	49	1.2	5 U	0.2 U	0.2 U	24
SF230	RV	2	11/06/1997		0.23 U	0.23	0.069 U	0.14 U	5 U	0.13 U	1 U	0.1 U	0.22 U	10.9 U
SF230	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U			5 U	0.2 U	0.2 U	10 U
SF230	RV	3	05/05/1998						51	0.3				
SF231	RV	2	11/06/1997		0.32 U	0.23	0.069 U	0.06 U	5 U	0.026 U	1 U	0.1 U	0.22 U	10.9 U
SF275	RV	3	05/07/1998		0.032 U	0.23 U	0.16 J	0.44 U	40.5 J	2.8 J	4 J	0.16 U	0.042 U	43.7
SF316	RV	3	05/08/1998		0.4	2 U	0.2 U	2 U	255	3.2	28	0.2 U	0.2 U	10 U
SF317	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	77.9 J	0.11 U	3.2 J	0.16 U	0.042 U	
SF317	RV	3	05/07/1998											0.94 J
SF318	RV	3	05/07/1998		0.032 U	0.23 U	15.2	0.44 U	25.8 J	43.9	107	0.16 U	0.042 U	2120
SF319	RV	3	05/07/1998		0.032 U	0.23 U	2.5 J	0.44 U	15.1 J	18.7	31.6	0.16 U	0.042 U	334
SF320	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	5.6 U	0.47 J	1 J	0.16 U	0.042 U	2.6 J
SF321	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	5.6 U	3	0.65 J	0.16 U	0.042 U	9.8 J
SF328	SP	2	11/08/1997		1.9 J	0.45 J	0.64	0.22 J	5 UJ	7.1	3.8 U	0.1 U	0.22 UJ	110
SF328	SP	3	05/17/1998		1.8	2 U	3.6	2 U	62	11.9	6	0.2 U	0.2 U	121
SF338	AD	3	05/18/1998		6.6	1.3	0.1 U	* 550	20 U	0.5 U	21.2	0.2 U	0.3 U	9.4
SF339	AD	3	05/17/1998		3.1 U	8.9 J		20.3 J	567	169	62.6	0.2 U	0.3 U	40.4
SF342	AD	3	05/18/1998		0.94	1.5	2.5	3 U	48.5 U	3.1	5 U	0.32	0.3 U	201
SF345	AD	3	05/17/1998		0.2 U	2 U	16.4	8	20 U	76.9	554	0.2 U	0.8	2510
SF346	AD	3	05/17/1998		0.2 U	2 U	5.7	2 U	98	0.9	453	0.2 U	0.2 U	851
SF347	AD	3	05/17/1998		0.2 U	2 U	73.2	3.4	64	666	1380	0.2 U	0.2 U	* 11000
SF349	AD	3	05/17/1998		0.2 U	2 U	0.8	2 U	20 U	35	5 U	0.2 U	0.2 U	84
SF350	AD	3	05/18/1998		6.2	5.4	0.1 U	3 U	377	2.5	114	0.2 U	0.3 U	5 U

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF386	AD	2	11/19/1997		0.83 U	25.2	0.35 U	3.2 J	770	7.2	24	0.1 U	0.22 U	39.9 U
SF389	AD	2	11/19/1997		2.5 J	3.5	0.48	5.3	1130	30.1	133	0.5	0.22 U	51.3 U
SF390	AD	2	11/19/1997		0.43 U	0.5 J	0.069 U	0.44 J	43.1 J	0.17 J	1.1 J	0.1 U	0.22 U	12.1 U
SF394	AD	2	11/20/1997		1 U	1.4 J	0.069 U	0.28 U	164	2	2090	0.1 U	0.22 UJ	38.1 U
SF394	AD	4	05/15/1991				0.9			3				126
SF394	AD	5	10/04/1991				0.5			5				83
SF394	AD	3	05/17/1998		1.6	2 U	1.7	2 U	400	9.2	2000	0.2 U	0.2 U	317
SF395	AD	2	11/20/1997		0.75 U	2.6	0.069 U	1.3 J	1380	32.2	678	0.1 U	0.22 UJ	29 U
SF395	AD	3	05/18/1998		0.5 U	1.9	0.1	3 U	910	16.6	918	0.2 U	0.3 U	17.7
SF396	AD	2	11/20/1997		0.32 U	0.16 U	0.069 U	0.28 U	5.9 U	0.62	1 U	0.1 U	0.22 UJ	11.7 U
SF396	AD	3	05/19/1998		0.26 U	0.23 U	0.041 U	0.44 U	40.6 J	0.84 J	0.8 J	0.16 U	0.042 U	1.1 J
SF398	RV	3	05/13/1998		0.28 J	0.33 J	0.4 J	0.83 J	84.9 J	5.2	19	0.16 U	0.042 U	84.3
SF605	OF	8	04/02/1996				16.2	5 U		54	314	0.2 U	1 U	2520
SF606	OF	8	03/23/1998		45 U	40 U	2 U	23.7		25 UJ	9.74	0.2 U	4 U	17 J
SF607	OF	8	04/02/1996				3.06	5 U		65.4	102	0.2 U	1 U	574
SF607	OF	8	03/24/1998		45 U	40 U	2 U	3 U		130 J	288	0.2 U	4 U	73.5
SF607	OF	8	07/31/1990				0.5 U			153				83
SF607	OF	8	11/07/1991				1 U			922				450
SF607	OF	8	01/03/1996				2			54				496
SF607	OF	8	01/10/1996				3			79				431
SF607	OF	8	01/17/1996				4			76				557
SF607	OF	8	01/24/1996							130				557
SF607	OF	8	01/31/1996				7			159				592
SF607	OF	8	02/07/1996				5			119				993
SF607	OF	8	02/14/1996				4			159				513
SF607	OF	8	02/21/1996				2			109				441
SF607	OF	8	02/28/1996				2			132				470
SF607	OF	8	03/06/1996				2			119				501
SF607	OF	8	03/13/1996				3			104				581
SF607	OF	8	03/20/1996				3			94				697
SF607	OF	8	03/27/1996							103				671
SF609	OF	8	04/02/1996				1 U	5 U		109	280	0.2 U	1 U	245
SF609	OF	8	03/24/1998		45 U	40 U	2 U	3 U		81 J	501	0.2 U	4 U	310
SF609	OF	8	07/31/1990				0.7			32				30
SF609	OF	8	11/07/1991				1 U			21				70
SF609	OF	8	12/21/1994				5			59				403
SF609	OF	8	12/28/1994				7			90				477

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF609	OF	8	01/04/1995				5			89				497
SF609	OF	8	01/11/1995				5			122				531
SF609	OF	8	01/18/1995				4			134				604
SF609	OF	8	01/25/1995				3			121				585
SF609	OF	8	01/03/1996							100				303
SF609	OF	8	01/10/1996							136				127
SF609	OF	8	01/17/1996							113				268
SF609	OF	8	01/24/1996							135				179
SF609	OF	8	01/31/1996							155				202
SF609	OF	8	02/07/1996				3			148				1910
SF609	OF	8	02/14/1996				2			163				356
SF609	OF	8	02/21/1996				2			155				198
SF609	OF	8	02/28/1996							161				137
SF609	OF	8	03/06/1996				2			183				150
SF609	OF	8	03/13/1996							162				199
SF609	OF	8	03/20/1996							203				264
SF609	OF	8	03/27/1996							137				252
SF611	OF	8	04/02/1996				1 U	5 U		3.27	2660	0.2 U	1 U	61.8
SF611	OF	8	03/24/1998		45 U	40 U	2 U	3 U		25 U	1470	0.2 U	4 U	14
SF611	OF	8	01/31/1994				7			70				142
SF611	OF	8	02/28/1994				7			73				99
SF611	OF	8	03/31/1994				6			68				132
SF611	OF	8	04/30/1994				7			83				169
SF611	OF	8	05/31/1994				8			82				168
SF611	OF	8	06/30/1994				7			129				130
SF611	OF	8	07/31/1994				7			87				197
SF611	OF	8	08/31/1994				8			87				85
SF611	OF	8	09/30/1994				7			71				114
SF611	OF	8	10/31/1994				6			99				316
SF611	OF	8	11/30/1994				8			131				178
SF611	OF	8	12/31/1994				8			86				234
SF611	OF	8	01/31/1995				3			74				279
SF611	OF	8	02/28/1995				3			69				181
SF611	OF	8	03/31/1995				4			71				141
SF611	OF	8	04/30/1995				3			75				178
SF611	OF	8	05/31/1995				3			79				153
SF611	OF	8	06/30/1995				3			90				137

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF611	OF	8	07/31/1995				2 U			100				152
SF611	OF	8	08/31/1995				2			93				135
SF611	OF	8	09/30/1995				2 U			104				583
SF611	OF	8	10/31/1995				5			306				512
SF611	OF	8	11/30/1995				5			110				507
SF611	OF	8	12/31/1995				6			135				234
SF611	OF	8	01/31/1996				8			80				340
SF611	OF	8	02/29/1996				4			82				188
SF611	OF	8	03/31/1996				2			89				767
SF611	OF	8	04/30/1996				8			128				231
SF611	OF	8	05/31/1996				3			100				244
SF611	OF	8	06/30/1996				3			114				247
SF611	OF	8	07/31/1996				2			100				198
SF611	OF	8	08/31/1996				2 U			83				124
SF611	OF	8	09/30/1996				2 U			180				264
SF611	OF	8	11/30/1996				3			100				95
SF611	OF	8	12/31/1996				4			70				439
SF611	OF	8	01/31/1997				6			80				533
SF611	OF	8	02/28/1997				2 U			110				183
SF611	OF	8	03/31/1997				3			60				445
SF611	OF	8	04/30/1997				3			50				195
SF611	OF	8	05/31/1997				2 U			80				225
SF611	OF	8	06/30/1997				3			90				247
SF611	OF	8	07/31/1997				2 U			90				172
SF611	OF	8	08/31/1997				2 U			100				321
SF611	OF	8	09/30/1997				2 U			80				265
SF611	OF	8	10/31/1997				2 U			130				182
SF611	OF	8	11/30/1997				2 U			67				185
SF611	OF	8	12/31/1997				2 U			62				182
SF611	OF	8	01/31/1998				2 U			65				
SF611	OF	8	02/28/1998				2 U			60				134
SF611	OF	8	04/30/1998				2 U			80				162
SF611	OF	8	05/31/1998				2 U			80				299
SF611	OF	8	06/30/1998				2 U			70				183
SF611	OF	8	01/15/1994				6			63				101
SF611	OF	8	02/15/1994				6			64				95
SF611	OF	8	03/15/1994				5			59				120

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF611	OF	8	04/15/1994				7			67				144
SF611	OF	8	05/15/1994				6			70				160
SF611	OF	8	06/15/1994				6			82				
SF611	OF	8	07/15/1994				7			75				118
SF611	OF	8	08/15/1994				7			76				152
SF611	OF	8	09/15/1994				6			57				82
SF611	OF	8	10/15/1994				6			85				100
SF611	OF	8	11/15/1994				5			88				174
SF611	OF	8	12/15/1994				7			77				148
SF611	OF	8	01/15/1995				2			66				157
SF611	OF	8	02/15/1995				1			57				183
SF611	OF	8	03/15/1995				2			62				156
SF611	OF	8	04/15/1995				1			69				126
SF611	OF	8	05/15/1995				1			70				150
SF611	OF	8	06/15/1995				1			80				129
SF611	OF	8	07/15/1995				2 U			88				132
SF611	OF	8	08/15/1995				0.4			82				112
SF611	OF	8	09/15/1995				2 U			81				116
SF611	OF	8	10/15/1995				1			134				263
SF611	OF	8	11/15/1995				2							222
SF611	OF	8	12/15/1995				3			7.8				280
SF611	OF	8	01/15/1996				3			92				182
SF611	OF	8	02/15/1996				2			66				229
SF611	OF	8	03/15/1996				1			74				172
SF611	OF	8	04/15/1996				2			82				283
SF611	OF	8	05/15/1996				1			89				177
SF611	OF	8	06/15/1996				1			93				207
SF611	OF	8	07/15/1996				2 U			90				195
SF611	OF	8	08/15/1996				2 U			77				151
SF611	OF	8	09/15/1996				2 U			73				110
SF611	OF	8	10/15/1996							90				133
SF611	OF	8	11/15/1996				2 U			90				66
SF611	OF	8	12/15/1996				2 U			70				193
SF611	OF	8	01/15/1997				3			60				222
SF611	OF	8	02/15/1997				2 U			70				155
SF611	OF	8	03/15/1997				2 U			50				260
SF611	OF	8	04/15/1997				2 U			40				172

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
SF611	OF	8	05/15/1997				2 U			70				177
SF611	OF	8	06/15/1997				2 U			70				211
SF611	OF	8	07/15/1997				2 U			70				157
SF611	OF	8	08/15/1997				2 U			80				235
SF611	OF	8	09/15/1997				2 U			70				219
SF611	OF	8	10/15/1997				2 U			80				116
SF611	OF	8	11/15/1997				2 U			56				124
SF611	OF	8	12/15/1997				2 U			51				97
SF611	OF	8	01/15/1998				2 U			57				
SF611	OF	8	02/15/1998				2 U			50				110
SF611	OF	8	04/15/1998				2 U			60				117
SF611	OF	8	05/15/1998				2 U			70				209
SF611	OF	8	06/15/1998				2 U			60				150
SF612	OF	8	04/02/1996				1 U	5 U		15.5	9.9	0.2 U	1 U	110
SF612	OF	8	03/24/1998		45 U	40 U	2 U	3 U		25 U	5.63	0.2 U	4 U	93.7
SF619	OF	8	03/23/1998		45 U	40 U	2 U	3 U		25 UJ	79.2	0.2 U	4 U	23.6 J
SF627	OF	8	04/04/1996		5 U	5 U	5 U	5 U		5.6	140	0.2 U	1 U	434
SF627	OF	8	03/25/1998		45 U	40 U	2 U	3 U		25 UJ	33.2	0.2 U	4 U	278
SF650	RV	18	05/24/1999						1400	83	340			80
SF8106	RV	13	—				5	35 U	12 U		2 U			3 U
SF8128	WL	13	—			29 U	3 U	* 310	12 U	15 U	14	5 U		3 U
SF8129	AD	13	—			29 U	4	35 U	12 U	3.9	2 U	5 U		3 U
SF8130	AD	13	—			29 U	3 U	35 U	12 U	4	2 U	5 U		3 U
SF8131	AD	13	—			29 U	5	35 U	12 U	15 U	4	5 U		3 U
SF8132	AD	13	—			6.2	4	35 U	12 U	15 U	4	5 U		3 U
SF8133	AD	13	—			29 U	6	44	12 U	15 U	7	5 U		3 U
SF8134	WL	13	—			29 U	8	35 U	12 U	15 U	7	5 U		3 U
SF8221	AD	13	—			41	5	35 U	12 U	15 U	3	5 U		3 U
SF8222	AD	13	—			29 U	8	35 U	220	15 U	340	5 U		3 U
SF8223	RV	13	—			29 U	7	35 U	12 U	15 U	6	5 U		3 U
SF8224	AD	13	—			29 U	8	35 U	12 U	15 U	7	5 U		3
SF8252	AD	13	—			29 U	3 U	35 U	12 U	15 U	5	5 U		10
Surface Water - Dissolved Metals (ug/l)														
SF10	RV	5	10/03/1991				8			1				13
SF201	RV	2	11/11/1997		0.67	1.2	0.093	0.5 U	10 U	0.13	1.4	0.2 U	0.03 U	20.9
SF201	RV	3	05/09/1998		0.71	1 U	0.6	3 U	20 U	0.92	5 U	0.2 UJ	0.3 U	117

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF202	RV	2	11/11/1997		0.5 U		0.04 U	0.5 U	10 U	0.11	1 U	0.2 U	0.03 U	4.5
SF202	RV	2	11/11/1997			0.24								
SF202	RV	18	05/22/1999				1 UJ		10 U	1 U	1 U			1.3
SF202	RV	3	05/09/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 UJ	0.3 U	6.2
SF204	RV	2	11/10/1997		0.5 U	0.11	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	5.99
SF204	RV	3	05/09/1998		0.5 U	1 U	0.1 U	4.3	20 U	0.5 U	5 U	0.2 UJ	0.3 U	5.9
SF205	RV	2	11/10/1997		0.5 U	0.32	0.04 U	0.5 U	36.5	0.1 U	11.3	0.2 U	0.03 U	6.78
SF205	RV	4	05/16/1991				0.2 U			3 UJ				20 U
SF205	RV	5	10/04/1991				0.2 U			1 U				12 U
SF205	RV	7	10/26/1993				0.25 U			2.5 J				26.2
SF205	RV	7	11/30/1993				0.25 U			3 J				5.7 J
SF205	RV	7	12/16/1993				0.25 U			1.5 U				59.3
SF205	RV	7	01/19/1994				0.5 U			1.5 U				14.8
SF205	RV	7	02/15/1994				0.5 U			1.5 U				11
SF205	RV	7	03/07/1994				0.25 U			1.5 U				59
SF205	RV	7	03/23/1994				0.25 U			1.5 U				15
SF205	RV	7	04/06/1994				0.25 U			3 J				5 U
SF205	RV	7	04/18/1994				0.25 U			5				5 U
SF205	RV	7	05/03/1994				0.25 U			3 J				15
SF205	RV	7	05/20/1994				0.25 U			2.5 J				20
SF205	RV	7	06/08/1994				0.25 U			1.5 U				19
SF205	RV	7	06/24/1994				0.25 U			1.5 U				23
SF205	RV	7	07/23/1994				0.25 U			4				43
SF205	RV	7	08/16/1994				0.25 U			2.5 J				22
SF205	RV	7	09/09/1994				0.25 U			1.5 U				11
SF205	RV	7	10/05/1994				0.25 U			1.5 U				21
SF205	RV	7	11/15/1994				0.25 U			1.5 U				13
SF205	RV	7	12/14/1994				0.25 U			1.5 U				5 U
SF205	RV	7	01/11/1995				0.25 U			1.5 U				23
SF205	RV	7	02/10/1995				0.25 U			1.5 U				21
SF205	RV	7	03/08/1995				0.25 U			1.5 U				25
SF205	RV	7	03/22/1995				0.25 U			1.5 U				22
SF205	RV	7	04/12/1995				0.25 U			1.5 U				14
SF205	RV	7	04/25/1995				0.25 U			1.5 U				10 J
SF205	RV	7	05/09/1995				0.3 J			1.5 U				12
SF205	RV	7	05/23/1995				0.25 U			1.5 U				5 U
SF205	RV	7	06/13/1995				0.5 J			4				10 J

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF205	RV	7	06/28/1995				0.25 U			1.5 U				5 U
SF205	RV	7	07/12/1995				0.25 U			1.5 U				16
SF205	RV	7	07/26/1995				0.25 U			1.5 U				5 U
SF205	RV	7	08/15/1995				0.25 U			1.5 U				20
SF205	RV	7	09/14/1995				0.25 U			1.5 U				12
SF205	RV	18	05/22/1999				1 UJ			1				2.7
SF205	RV	18	05/25/1999				1		11	1 U	5.4			5
SF205	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF206	RV	2	11/10/1997		2.6	0.64	0.04 U	5.49	10 U	0.1 U	1 U	0.2 U	0.03 U	4.3
SF206	RV	3	05/08/1998		4	2 U	0.2 U	7	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF207	RV	2	11/10/1997		1.2	0.38	0.04 U	0.54	10 U	0.1 U	1 U	0.2 U	0.03 U	16.4
SF207	RV	3	05/08/1998		0.9	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF208	RV	2	11/10/1997		0.95	0.46	0.04 U	0.75	67.2	0.71	124	0.2 U	0.03 U	10
SF208	RV	4	05/16/1991				0.2 U			3 U				20 U
SF208	RV	5	10/04/1991				0.2 U			1 U				12 U
SF208	RV	18	10/22/1998				1 UJ			1 UJ				20 UJ
SF208	RV	18	10/22/1998				1 UJ			1 UJ				20 UJ
SF208	RV	18	11/16/1998				1 UJ			2				59
SF208	RV	18	12/14/1998				1 UJ			1				24
SF208	RV	18	01/20/1999				1 UJ			1.2				22
SF208	RV	18	03/22/1999				1 UJ			1				20
SF208	RV	18	04/19/1999				1 UJ			1				9.1
SF208	RV	18	05/05/1999				1 UJ		18	1 U	48			8.2
SF208	RV	18	05/22/1999				1 UJ		12	1 U	28			4.3
SF208	RV	18	05/25/1999				1 U		12	1 U	12			3.5
SF208	RV	18	05/27/1999				1 UJ		7.7	1 U	18			4.1
SF208	RV	18	05/31/1999				1 UJ		8.4	1 U	16			3.9
SF208	RV	18	06/16/1999				1 UJ			1				3.7
SF208	RV	18	07/12/1999				1 U			1 U				3
SF208	RV	18	08/12/1999				1 U			1 U				3
SF208	RV	18	08/31/1999				1 U			1 U				8
SF208	RV	3	05/09/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	17.7	0.2 UJ	0.3 U	6
SF209	RV	2	11/10/1997		2.9	1	0.04 U	0.94	10 U	0.91	1 U	0.2 U	0.03 U	2.7
SF209	RV	3	05/08/1998		1	2 U	0.2 U	2 U	20 U	0.6	5 U	0.2 U	0.2 U	10 U
SF209	RV	3	05/19/1998		0.47 U	0.27 J	0.041 U	0.44 U	56.5 J	0.11 U	34.2 J	0.16 U	0.042 UJ	4 J
SF210	RV	2	11/10/1997		0.5 U	0.13	0.04 U	0.54	10 U	0.1 U	1 U	0.2 U	0.03 U	4.2
SF210	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF211	RV	2	11/09/1997		0.5 U	0.74	0.29	0.5 U	10 U		1.8	0.2 U	0.03 U	
SF211	RV	2	11/09/1997							0.3				22.9
SF211	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF212	RV	2	11/09/1997		5.24	2.7	0.04 U	12.1	10 U	1.62	1.9	0.2 U	0.03 U	6.84
SF212	RV	3	05/08/1998		2.6	2 U	0.2 U	7	20 U	0.6	5 U	0.2 U	0.2 U	10 U
SF213	RV	2	11/10/1997		0.5 U	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	7.35
SF213	RV	3	05/08/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF214	RV	2	11/09/1997		0.5 U	0.17	0.04 U	0.5 U	10 U	0.11	1.5	0.2 U	0.03 U	5.93
SF214	RV	3	05/11/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF215	RV	2	11/09/1997		0.99	0.49	0.04 U	1.4	33.1	0.69	60.8	0.2 U	0.03 U	11.4
SF215	RV	4	05/15/1991				0.2 U			3 UJ				20 U
SF215	RV	5	10/04/1991				0.2 U			1 U				12 U
SF215	RV	3	05/10/1998		0.032 U	0.35 J	0.042 U	0.61 J	34.6 J	0.32 J	10.9 J	0.16 U	0.042 U	7.6 J
SF216	RV	2	11/09/1997		0.53	0.18	0.12	0.62	10 U	0.27	1 U	0.2 U	0.03 U	28.4
SF218	RV	2	11/09/1997		0.92	1.1	0.96	0.5 U	10 U	3.39	16.3	0.2 U	0.03 U	190
SF218	RV	3	05/08/1998		0.9	2 U	0.9	2 U	20 U	1.7	5 U	0.2 U	0.2 U	150
SF219	RV	2	11/08/1997		0.5 U	0.21	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	2
SF219	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF220	RV	2	11/08/1997		1.9	0.5	0.59	1.1	31.1	3.08	76.3	0.2 U	0.03 U	135
SF220	RV	4	05/15/1991				0.2			3 U				27
SF220	RV	5	10/04/1991				0.6			4				106
SF220	RV	7	10/26/1993				0.8			3 J				177
SF220	RV	7	11/30/1993				0.8			5				166
SF220	RV	7	12/20/1993				0.8			3 J				194
SF220	RV	7	01/19/1994				0.6			3 J				177
SF220	RV	7	02/15/1994				0.7			4				183
SF220	RV	7	03/07/1994				0.6			5				116
SF220	RV	7	03/23/1994				0.6			4				138
SF220	RV	7	04/06/1994				0.25 U			1.5 U				73
SF220	RV	7	04/18/1994				0.25 U			1.5 U				26
SF220	RV	7	05/03/1994				0.25 U			1.5 U				58
SF220	RV	7	05/20/1994				0.8			7				47
SF220	RV	7	06/08/1994				0.5 J			1.5 U				65
SF220	RV	7	06/24/1994				0.5 J			3 J				89
SF220	RV	7	07/23/1994				0.5 J			4				135
SF220	RV	7	08/16/1994				0.8			5				176
SF220	RV	7	09/09/1994				0.6			1.5 U				150

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF220	RV	7	10/05/1994				1			3 J				198
SF220	RV	7	11/15/1994				0.8			1.5 U				183
SF220	RV	7	12/14/1994				1.1			3 J				216
SF220	RV	7	01/11/1995				0.6			3 J				121
SF220	RV	7	02/10/1995				0.5 J			1.5 U				108
SF220	RV	7	03/08/1995				0.6			1.5 U				115
SF220	RV	7	03/22/1995				0.9			1.5 U				191
SF220	RV	7	04/12/1995				1.2			6				106
SF220	RV	7	04/25/1995				0.6			1.5 U				77
SF220	RV	7	05/08/1995				0.5 J			3 J				45
SF220	RV	7	05/23/1995				0.9			4				54
SF220	RV	7	06/13/1995				0.6			4				51
SF220	RV	7	06/28/1995				0.25 U			3 J				68
SF220	RV	7	07/12/1995				0.5 J			4				97
SF220	RV	7	07/26/1995				0.6			3 J				117
SF220	RV	7	08/15/1995				0.6			5				131
SF220	RV	7	09/14/1995				0.8			4				161
SF220	RV	3	05/10/1998		0.21 J	0.42 J	0.19 J	0.61 J	39.6 J	0.62 J	13.8 J	0.16 U	0.042 U	42.2
SF221	RV	2	11/08/1997				0.046							
SF221	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF222	RV	2	11/08/1997		0.5 U	0.12	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	3.2
SF222	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF223	RV	2	11/08/1997		0.5 U	0.49	8.37	0.5 U	10 U	9.23	2.2	0.2 U	0.03 U	1340
SF223	RV	7	04/24/1998				5			14				628
SF223	RV	7	05/28/1998				3.9			16				613
SF223	RV	7	06/25/1998				5			18				789
SF223	RV	7	07/27/1998				6.5			18				609
SF223	RV	7	08/25/1998				7.5			17				943
SF223	RV	7	09/23/1998				8.1			19				1050
SF223	RV	7	10/27/1998				10			15				1540
SF223	RV	7	11/24/1998				16			16				2400
SF223	RV	7	12/31/1998				12			13				1660
SF223	RV	7	01/14/1999				10			9				1480
SF223	RV	7	02/22/1999				9.4			9				1330
SF223	RV	7	03/09/1999				17			13				1420
SF223	RV	3	05/06/1998		0.5 U	1 U	8.2	3 U	20 U	6.4	5 U	0.2 U	0.3 U	1400
SF224	RV	2	11/08/1997		0.95	0.52	0.049	0.91	10 U	9.96	1 U	0.2 U	0.03 U	5.57

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF224	RV	3	05/06/1998		0.5 U	1 U	0.1 U	3 U	31.6 U	4.7	5 U	0.2 U	0.3 U	5 U
SF225	RV	2	11/07/1997		0.5 U	0.25	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	5
SF225	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF226	RV	2	11/07/1997		0.5 U	0.16	0.04 U	0.5 U	10 U	0.22	1 U	0.2 U	0.03 U	11.5
SF226	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF227	RV	2	11/07/1997		1.6	0.45	0.79	0.93	22	4.03	45	0.2 U	0.03 U	164
SF227	RV	4	05/15/1991				0.3			3 U				41
SF227	RV	5	10/04/1991				0.8			1				77
SF227	RV	18	05/24/1999				1 U		5.9	1 U	7.3			45
SF227	RV	3	05/10/1998		0.17 J	0.37 J	0.34 J	0.59 J	38.2 J	0.65 J	9.7 J	0.16 U	0.042 U	64.3
SF228	RV	2	11/07/1997		1.7	0.44	0.87	0.95	19	2.42	44.9	0.2 U	0.03 U	193
SF228	RV	4	05/16/1991				0.3			3 UJ				54
SF228	RV	5	10/04/1991				0.6			1				10
SF228	RV	7	10/26/1993				1.1			3 J				225
SF228	RV	7	11/30/1993				1			1.5 U				239
SF228	RV	7	12/20/1993				1.5			1 U				241
SF228	RV	7	01/19/1994				0.9			1.5 U				190
SF228	RV	7	02/15/1994				0.9			1.5 U				212
SF228	RV	7	03/07/1994				0.8			1.5 U				182
SF228	RV	7	03/23/1994				1			3 J				216
SF228	RV	7	04/06/1994				0.8			1.5 U				145
SF228	RV	7	04/18/1994				0.5 J			1.5 U				86
SF228	RV	7	05/03/1994				0.6			1.5 U				89
SF228	RV	7	05/20/1994				0.8			2.5 J				95
SF228	RV	7	06/08/1994				0.8			1.5 U				132
SF228	RV	7	06/24/1994				0.8			1.5 U				122
SF228	RV	7	07/23/1994				0.9			1.5 U				148
SF228	RV	7	08/16/1994				1.3			2.5 J				221
SF228	RV	7	09/09/1994				0.9			1.5 U				183
SF228	RV	7	11/15/1994				1.1			3 J				277
SF228	RV	7	12/14/1994				1.7			4				339
SF228	RV	7	01/11/1995				1			1.5 U				209
SF228	RV	7	02/10/1995				0.9			1.5 U				213
SF228	RV	7	03/22/1995				1			1.5 U				182
SF228	RV	7	04/12/1995				1.7			5				170
SF228	RV	7	04/25/1995				0.8			1.5 U				140
SF228	RV	7	05/08/1995				1.4			3 J				76

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF228	RV	7	05/23/1995				1.4			3 J				89
SF228	RV	7	06/13/1995				0.9			5				102
SF228	RV	7	06/28/1995				0.8			1.5 U				116
SF228	RV	7	07/12/1995				0.9			3 J				126
SF228	RV	7	07/26/1995				1			1.5 U				181
SF228	RV	7	08/15/1995				1.1			1.5 U				203
SF228	RV	7	09/14/1995				1.1			1.5 U				208
SF228	RV	7	10/18/1995				0.8			2.5 J				260
SF228	RV	7	11/22/1995				1.1			1.5 U				1.5 U
SF228	RV	7	12/27/1995				1.6			4				249
SF228	RV	7	01/17/1996				1.1			3 J				227
SF228	RV	7	02/29/1996				0.9			4				188
SF228	RV	7	03/27/1996				0.9			3 J				193
SF228	RV	7	04/17/1996				0.7			3 J				146
SF228	RV	7	05/08/1996				0.8			4				151
SF228	RV	7	06/19/1996				0.9			4				145
SF228	RV	7	07/23/1996				1.2			5				140
SF228	RV	7	08/21/1996				1			6				246
SF228	RV	7	09/26/1996				1.2			5				236
SF228	RV	7	10/29/1996				1.1			4				215
SF228	RV	7	11/26/1996				1.2			7				280
SF228	RV	7	12/17/1996				1.5			5				475
SF228	RV	7	01/29/1997				1.1			3				334
SF228	RV	7	03/27/1997				1.4							253
SF228	RV	7	04/17/1997				1.8			1.5				209
SF228	RV	7	06/25/1997				0.5			2.5				109
SF228	RV	7	07/24/1997				0.8			1.5				140
SF228	RV	7	08/13/1997				0.9			4				159
SF228	RV	7	09/04/1997				1.3			7				223
SF228	RV	7	10/17/1997				1.3			6				243
SF228	RV	7	11/25/1997				1			3				200
SF228	RV	7	12/18/1997				1.3			8				206
SF228	RV	7	01/22/1998				1.3			4				235
SF228	RV	7	02/26/1998				1.3			4				257
SF228	RV	7	03/19/1998				1			3				204
SF228	RV	7	04/24/1998				1.2			3				114
SF228	RV	7	04/24/1998				1.2			3				94

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF228	RV	7	05/28/1998				0.6			3				116
SF228	RV	7	06/25/1998				1			3 U				163
SF228	RV	7	07/27/1998				0.9			3				130
SF228	RV	7	08/25/1998				1			3				161
SF228	RV	7	09/23/1998				1.1			4				183
SF228	RV	7	10/27/1998				1.2			4				294
SF228	RV	7	11/24/1998				2.4			3				282
SF228	RV	7	12/31/1998				2.6			7				284
SF228	RV	7	02/22/1999				2.8			3 U				194
SF228	RV	7	03/09/1999				3.1			4				235
SF228	RV	3	05/10/1998		0.18 J			0.68 J	40 J			0.16 U	0.042 U	
SF228	RV	3	05/10/1998			0.38 J	0.35 J			7.3 J	10 J			74.3
SF229	RV	2	11/07/1997		0.5 U	0.36	0.092	0.5 U	10 U	0.24	1 U	0.2 U	0.03 U	23.7
SF229	RV	3	05/05/1998		0.2	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	22
SF230	RV	2	11/06/1997		0.5 U	0.36	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	3.8
SF230	RV	3	05/05/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF231	RV	2	11/06/1997		0.5 U	0.43	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	6.04
SF275	RV	3	05/07/1998		0.032 U	0.23 U	0.17 J	0.44 U	26.8 J	0.23 J	0.4 J	0.16 U	0.042 U	49.4
SF316	RV	3	05/08/1998		0.3	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
SF317	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	57.3 J		0.5 J	0.16 U	0.042 U	
SF317	RV	3	05/07/1998							0.17 J				1.7 J
SF318	RV	3	05/07/1998		0.032 U	0.23 U	16	0.44 U	15.9 J	35.1	107	0.16 U	0.042 U	2340
SF319	RV	3	05/07/1998		0.032 U	0.23 U	2.6 J	0.44 U	5.6 U	8.7	26.5	0.16 U	0.042 U	378
SF320	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	5.6 U	0.11 U	0.42 J	0.16 U	0.042 U	3.1 J
SF321	RV	3	05/07/1998		0.032 U	0.23 U	0.042 U	0.44 U	5.6 U	1.2 J	0.07 J	0.16 U	0.042 U	10 J
SF328	SP	2	11/08/1997		1.8	0.72	0.67	0.5 U	10 U	7.42	1.5	0.2 U	0.03 U	88.6
SF328	SP	3	05/17/1998		1.7	2 U	1.1	2 U	41	7.7	5 U	0.2 U	0.2 U	115
SF338	AD	3	05/18/1998		6.7	1 U	0.1 U	* 551	20 U	0.5 U	20.9	0.2 U	0.3 U	9.9
SF339	AD	3	05/17/1998		1 U	7.5 J		0.6 J	69.8 J	2.4 J	1.9 UJ	0.2 UJ		10 J
SF342	AD	3	05/18/1998		0.99	1.4	2.4	3 U	20 U	1.1	5 U	0.2 U	0.3 U	190
SF345	AD	3	05/17/1998		0.2 U	2 U	15.1	7.9	20 U	68.7	563	0.2 U	0.7	2550
SF346	AD	3	05/17/1998		0.2 U	2 U	5	2 U	25	0.2	256	0.2 U	0.2 U	808
SF347	AD	3	05/17/1998		0.2 U	2 U	* 72.3	3	24	* 589	1400	0.2 U	0.2 U	* 11200
SF349	AD	3	05/17/1998		0.2 U	2 U	0.8	2 U	20 U	34.2	5 U	0.2 U	0.2 U	73
SF350	AD	3	05/18/1998		6	1.9	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
SF386	AD	2	11/19/1997		0.87	23.5	0.13	0.93	10 U	0.21	1.2	0.2 U	0.03 U	16.8
SF389	AD	2	11/19/1997		2.4	1.3	0.038	0.46	18	0.19	17	0.2 U	0.03 U	7.2

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF390	AD	2	11/19/1997		0.51	0.35	0.02 U	0.29	10 U	0.062	1 U	0.2 U	0.03 U	1.2
SF394	AD	2	11/20/1997		0.98	1.7	0.041	0.16	10 U	0.12	1870	0.2 U	0.03 U	24.9
SF394	AD	4	05/15/1991				0.7			3 U				20 U
SF394	AD	5	10/04/1991				0.4			1 U				12 U
SF394	AD	3	05/17/1998		1.5	2 U	1.1	2 U	51	0.5	* 2180	0.2 U	0.2 U	314
SF395	AD	2	11/20/1997		0.5 U	1	0.02 U	0.14	53.6	0.68	612	0.2 U	0.03 U	6.71
SF395	AD	3	05/18/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	271	0.2 U	0.3 U	5 U
SF396	AD	2	11/20/1997		0.5 U	0.12	0.02 U	0.21	10 U	0.26	1.1	0.2 U	0.03 U	5.93
SF396	AD	3	05/19/1998		0.25 U	0.23 U	0.041 U	0.44 U	22.4 J	0.12 J	0.36 J	0.16 U	0.042 U	5.8 J
SF398	RV	3	05/13/1998		0.28 J	0.31 J	0.34 J	0.61 J	50 J	1.1 J	11 J	0.16 U	0.042 U	83.5
SF607	OF	8	03/24/1998		45 U	40 U	2 U	3 U		61	280		4 U	66.8
SF607	OF	8	01/03/1996				2			35				445
SF607	OF	8	01/10/1996				3			54				387
SF607	OF	8	01/17/1996				4			52				500
SF607	OF	8	01/24/1996							85				511
SF607	OF	8	01/31/1996				6			* 127				553
SF607	OF	8	02/07/1996				5			73				752
SF607	OF	8	02/14/1996				4			92				450
SF607	OF	8	02/21/1996				2			71				413
SF607	OF	8	02/28/1996							67				430
SF607	OF	8	03/06/1996							71				461
SF607	OF	8	03/13/1996				3			73				554
SF607	OF	8	03/20/1996				3			53				678
SF607	OF	8	03/27/1996							88				620
SF609	OF	8	03/24/1998		54	40 U	2 U	3 U		40	502		4 U	314
SF609	OF	8	12/21/1994				4			33				361
SF609	OF	8	12/28/1994				6			52				437
SF609	OF	8	01/04/1995				4			50				434
SF609	OF	8	01/11/1995				5			71				485
SF609	OF	8	01/18/1995				3			59				529
SF609	OF	8	01/25/1995				3			67				522
SF609	OF	8	01/03/1996							58				272
SF609	OF	8	01/10/1996							79				71
SF609	OF	8	01/17/1996							63				232
SF609	OF	8	01/24/1996							76				144
SF609	OF	8	01/31/1996							96				158
SF609	OF	8	02/07/1996							80				1540

Data Summary Table
Upper South Fork - segment UpperSFCDRSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
SF609	OF	8	02/14/1996				2			88				284
SF609	OF	8	02/21/1996							97				160
SF609	OF	8	02/28/1996							88				92
SF609	OF	8	03/06/1996							101				90
SF609	OF	8	03/13/1996							95				168
SF609	OF	8	03/20/1996							98				182
SF609	OF	8	03/27/1996							69				222
SF650	RV	18	05/24/1999				1 U		7.4	1 U	6.6			7.1
SF8106	RV	13	—				2.3 U	10	3.7 U		1.2 U			3.1
SF8128	WL	13	—				2.3 U	260	3.7 U		13			3.9
SF8129	AD	13	—				2.6	8.4 U	3.7 U		1.2 U			2.5 U
SF8130	AD	13	—				2.3 U	8.4 U	3.7 U		1.2 U			2.5 U
SF8131	AD	13	—				2.3 U	15	3.7 U		3			2.5 U
SF8132	AD	13	—				2.3 U	16	3.7 U		2.9			2.5 U
SF8133	AD	13	—				3.4	18	8		3.8			2.5 U
SF8134	WL	13	—				2.3 U	14	3.7 U		2.4			2.5 U
SF8221	AD	13	—				2.5	16	3.7 U		3			2.5 U
SF8222	AD	13	—				2.3 U	15	50		270			2.5 U
SF8223	RV	13	—				2.3 U	13	3.7 U		3			2.5 U
SF8224	AD	13	—				2.3 U	13	14		3			2.5 U
SF8252	AD	13	—				4.4	8 U	12		5			2.5 U

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment UpperSFCDRSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	13	13	1.2	3,150	300	2.86	31.3	6	1	1
Arsenic	20	17	5.6	3,010	290	2.44	22	15	2	1
Cadmium	20	20	0.51	225	33.4	1.61	9.8	10	1	0
Copper	20	20	11	3,100	584	1.33	100	14	3	0
Iron	20	20	4,400	207,000	53,700	1.06	65,000	4	0	0
Lead	35	35	78	65,700	11,900	1.22	171	32	25	10
Manganese	20	20	185	27,700	4,730	1.39	3,597	6	0	0
Mercury	13	13	0.05	37.2	8.14	1.43	23.5	2	0	0
Silver	13	13	0.69	145	50.5	1.04	391	0	0	0
Zinc	20	20	15	39,400	5,380	1.72	280	13	7	1

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment UpperSFCDRSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	15	15	7	1,700	301	1.69	31.3	12	3	0
Arsenic	15	15	118	2,940	712	1.49	22	15	7	3
Cadmium	15	15	3.2	543	108	1.44	9.8	12	4	0
Copper	15	15	22.2	658	346	0.66	100	12	0	0
Iron	15	15	22,400	225,000	94,500	0.79	65,000	7	0	0
Lead	45	45	279	52,200	13,700	0.99	171	45	40	15
Manganese	15	15	102	27,500	10,400	1.01	3,597	10	0	0
Mercury	15	14	0.13	51.5	17.1	0.89	23.5	4	0	0
Silver	15	15	2.7	120	54.1	0.69	391	0	0	0
Zinc	15	15	62.6	83,900	16,700	1.43	280	12	12	2

Statistical Summary of Total Metals Concentrations in Sediment
Segment UpperSFCDRSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	19	4	0.948	50	23.1	0.9	3.3	3	1	0
Arsenic	19	19	3.19	214	27	1.8	13.6	8	1	0
Cadmium	19	19	0.067	112	15.5	1.97	1.56	14	4	0
Copper	19	19	9.81	283	107	0.73	32.3	16	0	0
Iron	19	19	6,160	129,000	40,400	0.99	40,000	6	0	0
Lead	19	19	31.1	23,500	4,060	1.79	51.5	16	13	4
Manganese	19	19	391	15,700	4,090	1.16	1,210	15	3	0
Mercury	19	18	0.0533	26	2.03	2.99	0.179	11	3	1
Silver	19	19	0.17	54.3	8.86	1.56	4.5	7	1	0
Zinc	19	19	58.7	16,300	2,970	1.54	200	17	5	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment UpperSFCDRSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	92	26	0.24	19	2.73	1.37	6	3	0	0
Arsenic	104	36	0.2	41	3.08	2.55	50	0	0	0
Cadmium	414	254	0.1	73.2	3.22	1.67	2	104	1	0
Copper	110	41	0.16	550	25	3.88	1	24	6	2
Iron	106	55	10	1,400	246	1.46	300	12	0	0
Lead	433	370	0.097	922	49.5	1.64	15	182	17	0
Manganese	119	86	0.65	2,660	195	2.43	50	33	9	0
Mercury	109	3	0.32	0.5	0.38	0.27	2	0	0	0
Silver	97	3	0.8	7.7	5.23	0.74	100	0	0	0
Zinc	433	368	0.94	11,000	268	2.45	30	306	60	1

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment UpperSFCDRSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	86	36	0.17	54	3.08	2.88	2.92	5	1	0
Arsenic	86	44	0.11	23.5	1.27	2.85	150	0	0	0
Cadmium	299	176	0.038	72.3	2.49	2.45	0.38	158	28	1
Copper	99	41	0.14	551	24.5	3.81	3.2	17	2	1
Iron	106	35	5.9	69.8	29.7	0.62	1,000	0	0	0
Lead	302	185	0.062	589	20.4	2.49	1.09	150	48	2
Manganese	108	58	0.07	2,180	156	2.69	20.4	21	10	1
Silver	85	1	0.7	0.7	0.7	< 0.001	0.43	1	0	0
Zinc	316	269	1.2	11,200	257	2.97	42	179	36	1

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligrams per kilogram

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